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Effect of Eustress, Flow, and Test Anxiety on Physical Therapy Psychomotor Practical Examinations

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Abstract

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MA, Walden University, 2016

BS, McNeese State University, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Psychology

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Abstract

Students at the graduate level undergo higher levels of stress compared to their peers, and this stress is known to affect academic performance. Most of the research is focused on the negative aspect of stress. Positive psychology aspects, such as eustress and flow, are related to success in some activities; however, it is unknown whether these correlate with academic performance. Several stress-related theories—Yerkes-Dodson curve, cybernetics, conservation of resources, and choking under pressure—guided this quantitative study of the effects of eustress, flow, and cognitive test anxiety (CTA) on a psychomotor practical examination for physical therapy students. A sample of 192 physical therapy graduate students across 3 campuses and 5 programs participated. Immediately following a standard psychomotor practical examination, and prior to any performance feedback, participants' levels of eustress, flow, and CTA were measured. All 3 variables had statistically significant bivariate correlations with exam score, and in the expected direction. In a standard multiple regression flow was the only statistically significant predictor; exam scores increased as flow increased. A follow-up analysis revealed that flow mediated (a) the positive relationship between eustress and exam score, and (b) the negative relationship between CTA and exam score, mitigating CTA's negative effect. Results suggest positive social change interventions focused on enhancing positive psychological states could improve academic performance and clinical training, leading to better clinical practice performance and outcomes for patients.

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Dedication

I would like to dedicate this work to the students, researchers, and people it may serve in the future. As a new researcher, I am honored to contribute to the body of knowledge that has the potential to shape the world into a better place.

My parents, Charles and Valerie Bourgeois, and my brothers, Jason and Kyle Bourgeois, have given me the tools and life lessons to bring me to the point in life I am now. I truly cannot express what they mean to me and I would like to dedicate this dissertation to them for all the support and strength they give me daily.

Acknowledgments

The following dissertation would not have been accomplished without the support and guidance of my chair, Dr. Tom Diebold, committee member, Dr. Anthony Perry, and URR, Anne Morris. Your feedback and critical analysis of my work has helped me grow in many ways as a professional and I aim to take these skills into my work as a continuing researcher to make a positive social change.

I would also like to acknowledge all my colleagues who helped me with the dissertation process and data collection. Without you this work could not have been completed.

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Chapter 1: Introduction to the Study

Introduction

University students demonstrate elevated levels of stress and anxiety compared to individuals who are not participating in an academic endeavor (Jacob, Itzchak, & Raz, 2013; Preuss, Schoofs, Schlotz, & Wolf, 2010; Walsh, Feeney, Hussey, & Donnellan, 2010). Secondary effects associated with stress and anxiety in the academic setting are thought to include a negative impact on emotional well-being, health, and academic performance (Kenwright et al., 2011; Lin & Huang, 2014; Palekar & Mokashi, 2014; Walsh et al., 2010). This stress and anxiety also seem to carry through to the graduate education level. Evidence shows even higher measures of negative psychological states for physical therapy students earning a doctorate level degree as compared to peers of the same age and gender (Chambers, Phillips, Burr, & Xiao, 2016; Palekar & Mokashi, 2014). Conditions such as written examinations and oral presentations seem to be the markers where the intensity of stress anxiety are at its highest levels (Lin & Huang, 2014; Preuss et al., 2010). The psychological variables associated with this negative psychology can lead to something known as “choking under pressure” that leads to adverse outcomes related to academic performance (Yu, 2015).

A plethora of research has investigated the impact of negative stress associated with students and academia, with less attention given to positive psychological stress in this environment (Duty, Christian, Loftus, & Zappi, 2015; Mesurado, Richaud, & Mateo, 2016). The positive aspect of stress is known as eustress and has recently received a bit more attention in regards to its effect on performance both empirically and from the

media (Hargrove, Becker, & Hargrove, 2015; Mesurado et al., 2016; Venkatesh, 2015). Another positive psychological concept is known as flow. Flow is also a hot topic in recent literature and media, described as the intense immersion, or complete focus, in a moment to moment activity (Csikszentmihalyi, 1975, 2014; Mesurado et al., 2016). Mesurado et al. (2016) identified that flow can directly improve student engagement, and eustress can indirectly affect student engagement through flow. However, no researchers have identified if these two positive psychological variables have an impact on a short-term psychomotor performance.

If the performance on a psychomotor practical is the standard measure to determine whether a physical therapy doctoral student is adequately learning content to participate in clinical settings, then it is important to understand what psychological factors affect performance during this academic exercise. This understanding of psychological factors can have an impact on the students' performance as far as academic progression through the curriculum but may also affect the knowledge and skills each of the students possess when moving into the real clinical setting. There is enough literature in the field to support the fact that cognitive test anxiety has a negative impact on most academic performances (Cassady & Finch, 2015), but it is unclear if there is a particular impact on psychomotor practical examinations. This concept is particularly the case in the realm of physical therapy education (Cassady & Johnson, 2002; Khalaila, 2015; Sparfeldt, Rost, Baumeister, & Christ, 2013). In this study, cognitive test anxiety served to control or identify if negative psychological appraisal can impact academic performance or correlate with the effects of positive psychology, eustress, and flow.

Learning is imperative because these doctoral students will soon have patients of their own, and the psychological state they perform in may negatively or positively affect learning depending on how the individual appraises the situation (Lin & Huang, 2014; Price & Tej, 2014). Specifically, the profession of physical therapy pertains to face-to-face interaction with patients and is heavily weighted on skill performance of psychomotor activities in the clinic. These physical therapy students need to attain the ability to control and be proficient in affective, psychomotor, and cognitive domains (Commission on Accreditation in Physical Therapy Education, 2016). Practical examinations in the graduate level settings serve to measure if the students are meeting these requirements to provide care as a physical therapy professional (Commission on Accreditation in Physical Therapy Education, 2016; Langford, Landray, Martin, Kendall, & Ferner, 2004; Price & Tej, 2014). Attaining a better understanding of what variables can increase or decrease performance in this important standard of clinical practice for physical therapists can assist administration in determining how to manage student progression through the curriculum as well as further our understanding of human performance from a psychological perspective in the academic realm.

In this chapter, I will provide a detailed introduction to the purpose of this study and the variables involved. A brief background of the related literature will be presented to identify what researchers have already found on the topic. This knowledge of the literature helped me establish a problem statement and the purpose of the study. Next, the research questions and hypotheses as well as the theoretical framework will be discussed.

Lastly, I will provide the nature of the study and discuss limitations involved with this study design.

Background of the Study

As I mentioned previously, most research in the realm of stress and academia focuses on the negative aspects of stress with less attention given to the positive components (Duty et al., 2015; Frank & Cassady, 2005; Jacob et al., 2013; McGowan, Gardner, & Fletcher, 2006; Mesurado et al., 2016; Preuss et al., 2010; Selye, 1975, 1980, 1983). The focus of this study was on the topic of eustress and flow, which are positive psychological variables that have promise to affect performance in the academic setting (see Mesurado et al., 2016; O'Sullivan, 2011; Payne, Jackson, Noh, & Stine-Morrow, 2011). Cognitive test anxiety was included as a concept in this study to serve as a control variable because it pertains to negative psychological effects and is one of the strongest indicators that negatively affect performance (see Cassady & Finch, 2015; Khalaila, 2015). This section will include a brief review of literature that demonstrates the value of this study.

The first study to identify that stress can have positive outcomes was conducted by Selye (1975). The Yerkes-Dodson law states that there is an optimal amount of stress in which performance can increase, but if these levels of stress become too high then performance is impaired (Le Fevre, Kolt, & Matheny, 2006; O'Sullivan, 2011; Yerkes & Dodson, 1908). Edwards and Cooper (1988) established a theoretical framework to state that positive psychological states could improve physical health. These historical studies served as some of the earlier qualitative research that has led to more investigation of

quantitative evidence to support the effects of positive psychology (Edwards & Cooper, 1988; Selye, 1975; Yerkes & Dodson, 1908).

Highlighting the most current evidence on the positive psychology variables, Mesurado et al. (2016) investigated how undergraduate student academic engagement was affected by self-efficacy, eustress, and flow. They then compared two cultural groups to determine if there were any differences in these variables and the amount of engagement. Their results indicated that eustress had significant positive correlations with flow but was only indirectly affiliated with engagement via its relationship with flow. Self-efficacy had a positive effect on flow and academic engagement (Mesurado et al., 2016). Their study shed light on eustress and flow as concepts that could improve academic performance, but they did not identify the effects on a momentary situation of a psychomotor practical examination.

O'Sullivan (2011) developed a measurement scale to assess the amount of eustress and explored how eustress, hope, and self-efficacy relate to life satisfaction in undergraduate students, and the results indicated that when eustress is elevated, life satisfaction rises. O'Sullivan also found that the combination of eustress, self-efficacy, and hope all correlated with increased life satisfaction, with hope being the best predictor for life edification. Primarily, the study served as the groundwork for a reliable scale to measure eustress at the academic level. It also indicated that eustress has the potential to have a positive influence on performance in a university setting.

The control variable of cognitive test anxiety and the idea of choking under pressure have continued to be pertinent research topic in the field. Duty et al. (2015)

investigated nursing students and their performance on written examinations in the presence of low, average, or high levels of cognitive test anxiety. Cognitive test anxiety represents the concept of worry, which is one of two components associated with test anxiety, the other being the emotional part (Duty et al., 2015). The results of Duty et al.'s study were in agreement with those of other studies that investigated cognitive test anxiety in different types of students and identified that students with higher levels of cognitive test anxiety or worry performed lower on examinations when compared to students with less cognitive test anxiety. Self-perceived anxiety scores did not correlate with academic performance (Duty et al., 2015). To hone in on the precise nature of this current study, Frank and Cassady (2005) were the first to provide evidence that physical therapy students show higher levels of stress and anxiety compared to the norm. More recent studies have investigated the effects of interventions and continue to show physical therapy students have high levels of perceived and physiological stress (Chambers et al., 2016), which alludes to the presence of stress in the physical therapy academic curriculum and testing that takes place.

Belletier et al. (2015) helped define the difference between monitoring and choking pressure. Monitoring pressure is when an individual's performance is being watched and evaluated by others, and outcome pressure is when there is an incentive offered for a particular outcome (Belletier et al., 2015). Both of these have been shown to decrease performance and relate to the concept known as choking under pressure (Belletier et al., 2015). Belletier et al. also identified how monitoring pressure can produce increased attentiveness to skill processes that in turn lead to counterproductivity,

and outcome pressure can cause reduced executive control of attention. In this particular study, the authors identified that individuals with high working memory capacity, as compared to people with low working memory capacity, were more susceptible to choking on classic measures of executive control.

These researchers have determined that there is a relationship between the variables of eustress, flow, cognitive test anxiety, and academic performance and the research question of whether these variables correlate with academic performance. In summary, there is little research to describe the effects of positive psychology and its relation to academic performance, and no research on the specific academic measure of a psychomotor practical. There also does not appear to be any specific literature on cognitive test anxiety, a negative psychology component, in the academic setting on psychomotor performance. The gap in the literature is apparent because the effects of eustress, flow, and cognitive test anxiety on academic performance on a psychomotor practical examination remain unclear. Understanding the relationship of these variables may help administration in educational settings determine ways to produce more capable students in the domain of psychomotor skills that are essential to academic progression and retention. This deeper understanding of student performance and what could be done to improve competence in their skills could lead to better healthcare practitioners and positively impact patient care.

Problem Statement

Physical therapy students demonstrate high levels of stress and anxiety throughout their academic curriculum in comparison to peers of the same age and gender (Chambers

et al., 2016; Frank & Cassady, 2005). These students experience even higher amounts of psychological stressors during examinations (Duty et al., 2015; Preuss et al., 2010). This increased stress applies in particular during exams, such as a psychomotor practical, that involve outcome and monitoring pressure, also known as choking pressure (Belletier et al., 2015; Yu, 2015). The profession of physical therapy requires a hands-on and face-to-face environment (American Physical Therapy Association, 2001), which is why many psychomotor practical examinations are administered throughout the doctorate of physical therapy curriculum to adequately prepare students (Commission on Accreditation in Physical Therapy Education, 2016). An understanding of the psychological states that affect academic performance, positively or negatively, during this type of examination is critical for student success (O'Sullivan, 2011).

Eustress has a significant positive correlation with flow in the academic setting (Mesurado et al., 2016). However, these variables have not been assessed under the acute condition of choking pressure. During written examinations, graduate and undergraduate students with higher levels of cognitive test anxiety exhibited lower performance outcomes (Cassady & Johnson, 2001; Duty et al., 2015). These findings can explain the effect of negative psychological states on performance but do not accurately identify how students with high or low levels of cognitive test anxiety perform during psychomotor practical examinations, which is a different testing situation then written exams. Furthermore, the literature on stress and anxiety as they relate to academic performance rarely take into account positive psychological states because the focus is primarily on negative psychological states (Gibbons, 2012, 2015; Mesurado et al., 2016; Selye, 1975,

1980). There was a paucity of literature to describe how eustress and flow correlate with performance on highly stressful practical exams in an academic setting, and none that utilizes a reliable measure of eustress (Le Fevre et al., 2006; Mesurado et al., 2016; O'Sullivan, 2011). In this study, I examined if eustress, flow, and cognitive test anxiety demonstrate a correlation with academic performance on a psychomotor practical examination amongst physical therapy graduate students.

Purpose of the Study

The purpose of this quantitative study was to determine if there is a correlation between eustress, flow, and cognitive test anxiety during a psychomotor practical examination for graduate level students. Doctorate level physical therapy students from the University of St. Augustine for Health Sciences, which has four campuses across the United States, served as the sample population. This multisite institution offered me the ability to perform a correlation research design investigation of graduate students from across the United States, increasing the generalizability (see Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008) to determine if the variables have predictive capabilities on academic performance. My aim was to identify the extent of the relationship of the variables to establish the importance of these psychological concepts as a basis for further design and development of interventions for students in a graduate level doctorate program that requires proficient performance of clinical skills during a psychomotor practical examination.

The dependent variable, the variable being affected, in the study was academic performance measured by a standardized academic rubric created by the University of St.

Augustine to assess student competence for this particular psychomotor practical examination. Each student is individually evaluated by a trained instructor who follows the standardized rubric to grade the student's performance. The instructor calculates the points according to the score received for each section of the rubric for a total grade to serve as a measurement of the student's performance. This process is considered the standard testing procedure for the university and was not jeopardized with this study design.

Eustress and flow were the independent variables, representing the positive psychological characteristics, with a third independent variable of cognitive test anxiety serving as the control variable and an indicator of negative psychological characteristics. I used psychometrically sound instruments to assess eustress, flow, and cognitive test anxiety. The independent variables were assessed immediately following the psychomotor practical examination and scoring of the academic performance.

Research Question(s) and Hypotheses

I developed one research question and three hypotheses associated with the variables of concern to guide this study.

Research Question: To what extent is performance on a psychomotor practical exam related to eustress, flow, and cognitive test anxiety?

$H_0$1: While controlling for flow and cognitive test anxiety, eustress does not correlate with performance on a psychomotor practical exam.

H_a1: While controlling for flow and cognitive test anxiety, eustress will correlate with performance on a psychomotor practical exam.

$H_0$2: While controlling for eustress and cognitive test anxiety, flow does not correlate with performance on a psychomotor practical exam.

H_a2: While controlling for eustress and cognitive test anxiety, flow will correlate with performance on a psychomotor practical exam.

$H_0$3: While controlling for eustress and flow, cognitive test anxiety does not correlate with performance on a psychomotor practical exam.

H_a3: While controlling for eustress and flow, cognitive test anxiety will correlate with performance on a psychomotor practical exam.

Theoretical Foundation

In this section, I will provide a brief explanation of the relevant theories associated with the variables of eustress, flow, and cognitive test anxiety. The concept of choking under pressure served as a secondary theory to students taking a psychomotor practical examination. Chapter 2 will include a more detailed explanation of these theories.

Eustress is the positive aspect of stress, first coined by Selye (1975), and requires a brief discussion of theories involved in stress literature (Mesurado et al., 2016; Nelson & Simmons, 2011; Selye, 1975). The Yerkes-Dodson law identified that there is an optimal level of stress in which performance is at its best; if stress levels are too low or too high, then a person can expect lower levels of performance (Yerkes & Dodson, 1908). The conservation of resources (CoR) theory suggests that stress is an individual's reaction to the experience of threat (Hobfoll, 1989, 2001). This theory can also be explained as the loss of psychological resources or valued material, which is what leads

to stress (Costello, 2012; Hobfoll, 1989, 2001; Morelli & Cunningham, 2012). Basically, if the individual views their resources as either threatened, used, or lost, then stress could be experienced (Hobfoll, 1989; Morelli & Cunningham, 2012). Lastly, there is the cybernetic theory, which is the fundamental notion that stress can either be appraised by an individual as positive or negative (Edwards & Cooper, 1988). If stress is appraised as a negative discrepancy, then a person may have the negative consequences associated with distress such as anxiety and poor coping, which can affect health and well-being (Edwards, 1992; Edwards & Cooper, 1988). However, if an individual views the stress as a positive discrepancy, then they may respond positively with more efficient coping mechanisms and decreased harmful effects of negative stress (Edwards & Cooper, 1988).

Flow theory is the framework around the variable of flow (Csikszentmihalyi, 2014; Jones, Hollenhorst, Perna, & Selin, 2000; Liao, 2006; Nakamura & Csikszentmihalyi, 2009; Parr, Montgomery, & DeBell, 1998). The optimal and positive experience of a person is a fundamental understanding of flow (Csikszentmihalyi, 2014). Common conditions generated in this experience are derived from flow theory, which can include being cognitively efficient, totally engaged, in full concentration, highly motivated, and engrossed in an enjoyable activity (Csikszentmihalyi, 2014; Fullagar, Knight, & Sovern, 2013; Liao, 2006; Santosa, 2015). When using the positive indicators of flow theory, an individual can see how it may counter the effects of negativity, and these signs can be explained by the experience of flow in effect, stimulation, absorption, autotelic motivation, a person's control over their actions and the environment, absence of anxiety, limitless time, and pleasure (Csikszentmihalyi, 1975, 2014; Davis & Wong,

2007; Nakamura & Csikszentmihalyi, 2014). An important theme of flow theory that continuously emerges within flow research is the balance between challenge and skill (Csikszentmihalyi, 1975, 2014; Davis & Wong, 2007; Dietrich, 2004; Fullagar et al., 2013; Gaggioli, Cipresso, Serino, & Riva, 2013; Liao, 2006; Nakamura & Csikszentmihalyi, 2014; Pace, 2004; Peifer, Schulz, Schächinger, Baumann, & Antoni, 2014; Santosa, 2015). The challenge of the task and the skill level of the individual as it relates to the activity must match and be at a high level to achieve flow (Csikszentmihalyi, 1990, 2014; Nakamura & Csikszentmihalyi, 2014; Santosa, 2015).

Test anxiety can be broken into two primary components, worry and emotional factors (Duty et al., 2015). The factor of worry has the strongest influence on test performance (Cassady & Finch, 2015; Cassady & Johnson, 2002; Duty et al., 2015; Eysenck & Calvo, 1992; Sarason, 1984). Worry can be explained as the cognitive interference experienced by an anxious student or individual with thoughts comparing themselves to peers, feelings and consequences of being unsuccessful, little confidence, overconcerned about the evaluation process, low levels of self-worth, and the sense of a person not being as prepared for a performance as they would like (Cassady & Johnson, 2002; Duty et al., 2015).

The skill deficit model is one of the more modern views of the concept of cognitive test anxiety (Cassady & Finch, 2014, 2015; Putwain et al., 2014). In the skill deficit model, the student or individual's inability to efficiently encode, comprehend, or organize content to be used during an examination (Cassady & Finch, 2015; Putwain, Shah, & Lewis, 2014). Hence, variables such as working memory, executive functioning,

or self-regulation are low functioning in these cognitive test anxious situations for students (Cassady & Finch, 2015; Owens, Stevenson, Norgate, & Hadwin, 2008).

Student performance on a psychomotor practical exam may require cognitive processing, such as maintaining essential and accessible information, while attending to comprehend, reason, and perform the psychomotor activities involved with the task (Conway, Jarrold, Kane, Miyake, & Towse, 2007; Hubbard, 2015). During these practical exams, there is the existence of monitoring pressure such as a grader observing the performance. Additionally, there is outcome pressure which represents the incentives for performing well such as making a good grade (Belletier et al., 2015; DeCaro, Thomas, Albert, & Beilock, 2011). The presence of these conditions indicates that physical therapy students are susceptible to choking under pressure. Distraction theory, explicit monitoring theory, and overarousal theory serve as theories that explain the concepts of choking under pressure (Baumeister, 1984; Lewis & Linder, 1997; Wine, 1971; Yerkes & Dodson, 1908).

Nature of the Study

The nature of this study was a quantitative approach. In consideration of the research question, presented hypotheses, the available sampling population, and ethical considerations, it was most appropriate to use a correlational research design (see Campbell & Stanley, 1963). This design allowed me to collect data in a typical test setting with little interruption of the standard test taking procedure. Academic testing was carried out at the study site as usual with the standardized academic rubrics developed for the psychomotor practicals. I applied the measurement scales within a timeframe of 30

minutes after the participants took the psychomotor practical examination. Pretest measures were not taken because the partnering organization, the University of St. Augustine for Health Sciences, would not allow the survey to be administered prior to the practical examination because it may have impacted a student's performance, and the measurement scale for flow required a reflection on a recent activity. I will provide a more detailed rationale in the research design section in Chapter 3. The implementation of this quantitative approach allowed for the appropriate investigation of the research hypotheses, which were to determine whether eustress, flow, and cognitive test anxiety have correlation capabilities for academic performance in physical therapy students taking a psychomotor practical examination.

Eustress and flow were the independent variables representing the positive psychological characteristics, with a third independent variable of cognitive test anxiety serving as the control variable and an indicator of negative psychological characteristics. The dependent variable was the academic performance on the psychomotor practical as indicated by grades on the standard academic rubric created by the University of St. Augustine for Health Sciences.

I used psychometrically sound instruments to measure the independent variables. Eustress was measured using the 15-item Eustress Scale (ES), which has been used in other studies to gauge the amount of eustress (see Mesurado et al., 2016; O'Sullivan, 2011). The measurement of flow states was conducted by the 26-item Active Flow State Scale (AFSS) that measures nine proposed dimensions of flow (see Csikszentmihalyi, 1975; Parr et al., 1998; Payne et al., 2011), though primary analyses used the overall

score. Lastly, the control variable was assessed with the short form, 17-item questionnaire known as the Cognitive Test Anxiety Scale (CTAS; see Cassady & Finch, 2014; Cassady & Johnson, 2002)

Logistically, I gave these instruments digitally via the University of St. Augustine's account with SurveyMonkey. Once data were collected, the University of St. Augustine's IR agreed to input the coded information into an Excel spreadsheet and give this information to me for analysis. I then placed the raw data into Statistical Package for Social Sciences (SPSS) to run a multiple regression analysis to determine the correlation of the variables.

Definitions

In this section, I will define the following variables and terms involved in this study to help clarify meanings and interpretations:

Academic eustress: O'Sullivan (2011) described academic eustress as the positive psychological response to stressors in a university setting where there is a perceived challenge. The skill and challenge needed to perform the task should be at a level in which the individual must stretch their normal ability to achieve their goal (Mesurado et al., 2016; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003).

Academic performance: The measure of success in an academic setting (Salanova, Schaufeli, Martínez, & Bresó, 2010). This can be measured in many ways, such as Grade Point Average(Llorens, Salanova, & Rodríguez, 2013; Nelson, 2014), scores on written exams (Cassady & Johnson, 2002), scores on objective structured clinical examinations practical (Zhang & Henderson, 2014), oral presentations (Preuss et al., 2010; Sparfeldt et

al., 2013), etc. For this study, I will refer to the score given on a practical examination as the measure of academic performance.

Chocking under pressure: A phenomenon that represents how stress can impact human behavior. This phenomenon is thought to occur if high rewards or even the threat of punishment can lead to high motivation but can also bring about performance diminution because of the high psychological pressure. This poor performance due to high rewards induces the concept of choking under pressure (Yu, 2015).

Cognitive test anxiety (CTA): An individual's cognitive response or internal dialogue regarding an evaluative situation (Cassady & Johnson, 2002; Depreeuw, 1984; Duty et al., 2015). CTA represents the concept of worry associated with the experience. Worry and emotion are the two principal components related to test anxiety, and worry is the component that has the largest impact on student performance (Cassady & Finch, 2014, 2015; Cassady & Johnson, 2002; Duty et al., 2015).

Distress: Bad stress, or distress, can be defined as an adverse physiological response to stressors (Mesurado et al., 2016; O'Sullivan, 2011; Simmons & Nelson, 2001a).

Eustress: The term stress can be separated into bad stress and good stress (Le Fevre, Matheny, & Kolt, 2003; McGowan et al., 2006; Selye, 1975, 1980). This good stress, or positive stress, is known as eustress, which involves the concepts of positive cognitive appraisal and challenging of the stressor (Mesurado et al., 2016; Selye, 1975, 1980). Eustress is representative of both the process of reacting positively to a stressor as

well as the outcomes associated with this process (Mesurado et al., 2016; O'Sullivan, 2011).

Flow: The optimal experience with intense involvement in a moment to moment activity (Csikszentmihalyi, 1975; Mesurado et al., 2016; Santosa, 2015). When in a flow state, attention is entirely invested in the task allowing the individual to perform at their highest capacity (Csikszentmihalyi, 1975; Csikszentmihalyi, Rathunde & Whalen, 1994; Mesurado et al., 2016; Parr, Montgomery, & DeBell, 1998). Psychomotor practical examinations represent a brief moment in time where flow can be a determining factor of the individual's performance.

Psychomotor practical examinations: A measurement of academic performance designed to test the students' knowledge and psychomotor skills through demonstration of clinical procedures (Hubbard & Blyler, 2016).

Stress: A person's appraisal of themselves and the environment around them as taxing and threatening to their well-being (McGowan et al., 2006; Selye, 1980, 1983). Stress and its effect on academic performance primarily focuses on negative psychological states versus the equally important positive psychological states that are far less studied in this genre (Duty et al., 2015; McGowan et al., 2006; Mesurado et al., 2016).

Assumptions

The main assumption associated with this study was that the psychological characteristics of eustress, flow, and CTA would be present during the practical

examination for the physical therapy students. With this correlation study design, the measurement scales for these psychological characteristics were implemented after the subject took the psychomotor practical examination. Only the flow state scale is designed to test the state of the individual during the moment he or she previously experienced. The eustress and CTA scale measures these constructs in general, trait, and not directed to a recent moment in time state. This understanding that eustress and CTA scales measure the individual's trait means these scales are not designed specifically to measure the practical examination the subject just experienced. However, Steyer, Mayer, Geiser, and Cole (2015) questioned the validity of a true trait measure because an individual is always assessed in a situation, or state, they are currently experiencing. The postpractical exam assessment could be used because all participants were in the same situation. Moreover, the social desirability effect can be common in trait measures and the immediacy of the state event could evoke increased construct clarity and association with the postpractical measurement design (Steyer, Mayer, Geiser, & Cole (2015). Therefore, my assumption was that these psychological characteristics will or will not be present during the practical examination.

In this study, I assumed there would be no differences for gender, consistent with the literature on the independent variables of interest (Cassady & Finch, 2014; Mesurado et al., 2016; O'Sullivan, 2011; Payne et al., 2011). The survey was administered in English; therefore, I assumed all participants were able to interpret the questionnaires appropriately. Lastly, I used students in their second term of physical therapy graduate school, and my assumption was that these students were at the most appropriate level of

stress and preparedness to be tested for the positive and negative psychological concepts. These second term students were selected because it appeared that anxiety plays a role in their performance on psychomotor exams more than other terms. If there is more understanding of the variables involved in this type of examination, then there could be more appropriate interventions derived to help the students.

Scope and Delimitations

In general, stress and anxiety are issues associated with poor performance in the academic setting, particularly for students at the graduate level (Cassady & Johnson, 2002; Duty et al., 2015; Gibbons, 2010; Mesurado et al., 2016). This stress and anxiety can not only lead to poor performance concerning academic success but also can have negative influences on biological, psychological, and social aspects of life (Faraji et al., 2014; Hubbard & Blyler, 2016). Healthcare professionals are responsible for taking care of their client's well-being; therefore, it is important that these individuals maintain well-being for themselves to better serve their patients (Price & Tej, 2014).

On the other hand, persons in a graduate setting may already possess characteristics that allow them to cope with the intensity of stress and anxiety presented. These existing coping characteristics could be perceived as an internal threat to the validity of this study because individuals who volunteer to participate in the study may already possess positive psychological features. Preparedness is not measured in this study, which is also a potential threat to internal validity because if the student is well prepared for the practical examination it may have allowed them to feel comfortable with participating in such a study (see Creswell, 2009). In comparison, those students who

struggle with the coursework and possess less positive psychological characteristics may have been less likely to volunteer for the study, which would lead to a sampling bias and may not allow for the most accurate interpretation of the data for the research question (see Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). Along the same lines, mortality could be an issue with this study design because individuals had the right to drop out of the study immediately after their psychomotor practical exam or just before taking the questionnaires (see Creswell, 2009). The volunteer student had the ability to elect to drop out if they perceived they did not perform well on their psychomotor practical exam and may have been emotional which led them to choose to not continue with participation in the study.

Another delimitation and threat to external validity was that the sample population was only physical therapy students at a graduate level institution enrolled in a first-year orthopaedic course at the University of St. Augustine for Health Sciences (see Creswell, 2009, 2013). This means that the results of the study can only infer its findings in relation to doctorate physical therapy students at the University of St. Augustine for Health Sciences versus other physical therapy programs or the general healthcare population (see Creswell, 2013; Frankfort-Nachmias & Nachmias, 2008). A benefit to the study design was that it tested students from across the United States, improving generalizability to physical therapy students (see Creswell, 2009, 2013; Frankfort-Nachmias & Nachmias, 2008). Future studies could use other healthcare professionals for the sample population to determine if the variables have generalizability across professions.

Test reactivity may have played a role in the threats to external validity. The participants' changing of behavior during their psychomotor practical exam due to them having the perception they were under investigation from the research study may be considered test reactivity (see Anthis, 2003). The student may have had an impression that the results of this study could affect future interventions for the rest of their time at the university. This test reactivity may have been reduced by the design because it allowed for the most standard form of the practical examination to occur with the measurement scales being provided to the subjects immediately after the standard practical examination versus having the scales measured just before the practical and potentially increasing test reactivity during the practical or altering their capability to focus and perform on the practical. This test reactivity was the reason the University of St. Augustine did not allow me to administer the surveys prior to the practical examination because it may have impacted a student's performance. More discussion on external validity and internal validity will be included in Chapter 3.

Limitations

In this study, I used a convenience sampling method, which means that students who were readily available at the University St. Augustine participating in the physical therapy program were the subjects I recruited to investigate the variables. These easily accessible students may have already possessed psychological characteristics that are either positive or negative, which may have made it difficult to determine the correlation between eustress, flow, and CTA on academic performance. Also, preexisting psychological characteristics other than the variables being investigated, such as self-

efficacy, self-determined choice, hope, and preparedness, that have been shown to affect academic performance in some degree could have been present (see Cassady, 2004; Mesurado et al., 2016; Murayama et al., 2015; Nelson, 2014). These mentioned variables were not measured during this study to focus on the variables of interest.

Self-reported questionnaires have inherent limitations, which can contribute to a weakness in the research results (Frankfort-Nachmias & Nachmias, 2008; Groves et al., 2009). These limitations are believed to occur due to participants potentially responding in a manner they perceive to be socially desirable versus what they actually appraise (Creswell, 2009). There could also have been the sense of a lack of true anonymity as a participant in the study, which could lead to inaccurate information portrayed on the instruments (see Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; Groves et al., 2009). To address these potential limitations, I used computer-generated surveys through SurveyMonkey, which have been shown to decrease social bias and increase a sense of anonymity (see Dale, 2006; Nelson, 2014; Zwaanswijk & van Dulmen, 2014)

Another threat to internal validity and possible limitation was that the rubric used for grading the academic performance does not have the psychometrics to determine its validity and reliability (see Creswell, 2009, 2013; Frankfort-Nachmias & Nachmias, 2008; Groves et al., 2009). I chose this rubric because of its long-standing history of use at the University of St. Augustine to assess this orthopaedic practical examination and the student skills.

Significance of the Study

Many researchers have investigated the amount of stress and anxiety associated with written examinations. More specifically, different types of testing, such as oral presentations, have substantially higher levels of stress and anxiety for students compared to formal written examinations (Cotton, Dollard, & De Jonge, 2002; Dickerson & Kemeny, 2004; Preuss et al., 2010). Researchers have opined that the reason for this difference between a written examination and an oral examination is due to social-evaluative threat, which is the negative perception of the student's task performance being judged by others and strongly correlates with the definition of monitoring pressure (Belletier et al., 2015; Dickerson & Kemeny, 2004). However, there is little evidence to identify the amount of positive stress affiliated with academic performance, particularly for a psychomotor practical exam, which is also different from an ordinarily written examination (Mesurado et al., 2016; O'Sullivan, 2011).

Higher levels of stress and anxiety during academic testing have been associated with poor academic performance and unfavorable health outcomes (Cotton et al., 2002; Dickerson & Kemeny, 2004; Hubbard & Blyler, 2016; Lin & Huang, 2014; Mesurado et al., 2016; Preuss et al., 2010). Again, it is unclear if positive stress has a correlation with academic performance in comparison to negative stress levels. Further understanding of which type of stress has a greater influence on academic performance can significantly alter the approach to managing stress in these educational environments. In the presence of high monitoring and outcome pressure, such as in a psychomotor practical examination, it is unclear if a student's level of eustress correlates to the amount of flow

experienced during the performance and if these variables have a positive effect on the academic outcome, counteracting CTA.

If flow and eustress have a positive correlation with each other in the academic setting (Mesurado et al., 2016), then it is possible flow could also be a valid predictive variable associated with academic performance in a given moment in time. Understanding the impact of eustress, flow, and CTA levels in students during the fulfillment of psychomotor practical exams may provide helpful information for university administrators on academic success and the well-being of graduate-level physical therapy students (see Cotton et al., 2002; Dickerson & Kemeny, 2004; Preuss et al., 2010). Furthermore, the results of this study can provide preliminary evidence to guide further research to understand if these positive psychological variables can impact patient care given by these students in the future as practitioners.

Summary and Transition

The aim of this study was to determine if eustress, flow, and CTA have a correlation with academic performance during a psychomotor practical examination for doctoral students. An understanding of this correlation can help administration better determine interventions that could help doctoral students progress through programs as well as potentially identify areas that could improve patient management skills for the students in the future. This chapter served as an introduction to the study by providing a background and problem statement to justify the need for this investigation. In this chapter, I provided a brief explanation of the theoretical framework and the nature of the

study. Also included were the definitions of the concepts associated with this study. Lastly, I discussed the assumptions, limitations, and potential significance of the study.

In Chapter 2, I will provide a more detailed explanation of the theoretical foundation associated with the variables in the study. An extensive literature review of the concepts pertaining to the study will also be presented. This literature review will be provided to explain the relationships of the variables and identify a gap in the literature.

Chapter 2: Literature Review

Introduction

Students who are enrolled in a graduate level doctorate program demonstrate high levels of stress and anxiety associated with testing (Chambers et al., 2016; Duty et al., 2015; Frank & Cassady, 2005; Preuss et al., 2010). These high levels of negative psychological states have been historically shown to impede performance on examinations, and this includes written exams, orals, and motor tasks (Belletier et al., 2015; Chambers et al., 2016; Duty et al., 2015). These results have also been identified specifically in students trying to attain a doctorate of physical therapy (Chambers et al., 2016; Jacob et al., 2012). These students must perform a variety of different tests (i.e., written, oral, and practical examination) to attain the degree (Chambers et al., 2016; Commission on Accreditation in Physical Therapy Education, 2016; Jacob et al., 2012; Price & Tej, 2014).

There is an understanding of the effects of negative psychology as it pertains to students and academic performance, but less attention has been given to the positive aspects of psychology (Duty et al., 2015; McGowan et al., 2006; Mesurado et al., 2016). Eustress is a term used to describe the positive aspect of stress that has the potential to improve performance mostly because there is some correlation with flow states (Gaggioli et al., 2013; Mesurado et al., 2016; Peifer et al., 2014). Flow states are the heightened sense of awareness and focus a person can experience when in a challenging situation (Csikszentmihalyi, 2014; Mesurado et al., 2016; Nakamura & Csikszentmihalyi, 2014). Previous research has not determined how these positive psychological states correlate

with academic performance, and no researchers have focused on psychomotor practical exams (Mesurado et al., 2016). The purpose of this study was to determine if eustress and flow, using CTA as a control variable, correlate with academic performance on a psychomotor practical examination.

In this chapter, I will describe how the literature review was conducted to investigate the study variables. Also, the theoretical foundation of eustress, flow, and CTA will be highlighted. I will present the full literature review for the variables in this chapter as well as identify the gaps in the literature related to the variables and emphasize the importance of conducting this study to answer the research question.

Literature Search Strategy

In this literature review, I employed an extensive literature search by choosing multiple databases and using filters to select only journals, books, dissertations, and government documents that were peer reviewed. The peer-reviewed articles included in this study were published in empirical journal articles that consisted of randomized control trials, systematic reviews, and meta-analyses. Both quantitative and qualitative study designs were used to explain the current research and theoretical development of constructs involved. The primary search databases I used were Arts & Humanities Citation Index, Education Resources Information Center, Health and Psychological Instruments, MEDLINE Info, Mental Measurements Yearbook and Test in Print, ProQuest, PsycARTICLES, PsycEXTRA, PsycINFO, PsychTESTS, PubMed, and SAGE Journal.

The key term search words used were *academic, choking, cognitive test anxiety, eustress, exams, flow, graduate, lab exam, monitoring, performance, physical therapy, pressure, psychomotor, student,* and *theory*. In this literature review, I primarily used current research published between 2007–2017 to maintain empirical literature. Also, evidence that dated to the mid-20th century was also used to gather information regarding the theoretical framework and perspectives on the concepts to explain the timetable and relevant history to connect the variables involved.

Theoretical Foundation

For physical therapy students to perform effectively on a psychomotor practical exam, they must be capable of maintaining essential information accessible while attending to comprehend, reason, and perform psychomotor activities which require cognitive processing (Conway et al., 2007; Gimmig, Huguet, Caverni, & Cury, 2006; Hubbard, 2015; Price & Tej, 2014). Concurrently, there is the presence of monitoring pressure such as a grader observing the performance. Also, there is the existence of outcome pressure, which represents the incentives for performing well such as earning a good grade (Belletier et al., 2015; DeCaro et al., 2011). The presence of these conditions makes it evident that physical therapy students undergo high-stakes situations during their studies.

In this theoretical review, I will discuss the theoretical constructs around eustress, flow, and CTA, which provided me with a framework around which to investigate these variables in an academic setting. Secondary theories will also be discussed to connect

aspects of positive psychology and how they could relate to choking pressure for students engaging in a psychomotor practical examination.

Relevant Theories on Eustress

A current operational definition for stress is a person's appraisal of themselves and the environment around them as taxing and threatening to their well-being (McGowan et al., 2006; Selye, 1980, 1983). Much previous research has focused on the negative aspect of stress, known as distress, and has paid little attention to the potential benefits of an appropriate amount of stress (Beilock & Decaro, 2007; Edwards & Cooper, 1988; Hargrove et al., 2015; Hargrove, Nelson, & Cooper, 2013; Kiecolt-Glaser, Glaser, & Christian, 2014; Mesurado et al., 2016; Quick, Wright, Adkins, Nelson, & Quick, 2013). This type of distress is associated with discomforting or hazardous stimuli which create conflict as well as inadequate coping (Breedlove & Watson, 2013; Hargrove et al., 2015; Quick et al., 2013). Internally, distress leads to negative outcomes such as poor physical and mental health (Breedlove & Watson, 2013; Hargrove et al., 2015; Irwin, 2008; Kendall-Tackett, 2009; Quick et al., 2013). In contrast, positive stress, also known as eustress, is shown to improve performance and enhance well-being (Mesurado et al., 2016; Nelson & Simmons, 2011; O'Sullivan, 2011; Simmons & Nelson, 2001b). In the following subsections, I will discuss the theories that have surrounded the stress literature, which help demystify eustress from stress.

Yerkes-Dodson curve law. Yerkes and Dodson (1908) were the first to identify that stress can have positive outcomes, and Selye (1975) built on the Yerkes-Dodson curve law and was the first to coin the term eustress (Edwards & Cooper, 1988; Selye,

1987). The Yerkes-Dodson law states there is an optimal amount of stress in which performance is increased, but if these levels of stress become too high then performance may be impaired (Le Fevre et al., 2006; O'Sullivan, 2011; Yerkes & Dodson, 1908). This law can be explained with a bell curve, with higher performance yielding with ranges in the moderate range of stress measurements and inferior performance levels with low stress and high-stress levels (Yerkes & Dodson, 1908). This law also states that stress is different for different individuals, and many other factors associated with that person and the environment play a role (Yerkes & Dodson, 1908).

Yerkes-Dodson curve law has the capability of explaining the type of stress associated with students undergoing a psychomotor practical examination. According to this law, if the student has a low amount of stress or a high amount of stress they are likely to have reduced levels of performance as compared to those with a moderate amount of stress (see Le Fevre et al., 2006; Yerkes & Dodson, 1908).

Cybernetic theory. The cybernetic theory of stress, coping, and well-being may serve as a means to explain how stress can have both negative and positive appraisals (Cummings, 1979; Edwards, 1992; Edwards & Cooper, 1988). Researchers have defined this theory in the field of organizational stress, and Edwards and Cooper (1988) used this model to define stress "as a negative discrepancy between an individual's perceived state and desired state, provided that the presence of this discrepancy is considered important by the individual" (p. 1447; Schuler, 1982).

From this definition, some interesting connections to eustress can be determined. The perceived state represents the individual's cognitive representation of their physical

and social surroundings, and the desired state is what the person considers an adequate state for them. Stress exists when the individual perceives a negative discrepancy, or negative state, which fails to meet the individual's desired state. This perceived stress leads to either psychological and physiological functioning that can be detrimental to mental and physical health or effective or noneffective forms of coping (Edwards & Cooper, 1988; Katz & Kahn, 1978). The continuation of this process of negative discrepancy and coping or not is described as a negative feedback loop (Edwards, 1992; Edwards & Cooper, 1988;). Edwards and Cooper (1988) indicated this theory is readily adaptable to the concept of positive psychology if the individual appraised positive discrepancies, such as their perceived state as positive, representing something that exceeds their desired state. This concept relates back to the eustress definition provided by Seyle (1980, 1983, 1987) as the positive discrepancy of an individual's perceived and desired state and is considered a significant divergence for that individual. Hence, it is possible this theory could be perceived as a positive feedback loop, which would relate to the concept of eustress.

Conservation of resources (COR) theory. COR theory is one of the more modern and integrative theories associated with stress and has stood the times of cross domain relevance (Hobfoll, 2001; Morelli & Cunningham, 2012). COR theory suggests that stress is an individual's reaction to the experience of threat or the loss of psychological resources or valued material (CITE). Per the COR model, the process of an individual to deter the negative stress response of the lost mental resources or material creates an intrinsic motivation (Hobfoll, 1989, 2001; Morelli & Cunningham, 2012). In

simplified terms, this theory depicts that stress is experienced when an individual's resources are perceived as either threatened, used, or lost (Hobfoll, 1989; Morelli & Cunningham, 2012). Morelli and Cunningham (2012) made a valid point in that a critical component of this theory is the value of these available resources: If an individual values their resources at different levels there may be a different magnitude of stress response that pertains to that individual's threat of these resources.

COR theory also illustrates that stress can also be induced when an person fails to gain adequate resources following a stress cycle, which would be used to reinvest in the next episode of stress encounter (Hobfoll, 1989, 2001). To connect eustress to COR theory, I assumed it was possible that after each stress cycle, an individual is equipped with better resources than they previously had by gaining the adequate resources to manage stress. Meaning that although resources are lost in the short term, it is possible that better resources are gained in the long-term, which can develop into the concept of eustress.

Relevant Theories on Flow Theory

Students who undergo a psychomotor practical examination experience a challenge to their knowledge, competence, physical capabilities, and comprehension about a particular task (Francis-Coad & Hill, 2014; Hubbard, 2015; Preuss et al., 2010; Price & Tej, 2014). For the students to perform at an adequate level during a psychomotor practical they must possess the skills necessary to do so (Francis-Coad & Hill, 2014; Hubbard, 2015). The process of performing on a psychomotor practical examination requires much concentration on the part of the students, which may bring

them into a psychological state known as flow. Flow is explained as the optimal and positive experience of a person who is cognitively efficient, totally engaged, in full concentration, highly motivated, and engrossed in an enjoyable activity (Csikszentmihalyi, 2014; Fullagar et al., 2013; Liao, 2006; Santosa, 2015). Indicators of positivity can further explain the experience of flow in effect, stimulation, absorption, autotelic or intrinsic motivation, sense of control over actions and environment, loss of anxiety and limitation, and pleasure (Csikszentmihalyi, 1975, 2014; Davis & Wong, 2007; Nakamura & Csikszentmihalyi, 2014).

The balance between challenge and skill formulate the original flow theory established by Csikszentmihalyi (1975). This balance indicates the challenge should match the skill level of the individual for flow to occur (Csikszentmihalyi, 1975, 2014; Santosa, 2003, 2015). If the challenge is too high when compared to the skill set of the individual, there could be an adverse consequence associated such as distress and anxiety (CITE). If the challenge is to light or easy as it pertains to the individual skills, there may be the presence of boredom (CITE). Both distress or anxiety and boredom are not antecedents of flow (Csikszentmihalyi, 1990, 2014; Santosa, 2015). This balance between challenge and skill is an important theme of flow theory that has continuously emerged within flow research (Csikszentmihalyi, 1975, 2014; Davis & Wong, 2007; Dietrich, 2004; Fullagar et al., 2013; Gaggioli et al., 2013; Liao, 2006; Nakamura & Csikszentmihalyi, 2014; Pace, 2004; Peifer et al., 2014; Santosa, 2015).

Flow theory also assumes the flow experience to have no limits or equilibrium points for that individual's function. In other words, when a person experiences flow

there is a tendency to seek more complexity and greater enjoyment of the task they are engaged in (Csikszentmihalyi, 1990, 2014; Santosa, 2003). Flow theory has been used in several human studies from the context of sports performance (Jackson & Marsh, 1996; Liao, 2006), work or job setting (Allison & Duncan, 1988; Csikszentmihalyi, 2014), gaming (Harmat et al., 2015; Tozman, Magdas, MacDougall, & Vollmeyer, 2015), marketing (Santosa, 2015), and reading (Mcquillan & Conde, 1996) to name a few. Flow theory has been applied in the area of education, but mostly with a focus on online education (Santosa, 2003, 2015). It is perceived that the flow experience has a positive effect on academic performance and intention to use (Davis & Wong, 2007; Santosa, 2003, 2015).

Relevant Theories on Cognitive Test Anxiety

The primary concepts associated with test anxiety are worry and emotional factors, and from here there has been attempts to differentiate other aspects of test anxiety (Cassady & Finch, 2015; Cassady & Johnson, 2002; Duty et al., 2015; Eysenck & Calvo, 1992; Sarason, 1984). The vast literature on stress and anxiety about test performance remains diverse and often in conflict (Cassady & Finch, 2014, 2015; Cassady & Johnson, 2002; Eysenck & Calvo, 1992; Sarason, 1984). Therefore, we will utilize the concept of CTA to accurately isolate the cognitive component of test anxiety associated with this study.

Cassady and Johnson (2002) explained the concept of worry as insufficient to explain the broad class of cognitive processes involved in test anxiety and therefore introduced the term cognitive test anxiety to represent this dimension (Cassady & Finch,

2015; Cassady & Johnson, 2002; Sarason, 1984). CTA is an individual's cognitive response or internal dialogue regarding an evaluative situation (Cassady & Johnson, 2002; Depreeuw, 1984; Duty et al., 2015). In the context of time, CTA can occur before, during, as well as after the evaluative situation (Cassady & Johnson, 2002).

Worry is the cognitive interference experienced by the tests anxious individual with thoughts commonly fixated on comparing themselves to colleagues, the consequences of being unsuccessful, lack of confidence, excessive worry about the evaluation process, low levels of self-worth, and the feeling of being unprepared for performance (Cassady & Johnson, 2002; Duty et al., 2015). There is literature to support these influencers have the most consistent detrimental effect on student performance, as well as the process of studying to prepare for these performances (Cassady, 2004; Cassady & Johnson, 2002; Depreeuw, 1984; Duty et al., 2015; Hembree, 1988). In fact, there is precise evidence that indicates worry had a significant correlation to academic achievements for post secondary students which are most closely related to this study (Bandalos, Yates, & Thorndike-Christ, 1995; Cassady & Johnson, 2002).

One of the most classic views of how test anxiety negatively impact performance secondary to worry, or cognitive interference, along with a combination of distraction is known as anxiety blockage (Cassady & Finch, 2015; Sarason, 1984). This view has led to more empirical research in the realm of the concept known as choking under pressure (see section on choking under pressure).

The skill deficit model is one of the most current views associated with CTA to explain the results of deficient performance for tests anxious learners (Cassady & Finch,

2015; Putwain et al., 2014). This view describes CTA as a detractor from performance secondary to an individual's inability to efficiently encode, comprehend, or organize content to be used during the testing procedure. In this view, the deficits primarily come from limitations in working memory, executive functioning, or self-regulation that inhibit effective encoding (Cassady & Finch, 2015; Owens et al., 2008). This concept has been identified in both the evaluative and nonevaluative settings (Cassady & Finch, 2015; Naveh-Benjamin, 1991; Putwain et al., 2014), which means this view may have a better explanation of CTA versus previous interpretations that weighed heavily on perceived evaluative stress (Beilock & Decaro, 2007; Beilock & Carr, 2001; DeCaro et al., 2011; Montero, 2015).

Choking under pressure. Situations pertaining to future opportunities and success typically call for high-stakes circumstances where it is desirable to have performance at its best (Beilock, Carr, MacMahon, & Starkes, 2002; Beilock & Decaro, 2007; DeCaro, Thomas, Albert, & Beilock, 2011). The notion that performance needs to be high to overcome these high-stakes is thought to create performance pressure (Baumeister, 1984; Belletier et al., 2015; DeCaro et al., 2011). Evidence indicates this performance pressure often leads to inferior performance for people concerning their actual capabilities (Beilock, 2008; DeCaro et al., 2011; Forgas, Brennan, Howe, Kane, & Sweet, 1980; Gimmig, Huguet, Caverni, & Cury, 2006; Yu, 2015). This phenomenon of poor performance during high stake tasks is known as choking under pressure (Belletier et al., 2015; DeCaro et al., 2011). For this study, choking under pressure may explain the experience physical therapy students undertake with psychomotor practical examinations

and in general lead to negative consequences on people's lives (Belletier et al., 2015; DeCaro et al., 2011; Hubbard, 2015; Jacob et al., 2013).

Furthermore, evidence on choking pressure also demonstrated that individuals who have higher working memory capacity are those who are most susceptible to failure under high-pressure circumstances (Belletier et al., 2015; DeCaro et al., 2011). Although there is no direct evidence to state that graduate level students have higher working memory capacity, the understanding that individuals with higher working memory capacity are more susceptible to choking under pressure may improve the specificity of this study. Physical therapy students who undertake psychomotor practical examinations may be vulnerable to choking under pressure due to the high-stakes situation, monitoring pressure, outcome pressure, and the notion that physical therapy students have high working memory capacity. For this reason, relative theories on choking under pressure are briefly discussed. Distraction theory, explicit monitoring theory, and over-arousal theory are the three main theories associated with choking under pressure (Baumeister, 1984; Lewis & Linder, 1997; Wine, 1971; Yerkes & Dodson, 1908).

Distraction theories propose that high-pressure situations degrade performance by diverting individual attention to task-irrelevant thoughts, such as worried about the situation and its consequences (DeCaro et al., 2011; Lewis & Linder, 1997; Wine, 1971; Yu, 2015). Proposed measures of flow and CTA can be interpreted with respect to distraction theory. Explicit monitoring theory indicates pressure increases self-consciousness about performing correctly, which in turn leads performers to focus their attention on skill execution to ensure an optimal outcome (Baumeister, 1984; Beilock &

Carr, 2001; Yu, 2015). The measure of eustress can be interpreted with respect to explicit monitoring theory. Lastly, over arousal theory suggests that in the presence of excess arousal due to high incentives or social pressure performance can be impaired (Yerkes & Dodson, 1908; Yu, 2015). CTA can be interpreted with respect to over-arousal.

Literature Review

This study investigates if positive psychology factors influence academic performance on a psychomotor practical examination in physical therapy graduate students. The key variables of positive psychology include eustress and flow. The variable of cognitive test anxiety will serve as the control for the profoundly studied distress aspect on academic performance. This section will provide a literature review of the key variables to explain the concepts involved in the study thoroughly.

Literature Review on Eustress

The stress response is complex, and it is believed that most of the time there is a combination of both negative and positive components of the stress response (Kupriyanov & Zhdanov, 2014; Nelson & Simmons, 2011; Selye, 1975). Nelson and Simmons (2011) believed that this stress response could occur as separate entities or simultaneously, and this idea is supported in the previous literature (Lundberg & Frankenhaeuser, 1980). We know that negative stress, distress, has long been associated with many negative consequences such as anxiety, morbidity, morality (Gilbert-Ouimet, Trudel, Brisson, Milot, & Vézina, 2014; Le Fevre et al., 2003; Nelson & Simmons, 2011). Although difficult to obtain empirical data, it is believed that occupational stress

results in $200 to $300 billion spent per year in the United States, which is referring to the negative aspect of stress (Le Fevre et al., 2003).

Eustress is the positive component to the stress response which has been described as a pleasurable and positive discrepancy amongst perception and desires (Edwards & Cooper, 1988; Le Fevre et al., 2003; Mesurado et al., 2016; O'Sullivan, 2011). This optimism is thought to occur in response to a stressor from an individual's positive emotions, i.e. hope, gratitude, meaningfulness, exhilaration, goodwill, etc., that can lead to higher amounts of eustress (Hargrove et al., 2013; Le Fevre et al., 2003; Nelson & Simmons, 2011; Selye, 1987; Simmons & Nelson, 2001a). Eustress is also thought to simultaneously reduce distress (Le Fevre et al., 2003; Selye, 1987). The determining factor of whether or not someone experiences distress or eustress is that individual's perception and interpretation of the situation (Kupriyanov & Zhdanov, 2014; Le Fevre et al., 2006, 2003; Selye, 1987).

Distress prevention has been the focus of most literature, but the idea of eustress generation may be half the battle when managing stress (Mesurado et al., 2016; Nelson & Simmons, 2011). It may be a more holistic framework for managing negative stress if both distress prevention and eustress generation are implemented (Nelson & Simmons, 2011). Although first identified in 1975, eustress appears to be an insufficiently explored phenomenon and few analyses of the stress response entertain the concept of eustress (Kupriyanov & Zhdanov, 2014; Selye, 1975). To add, it does appear the idea of eustress has significant coverage in the popular press but lacks empirical investigation (Le Fevre et al., 2003). The majority of this mainstream modern understanding relies on the Yerkes-

Dotson Law, and there is no distinction between distress and eustress (Le Fevre et al., 2003; Yerkes & Dodson, 1908). For instance, a search in Thoreau EBSCO from 1959 to 2018 using the term distress as a keyword yielded 388,142 citations. A search with eustress as the keyword yielded 472 citations, and some of the citations did not seem to fully comprehend the differential definition of eustress from distress (Al-kuraishy & Al-gareeb, 2017; Le Fevre et al., 2003).

Eustress and performance. Almost all of the research done on eustress and performance is associated with occupational performance (Drageset, Espehaug, & Kirkevold, 2012; Gibbons, 2010; Gibbons, Dempster, & Moutray, 2008). Venkatesh (2015) recently described all the dimensions associated with stress, positive and negative aspects. This article provides a heavy emphasis on explaining how the presence of eustress provides efficient and productive employees and allow for increased opportunity for employees to change for the good (Venkatesh, 2015). Eustress, the positive component of stress, is thought to induce a psychological state such as positive affect, hope, vigor, and good will (Hargrove et al., 2015; Mesurado et al., 2016; Nelson & Simmons, 2011; Quick et al., 2013). For instance, research by Simmons (2000) showed that elevated levels of eustress, measured by hope and active engagement, are reported by working nurses with demanding jobs. Nurses who often face patient deaths still experience eustress and the benefits of it if they are engaged and find meaning in their work (Simmons, 2000).

Previous literature focuses mostly on distress prevention (Quick et al., 2013), but Nelson and Simons (2011) collectively organized aspects of eustress generation. These

aspects of eustress include job redesign efforts to enhance the positive areas of work experience, follow happy-productive worker hypotheses produced by Folkman and Moskowitz (2000), empower hopeful employees by establishing meaningful and positive goals to all members, avoid role ambiguity (confusing an employee of what is expected), and help individuals improve competencies to recognize when they experience eustress in themselves (Folkman & Moskowitz, 2000; Nelson & Simmons, 2011; Simmons & Nelson, 2001a).

Hargrove et al.(2015) formulated a human resource development eustress model conceptually suggesting there is an important causal link between the generation of eustress and performance for organizations. If positive stress can be imparted upon employees, it is believed to increase performance. Furthermore, this model explains that employees can convert stress from a threatening perception to a source of energy, or eustress, with active and purposeful reflection (Hargrove et al., 2015; Raelin, 1997). This enlightened appraisal may help employees incorporate a learned response which involves both cognition and feelings to acclimate to new experiences with this positive appraisal (Boud, Keogh, & Walker, 1985; Hargrove et al., 2015). Hargrove et al. also reported there is a fundamental need for a challenge to be introduced for the employee to experience eustress. The amount of challenge needs to be meaningful and heavily related to the individual goals to accomplish or stimulate personal development (Hargrove et al., 2015, 2013).

Some literature on performance is in part to describe models and theories (Nelson & Simmons, 2011), and even specifically from human resources perspective (Hargrove et

al., 2015, 2013). Nelson and Simons (2011) having the most current published evidence describing eustress associated with occupational performance. The primary focus of this work has to do with the differences between eustress and distress and how employees can either savor eustress or cope with distress. The model that they developed around eustress has the additional emphasis on the use of health in the presence of a positive mental, spiritual, and physical well-being in combination with training employees how to avoid distress which is heavily researched and thought to lead to disease and dysfunction. All this literature supports the idea that eustress has the capability of affecting performance in a working environment which is like the executive processing and psychomotor performance skills that are necessary for a student to do well on a practical examination.

Eustress and academics. The effects of negative stress have a plethora of literature in the student setting which leads to low levels of well-being, satisfaction, and of primary interest, performance in school (Cotton et al., 2002; Mesurado et al., 2016). The concept of eustress is often left out entirely in the investigation process and the term stress only refers to the negative consequences associated with academic performance (Crego, Carrillo-Diaz, Armfield, & Romero, 2016; Gibbons, 2010, 2012; Mesurado et al., 2016; O'Sullivan, 2011).

Mesurado et al.(2016) investigated how self-efficacy and eustress produce increased amounts of flow and engagement in the academic setting for two diverse cultural populations, Philippines and Argentina. The purpose of investigating two separate cultures was to determine if the cultural differences of self-efficacy and the amount of eustress altered the amount of engagement and flow states. Utilizing survey

inventories, it was inferred that both countries had higher academic engagement if there was the presence of high self-efficacy. This finding identifies that if students believe in their academic capabilities, then there is a tendency to experience more flow and academic engagement (Mesurado et al., 2016). However, eustress did not show a direct association with engagement. Eustress only affected engagement via its effect on flow states. Mesurado et al. thought that this might be due to eustress being an immediate appraisal of momentary stressors, but engagement is a more stable and prolonged state. To add, higher amounts of flow were also associated with higher levels of engagement in both cultural settings (Mesurado et al., 2016). Here we can see there is a potential that flow and eustress could have an association with academic performance, but it is most likely in some form of momentary stress versus a prolonged activity in time which requires engagement. It is important to note that Mesurado et al. did not take into effect if engagement does, in fact, correlate with academic performance from an objective measure of performance.

Crego et al. (2016) looked specifically at dental students and the stress associated with examination skills and how it affected academic performance. The results of this online survey research identified that dental students who perceived themselves as efficient on examinations and had a positive self-efficacy appraisal tended to report higher academic performance (Crego et al., 2016). This article is one of the closest to studying the variable of this study and investigates a similar population, but again does not objectively look at academic performance or a moment in time of a face-to-face practical examination.

A study that examined if the source of stress and coping mechanisms affected motivation, the perception of being a part of a learning community, and student satisfaction for first-year undergraduate students in the United Kingdom (Gibbons, 2012). These authors utilize the term positive psychology interchangeable with the term eustress. The findings from this work indicate stress sources that are rated as negative appear to have a stronger correlation with scores in the category being a part of a learning community. For instance, if influencers such as University support facilities, tutoring, and formal social support systems were perceived and rated as a hassle then higher scores for feeling a part of a learning community were observed (Gibbons, 2012). Furthermore, this work identified that student course satisfaction alone is not a good predictor of the student experience and academicians should consider the learning community and intellectual motivation within this equation of determining the student experience (Gibbons, 2012). This evidence supports the notion it is not important to measure variables such as student satisfaction or motivational levels with a practical examination. It is also pertinent to note this large-scale study also did not investigate if these variables influence academic performance.

O'Sullivan (2011) developed a measurement scale to assess the amount of eustress and explored how eustress, hope, and self-efficacy relate to life satisfaction in undergraduate students. Results indicated when eustress was elevated, there was also an improvement in life satisfaction. Also, the combination of eustress, self-efficacy, and hope all correlated with increased life satisfaction with the factor of hope being the best

predictor for life edification. Primarily, this study serves as the groundwork for a reliable scale to measure eustress at the academic level.

Although not recent, it is worthwhile discussing the findings associated with the study done by Gibbons (2010) that investigated stress related to burnout and coping in nursing students. This work was the first study that looked at the concept of eustress among nursing students and association to coping, self-efficacy, and burnout prediction. The findings of this study reported sources of stress that were likely to produce distress have a stronger correlation with well-being than sources of stress that may lead to eustress (Gibbons, 2010). Lower reports of emotional exhaustion were seen in the presence of potential eustress, defined as stronger evidence of dispositional control and self-efficacy. Depersonalization and personal achievement had relatively small variance explanation of eustress production, and Gibbons thought this was due to the lack of sensitivity to individual achievement measures in the eustress scale.

Literature Review on Flow

Flow was first coined by Csikszentmihalyi (1975) by which he defined this as the total involvement of an individual in a task. Csikszentmihalyi began his work with flow by looking at rock climbers, surgeons, chess players, basketball players, composers, and even modern dancers that then grew to other occupations and genres such as educational settings (Csikszentmihalyi, 1975, 1990, 2014; Nakamura & Csikszentmihalyi, 2014; Shernoff et al., 2003). Current literature describes flow as the positive and intense involvement in an activity that seems to invoke the feeling that nothing else matters at that moment, optimal performance is achieved, and time appears to be irrelevant or

altered (Cseh, Phillips, & Pearson, 2016; Csikszentmihalyi, 2014; Hirao, 2014; Mesurado et al., 2016; Nakamura & Csikszentmihalyi, 2009; Nielsen & Cleal, 2010; Shernoff et al., 2003).

Typically, the description of flow is in the context of a state. States are the resemblance of how a person feels about themselves and the environment at a certain point in time (Nielsen & Cleal, 2010; Xanthopoulou, Bakker, Heuven, Demerouti, & Schaufeli, 2008). Hence, the terminology "flow state" is what a lot of the literature uses to describe flow (Csikszentmihalyi, 2014; Liao, 2006; Payne et al., 2011; Yoshida et al., 2014). The three primary elements of flow state include absorption, enjoyment, and intrinsic motivation (Bakker, 2005; Fullagar et al., 2013; Nielsen & Cleal, 2010). Flow states are also characterized by the presence of complementary demand and instant clarity of what is the best course of action (Engeser & Rheinberg, 2008; Fullagar et al., 2013; Nielsen & Cleal, 2010). There is also a sense of the activity seamlessly moving from one step to the other without complications with the feeling that one's capabilities are being optimally engaged at its full capacity and totally under control (Csikszentmihalyi, 2014; Engeser & Rheinberg, 2008; Nakamura & Csikszentmihalyi, 2014; Nielsen & Cleal, 2010). Lastly, Csikszentmihalyi (1975) stated the presence of unambiguous feedback is an essential element in the flow state development, meaning that there needs to be a clear identification of one's good from bad ideas early on in the activity (Bakker, 2005; Cseh, Phillips, & Pearson, 2014; Cseh et al., 2016; Csikszentmihalyi, 1975; Fullagar et al., 2013).

Cseh et al.(2014) accumulated the works done by Csikszentmihalyi and subsequent research to identify nine key characteristics associated with the flow experience: (1) skill-challenge balance; (2) merged action and awareness; (3) clear goals; (4) instant, unambiguous feedback; (5) total focus of attention; (6) sense of control; (7) lack of self-consciousness; (8) altered sense of time; (9) intrinsic sense of reward. Most notably, it has been proposed that the flow experience is vital to stimulate motivation leading to participation in activities without the need for external reward (Cseh et al., 2014).

Flow and physiology. High levels of flow have been found in the laboratory setting to correlate to moderate levels of baroreflex and parasympathetic activity (Tozman et al., 2015). This laboratory finding means when flow is high there is a tendency for heart rate frequencies to slow down versus when there is an anxious situation, when challenge exceeds the subjects skill level, pulse rates tend to go up (Peifer et al., 2014; Tozman et al., 2015).

Yoshida et al. (2014) recently investigated the brain activity of flow experience utilizing functional near-infrared spectroscopy. University students were asked to play a video game that was designed to either create boredom or flow conditions. The students were also invited to fill out a flow state scale to assess if the participants got into flow or not. Interestingly, the researchers decided to study the brain activity while taking the pre- and post-test flow state scale as well to investigate activities that were nonmotor related and task specific. Levels of oxygenated hemoglobin were shown to increase in the right and left ventral lateral prefrontal cortex during flow states, but tend to decrease with

boredom (Yoshida et al., 2014). Activation of this area of the brain suggests the involvement of processing reward and emotion in a state of flow (Kringelbach & Rolls, 2004). Brain activity increased in the right and left dorsolateral prefrontal cortex, only the left ventral lateral prefrontal cortex, and both right and left frontal pole areas during the administration of the posttest of the flow scale, but only for the group that experience flow during playing video games (Yoshida et al., 2014). These all indicate that flow states are associated with cognition, emotion, reward processing, self-evaluation process, and conservation of intrinsic goals (Kringelbach & Rolls, 2004; Yoshida et al., 2014). These findings seem to correlate with variables involved when a student is taking a psychomotor practical examination (Price & Tej, 2014; Yoshida et al., 2014).

Psychobiological effects on flow states have been shown with experimental exogenous cortisol medications (Peifer et al., 2015). In a double-blind, placebo-controlled, crossover and randomized design, Peifer et al. (2015) conducted a study to determine if isolated levels of cortisol would affect flow. 20 mg of the stress hormone cortisol, in the form of hydrocortisone, was orally administered to healthy subjects one day and then a placebo on the next. This amount of cortisol in the human system on the days taking cortisol compares to the natural response to a severe stressor (Deinzer, Kirschbaum, Gresele, & Hellhammer, 1997; Peifer et al., 2015). The subjects were then asked to play video games to determine if the levels of flow were altered when higher levels of cortisol were in their system. These results demonstrated an adverse effect of both high and low cortisol levels concerning the amounts of flow states. In line with flow theory, moderate levels of cortisol were positively associated with flow experience in

which there is an inverted U-shaped relationship between cortisol levels and flow states (Csikszentmihalyi, 2014; Parr et al., 1998; Peifer et al., 2015, 2014). This evidence supports the need to have some measure indicating the amount of stress a student is experiencing during a psychomotor practical, which is why the cognitive test anxiety scale is implemented in the current study.

Flow and performance. Flow has a significant connection with the cognitive aspect associated with psychomotor performance (Csikszentmihalyi, 2014; Nielsen & Cleal, 2010; Ulrich, Keller, Hoenig, Waller, & Grön, 2014; Wolf et al., 2015). Elite athletes tend to have optimal psychomotor performance when there is suppression of task irrelevant cognitive processes, such as explicit monitoring or disrupting thoughts, and exterior attention is enhanced (Hatfield, Haufler, Hung, & Spalding, 2004; Wolf et al., 2015; Zhu, Poolton, Wilson, Maxwell, & Masters, 2011). Wolf et al. (2015) investigated the alpha power frequencies between left and right hemispheres of the brain and compared these frequencies between elite and amateurs tennis players. Decreased cortical activation of the left hemisphere, specifically the temporal area, was associated with more flow experiences and higher rankings in elite status. This reduced activation of the left temporal area is indicative of less involvement of the verbal-analytic processes, and the increase in right hemisphere activation represents increased or superior visual-attentional motor processing (Salazar et al., 1990; Wolf et al., 2015). Another finding in the study indicates there was increased cohesion between the fronto-temporal and premotor oscillations of the right hemisphere for the elite athletes compared to amateurs, but this was not necessarily associated with increased flow experience (Wolf et al., 2015).

There are a few studies that assess performance outcomes as it pertains to the relationship with flow and performance (Koehn, Morris, & Watt, 2013; Türksoy, Altıncı, & Üster, 2015; Wrigley & Emmerson, 2013). One study did determine if there is a relationship between flow states and the ability to accurately hit a tennis ball about different performance tasks. Koehn et al. (2013) looked at 60 junior tennis players between ages 12 and 18 to determine if flow states influenced two different type of physical performance outcomes, self-paced performance (i.e., the tennis serve) and external-paced performance (i.e., groundstrokes or returning a ball in tennis). There was a significant positive correlation between both performance measures and flow states but was specific to certain dimensions of flow. For instance, the concepts of flow about action awareness merging and loss of self-consciousness were the only two that had a significant positive correlation to the self-paced performance outcomes, the tennis serve. For the external-paced performance, the groundstrokes in tennis, the concept of flow for challenge skill balance, action awareness merging, clear goals, concentration on the task at hand, a sense of control, and loss of self-consciousness all demonstrated a significant positive relationship with performance (Koehn et al., 2013). These findings indicate that external-paced activities may have a stronger influence associated with flow states. Because psychomotor practical examinations are under the confinements of time and can be considered an external-paced activity, one could infer that flow could have a positive correlation with performance outcomes.

To describe more of the cognitive aspects performance associated with flow, Cseh et al. (2014) conducted a within-subjects correlation study investigating undergraduate

students in psychology performing a creative mental synthesis task of drawing utilizing pre- and post-task questionnaires. Findings indicate flow was related to the efficiency improvement of creativity and linked to productivity and self-rated creativity. However, flow was not linked to any other performance measures. Cseh et al. concluded that flow may not be related to external performance measures yet is strongly correlated with self-rated creativity. This information may presume that flow motivates perseverance towards achieving excellence but does not directly improve cognitive performance for creativity (Cseh et al., 2014). This evidence may oppose the hypothesis of this current study in that the amount of flow during a psychomotor practical will correlate with academic performance.

Ulrich et al. (2014) took a deeper look at the cognitive performance of flow states utilizing Magnetic Resonance -based perfusion imaging to measure neural correlates of flow in the human brain. In addition to subjective experiences, this allowed the researchers to determine which areas of the brain became more active during various levels of potential flow experiences (Ulrich et al., 2014). The cognitive task used to induce these flow states was arithmetic calculations that continuously altered the challenge and skill level of the individual. This continuous operation of intensity allowed the researchers to create an experimental setting of either boredom, optimal, or overload and anxiety to determine what areas of the brain had changes in regional cerebral blood flow during optimal flow states. Cerebral blood flow significantly increased at the left anterior inferior frontal gyrus, and significantly decreased the amygdala. These measures at the left anterior inferior frontal gyrus indicate an individual greater sense of control,

and findings at the amygdala account for the presence of positive emotions (De Baene, Albers, & Brass, 2012; Straube, Pohlack, Mentzel, & Miltner, 2008; Ulrich et al., 2014). But These findings all correlated with subjective ratings of flow experiences per the flow questionnaire and align with the definition of flow states (Ulrich et al., 2014). The results of this study indicate that the existence of flow has the capability of producing a psychologically, or cognitive, state to improve performance for students taking a practical examination. This evidence also serves to understand that the challenge should be at an optimal level for the student's skill level to produce a flow state that can help improve performance.

Other studies investigating the aspects of performance and flow pertaining to employment-based activities exist. Seemann and Seemann (2015) gathered information done on flow to determine the preconditions that may allow an individual to get in a flow state from a managerial perspective. These prerequisites include: (1) generating an intellectually stimulating task; (2) giving assignments that have clear goals and provide short-term feedback on activity; (3) allowing sufficient autonomy to feel in control of one's actions; (4) providing the opportunity to concentrate on the task without disruptions (Nielsen & Cleal, 2010; Seemann & Seemann, 2015). These prerequisites are thought to allow employees to engross in cognitively challenging stimulates, such as problem solving, planning, evaluating, which lead to flow like states (Nielsen & Cleal, 2010). The same can be inferred to students in which they would need to plan or prepare, problem solve, and evaluate their performance if they are participating in a practical examination.

These mentioned preconditions could indicate the high likelihood these students have of getting into a flow state during the practical examination.

Flow and academics. Some studies have investigated the effects of flow in an academic setting, primarily in high school and undergraduate settings (Mesurado et al., 2016; Nakamura & Csikszentmihalyi, 2002; Santosa, 2003, 2015; Shernoff et al., 2003). Shernoff et al. (2003) collected data from 13 different high schools in which 526 high school diverse students were examined for their location, activity, and efficient and cognitive experience at random moments. This collection of data is a method called experience sampling method (Csikszentmihalyi & Larson, 1987). The results concluded that academic activities that are intense and promote positive emotions are most likely to improve engagement (Shernoff et al., 2003). It is important to note that within this study the researchers considered the term academic engagement to be a component of flow theory, and does not explicitly separate the concept of engagement and flow.

Most recent literature investigating flow experience in academics focuses on the online environment because it is a relatively new process of pedagogy and andragogy (Esteban-Millat, Martínez-López, Huertas-García, Meseguer, & Rodríguez-Ardura, 2014; Santosa, 2015). Since this literature is the most current evidence associated with flow experiences and academia, a review of online studies is merited. Initially, Santosa (2003) produced research on a conceptual framework of how to implement flow theory around a web-based course. In this context the author described ways students may be able to improve performance and the importance of having the challenge match the student skill levels (Santosa, 2003). Santosa (2015) followed up this concept with a study to

investigate these suggestions and determined that the two key variables which increase flow experience in an online tutorial include prior knowledge, such as online skills, and a perceived challenge. These works also suggest that the flow experience will have a positive effect on the student performance and intention to use online tutorials (Davis & Wong, 2007; Santosa, 2003, 2015), which can easily be generalized to students in a blended course of both online and face to face.

Esteban-Millat et al. (2014) further investigated the online learning environment utilizing both quantitative and qualitative methods. This consisted of extensive interviewing of approximately 29 students for the qualitative portion and then survey methodology of 2,574 students in higher education learning programs for the quantitative component. The data obtained indicated that two conditions, a perceived alteration of time and an absolute attention to an activity, are the strongest to determine the amount of flow state a student may experience. Meaning the more a student is absorbed and focus on an activity, the less they may be aware of the passage of time. Other variables such as control of one's actions, interactivity, challenge, as well as the perceived challenge, and adaptation to their needs as a learner affected flow but indirectly through the two most important variables (Esteban-Millat et al., 2014).

Esteban-Millat et al. (2014) made a profound statement that there are two consequences of students being in a flow state in an online environment. These two consequences include a positive effect and student learning (Esteban-Millat et al., 2014). This statement on positive effect was made mostly by leaning on previous work done by Steele and John (2009). The work by Steele and John also utilized a web-based survey in

which they recruited 137 college students to determine if flow experiences were associated with psychological and physical health. They determined that flow mediated the relationship between academic work characteristics and psychological well-being and physical health and psychological well-being were indirectly affected by flow experiences. One important aspect to mention for both studies is that the authors clearly indicated the assessment of learning was based on subjective perception of the individual being interviewed (Esteban-Millat et al., 2014; Steele & Fullagar, 2009). This supports the need to have objective measures to determine if there is an association with academic performance and flow.

I found limited studies that can describe the relationship between academic performance outcomes and flow states. Rossin, Ro, Klein, and Guo (2009) looked at the effects of flow and learning outcomes with 23 graduate level MBA students taking online courses. Pre tests were given to all students to assess their beginning levels of knowledge in the form of a 20-question quiz. After two-different two-week module classes there was a post-test quiz with the same questions given as well as a survey to determine characteristics of flow activities, dimensions, perception of learning and skill development, and student satisfaction associated with their experience during the 2 week modules. This research produced evidence that the overall flow score was not related to learning performance, as students did not show an association with increased quiz results and the levels of flow. Only the flow dimension of autotelic experience levels was able to predict the amount of perceived learning by the student and student satisfaction (Rossin et al., 2009). The dimensions and characteristics of flow were able to predict the

perceived skill development, but the overall flow score did not show statistical significance (Rossin et al., 2009). This study is the evidence that flow may not be indicative of learning outcomes on a cognitive performance measure as the students were assessed with multiple-choice questions. It also indicates there are dimensions and characteristics of flow that have a potential effect on skill development because the students did show an improvement in perceived skill development, but it was not actually measured. This current study does measure if cognitive skill is associated with flow states.

More recently, Hirao (2014) reported flow experience might have the potential to improve learning indirectly by enhancing student's wellness and willingness to learn (Asakawa, 2010; Nakamura & Csikszentmihalyi, 2002, 2014; Steele & Fullagar, 2009). This information led the conduction of a study to better understand the biological bases of flow in the educational setting. Like the work done by Yoshida et al. (2014), Hirao used near-infrared spectroscopy to measure the amount of oxygenated hemoglobin concentration in the prefrontal cortex of the brain. To start, different results were found in the study because the mechanism of measurement for near-infrared spectroscopy was not as valid as the methods used by Yoshida et al.. The reason for reporting this study is because of its similarities to the variables associated with the current research study. Hirao specifically investigated occupational therapy students during the performance of a cognitive task using vowel sounds to correlate with as many words they could think of in 20 seconds; this process was repeated three times continuously. These results demonstrated a negative correlation with the amount of prefrontal cortex activation and

the amount of flow, which is different to the Yoshida et al. study. However, it is important to note that Hirao found this verbal task performance to significantly correlate with the flow levels for subgroups in which the students had elevated levels of skills and high levels of challenge during the performance. These findings produce convincing evidence that flow may have positive correlations with performance levels for psychomotor practical examinations. This evidence also supports the notion that measurement procedures such as near infrared spectroscopy are not necessary for this current study because it may not be reliable enough, and it only measures superficial activity in the brain (Hirao, 2014; Ulrich et al., 2014; Yoshida et al., 2014).

Eustress and flow. Eustress has been shown to have a significant positive relationship with flow (Mesurado et al., 2016). A positive perception of stressors appears to be one of the essential components present for the experience of flow to occur (Csikszentmihalyi, 2014; Mesurado et al., 2016; Nelson & Simmons, 2011). O'Sullivan (2011) acknowledged that in the presence of positive stressors (eustress) people were more productive and effectively productive within that moment as compared to if there were no stress at all (positive or negative stress). This information indicates that flow and eustress affect a momentary mental state due to the positive cognitive appraisal of transient stressors (Mesurado et al., 2016).

Mesurado et al. (2016) identified that eustress does not have a direct relationship with academic engagement but does have an indirect effect on student engagement through flow states because positive appraisal of the stress involved is essential for an individual to experience flow. Therefore, eustress does not need to be present for

academic engagement to occur, which sets a clear distinction between flow and academic engagement (Mesurado et al., 2016). This finding is also in support of flow theory as this indicates the need for a challenge in which the student can adapt to and rise to the occasion to produce elevated levels of flow. The key point is that appropriate levels of challenge are the connection between eustress and flow (Mesurado et al., 2016; Peifer et al., 2014). Again, it is important to note the work done by Mesurado et al. focused on engagement in the academic setting and not academic performance or academic results associated with the variables as the present study does.

Literature Review on Cognitive Test Anxiety

Test anxiety has been studied for over 50 years, and many subcomponents have been identified to describe aspects of the anxious response students experience during the evaluation and learning process (Cassady & Finch, 2015; Duty et al., 2015; Liebert & Morris, 1967). The two principal dimensions that consistently explain test anxiety are emotionality and worry. Emotionality elicits physiological indicators such as tension, increase heart rate, increased cortisol levels, and skin perspiration (Beilock & Decaro, 2007; Eysenck & Calvo, 1992; Sarason, 1984) which is not the aspect of test anxiety that will be the focus of this study. The dimension of worry has a larger range of beliefs and behaviors that have an impact on the students testing and learning experience (Cassady & Finch, 2015; Liebert & Morris, 1967; Sarason, 1984). This dimension of worry is also referred to as the cognitive test anxiety and has been identified as the component of test anxiety to have the most impact on academic performance (Cassady, 2004; Cassady & Finch, 2014, 2015; Cassady & Johnson, 2002; Duty et al., 2015; Zhang & Henderson,

2014). For this reason, CTA and its particular impact on academic performance will be the focus of this literature review.

To further elaborate on CTA, Sarason (1984) identified that worry and test-irrelevant thinking are the core elements of this cognitive dimension of test anxiety which led to a series of engaging studies to investigate these concepts (Cassady & Finch, 2015; Sarason, 1984). This engaging research has resulted in the understanding that there seems to be a broad range of factors associated with individuals with cognitive test anxiety. The common characteristics related to CTA includes (a) an elevated perceived threat for examinations; (b) poor cognitive processing, which includes study strategies and organizational skills; (c) cognitive interference, or distraction, easily occurs either during the testing period, study sessions, or both; (d) perspectives on motivation which promote disengaged coping strategies, task avoidance, and acceptance of failure (Cassady, 2004; Cassady & Finch, 2014, 2015; Cassady & Johnson, 2002; Sarason, 1984).

Students with test anxiety seemed to display poor test performance secondary to poor organization skills, decreased comprehension of content during the exam, and inefficient encoding (Cassady & Finch, 2015; Naveh-Benjamin, 1991). These deficits seem to come from the individual's lack of executive functioning, including working memory, as well as self-regulation for the concept of effective coding (Cassady & Finch, 2015; Owens et al., 2008). Interestingly, these deficits do not appear to be significantly affected if the student is under an evaluative event or not because the limitations present in an individual with cognitive test anxiety were studied in nonevaluative or pressured settings (Cassady, 2004; Cassady & Finch, 2015; Putwain et al., 2014).

There is supportive evidence to show academic performance specifically is hindered by the levels of cognitive test anxiety (Cassady & Johnson, 2002; Duty et al., 2015; Khalaila, 2015; Zhang & Henderson, 2014). The focus will be on the most current reports of this association and studies that investigated students in the healthcare professions. Zhang and Henderson (2014) looked at 166 chiropractic students in their third-quarter and gave them the Spielberger Test Anxiety Inventory midway through the term. This test anxiety inventory tests for two subscales that measure worry and emotionality (Spielberger, 1983). Analysis of the data in comparison to two academic performance measures, which was a written examination for knowledge and a skills performance assessment for a head and neck physical examination (Zhang & Henderson, 2014). The findings revealed there was a small statistically significant negative correlation with the test anxiety inventory scores and the combination of total exam performance. Interestingly, a multiple regression was conducted to determine if the aspect of worry and emotionality affected academic performance differently than the total test anxiety inventory. Worry was the strongest indicator in which there was a moderate statistically significant negative correlation with written exams. As so did emotionality, but to a lesser degree (Zhang & Henderson, 2014). Of particular interest for this study, the skills assessment performance showed a small trend towards a negative correlation with the test anxiety inventory but was not statistically significant. For some unknown reason, it does not appear the researchers did a multiple regression for the subcategories of worry and emotionality on the academic performance for skills assessment. This lack of conciseness leads to an unresolved question of whether or not cognitive test anxiety

specifically altered psychomotor practical performance, which was termed skills assessment in the Zhang and Henderson (2014) study.

Duty et al. (2015) investigated the effects of cognitive test anxiety from 183 undergraduate students in a private all female nursing program on examination T scores. T scores are a more global, or standardized, assessment of academic performance in the three fall semester examinations (Duty et al., 2015). This research implemented the original 25 item cognitive test anxiety used by Cassady and Johnson (2002) who identified the adverse effects of cognitive test anxiety on subjective report of academic performance measures for undergraduate students (Cassady & Johnson, 2002). This scale was administered at the beginning of the semester before any examinations took place. Just as Cassady and Johnson did in their study, Duty et al. separated the data of the cognitive test anxiety scores into low, average, and high to investigate comparison to examination T scores. Findings indicated T score measures were small but statistically significantly different amongst the three levels of cognitive test anxiety. Although results did say that the third exam T scores did not have a significant statistical difference, the researchers felt that it may be due to a lack of power because the sample size reduced for that exam. High versus low levels of cognitive test anxiety groups demonstrated 3 to 5 points lower on the T scores generally, and there was less significance between low to average and average to high cognitive test anxiety (Duty et al., 2015). Again, we see the adverse effects of cognitive test anxiety on academic performance in the realm of examination scores versus psychomotor practical exams. Also, this study by Duty et al.

investigated a global assessment of academic performance versus a particular moment in time.

Khalaila (2015) conducted a study to determine if the negative effects of cognitive test anxiety on academic performance could be moderated with the amounts of intrinsic motivation and academic self-concept using undergraduate nursing students in a 4-year program. Academic self-concept consisted of seven subscales including final grade and effort, study habits, peer evaluation of academic ability, self-confidence in academics, satisfaction with college, self-doubt regarding ability, and self-evaluation with external standards (Khalaila, 2015; Reynolds, 1988). The students' overall grade point average for all courses determined the measurement of academic performance. Spielberger Test Anxiety Inventory was used for the test anxiety measure (Spielberger, 1983), and intrinsic motivation was measured with a 12 item intrinsic subscale of the academic motivation scale (Vallerand et al., 1992). Findings indicated that academic self-concept has a significant direct relationship with academic achievement, in that if a student perceives positivity towards their skills and accomplishments the more likely they will have higher academic achievement. It was also determined that intrinsic motivation and test anxiety are capable of mediating the relationship between academic self-concept and academic achievement. This mediation finding means high academic intrinsic motivation scores and high test anxiety scores have the capability of explaining the association between academic self-concept and academic achievement. Lastly, both mediators, intrinsic motivation and test anxiety, were capable of predicting academic achievement (Khalaila, 2015). Intrinsic motivation may be considered one of the components of flow,

i.e. intrinsic sense of reward, and this study indicates flow may have potential to affect academic performance as well as further evidence to prove test anxiety can have detrimental effects on academic performance (Cseh et al., 2014; Khalaila, 2015).

Recently, Cassady and Finch (2015) looked further into the dimensions associated with cognitive test anxiety. Utilizing 619 undergraduate students primarily in educational psychology courses over a span of two years, Cassady and Finch gave the revised 17 item cognitive test anxiety scale either online or in a classroom setting. This revised scale took out the test confidence aspect of the original CTA scale (Cassady & Finch, 2014). The researchers also included eight additional questions to investigate three phases of the learning test cycle to test the research question, which identified a nonsignificant determinant of CTA. Based on the results from reported levels of test anxiety it was determined that there are two covert classes of students, low levels of cognitive test anxiety and high levels of CTA. The interesting finding from these two categories of students is that they both had distinct factors associated with anxiety. Individuals with levels of cognitive test anxiety seemed to identify a unidimensional construct for most of the items on the revised cognitive test anxiety scale. Those with high levels of cognitive test anxiety view this concept of CTA in two ways, which include cognitive interference and focusing on perceived deficits and skills for test taking (Cassady & Finch, 2015). These findings indicate that CTA may need to be analyzed in subgroups to determine the true effect of CTA on academic performance because students appeared to appraise CTA differently depending on their level of anxiety.

To further explain the literature that has been presented, all of these studies reported age, race, program track, highest academic degree, ethnicity, and academic year did not show any statistically significant differences in the test procedures of cognitive test anxiety and academic performance (Duty et al., 2015; Zhang & Henderson, 2014). Most of the study did provide evidence that females have higher academic performance measures than males but does not appear to be significantly different amongst male and females with the relationship of cognitive test anxiety and academic performance (Cassady & Johnson, 2002; Khalaila, 2015; Zhang & Henderson, 2014). Also, none of the studies investigate the immediate correlation of test anxiety, or positive psychology, of a psychomotor practical examination.

Literature Review on Academic Performance

Academic performance is the measurement of the student's achievement in the academic setting, and can be assessed in many ways (Bay & Kotaman, 2011; Branch, Cohen, & Hynd, 1995; Rana & Mahmood, 2010; Yu, 2015). In reviewing the literature there were many terms used for academic performance such as academic achievement, learning outcomes, student grades, or academic achievement to name a few (Cotton et al., 2002; Geiger & Cooper, 1996; Hubbard, 2015; Karlen & Mccathie, 2015; Marden, Ulman, Wilson, & Velan, 2013). Academic performance in the context of this research is an assessment of a graduate-level physical therapy student's capability of performing a psychomotor practical examination in an orthopaedics course. This orthopaedic course utilizes an academic rubric that is consistent amongst all instructors who evaluate

students for their performance. This literature review on academic performance focuses on explaining evidence to support this method of evaluation in graduate-level education.

In modern times, it is common to use an academic rubric to assess these different types of academic performances (Arter & Chappuis, 2007; Cybinski & Selvanathan, 2005; Hohmann & Grillo, 2014; Lee, Lee, & Bong, 2014; Mustapha, Samsudin, Arbaiy, Mohamed, & Hamid, 2016; Reddy & Andrade, 2010). Rubrics are utilized in education to increase objectivity, accuracy, and reliability of academic performance for students trying to attain degrees or skills (Mustapha et al., 2016; Reddy & Andrade, 2010). A clear indication of expectations for performance is included in these rubrics by listing out the criteria of what counts, as well as describing the level of quality from excellent performance to poor performance (Reddy & Andrade, 2010).

Reddy and Andrade (2010) conducted a literature review of rubrics in higher education. Some key findings from their report were rubrics are being utilized in higher education for a variety of different disciplines and used for a variety of genres of academic performance such as oral presentations, projects, literature reviews, and even written communication (Reddy & Andrade, 2010). The research also suggests that higher levels of achievement and more learning occurs when instructors utilize rubrics (Mustapha et al., 2016; Reddy & Andrade, 2010).

Petkov and Petkova (2006) looked at the effects of rubrics for short-term projects in a postgraduate level course in management and business. The design consisted of two similar courses with 20 students and each given a similar project that was to be for a final grade assessment. One cohort received a rubric, and the control group did not. There was

significantly higher performance measured in the group that received the rubric versus the group that did not (Petkov & Petkova, 2006). Contradictory, Green and Bowers (2006) found that there was no statistically significant difference between two groups of graduate-level students with one receiving a rubric and the other not for a literature review evaluation. Weakness of this study can be identified because there were only 16 participants and it is questionable if the rubric was utilized correctly (Green & Bowser, 2006). Power to detect a medium population effect (Cohen's d = .5) was only 15% and power to detect even a large effect (Cohen's d = .8) was only 32%.

There is evidence to support that rubrics are more useful if the students have an opportunity to engage in the rubric (Hohmann & Grillo, 2014; Reddy & Andrade, 2010). For instance, Hohmann and Grillo (2014) did a study to determine if a rubric designed to investigate critical thinking skills consisted of gathering appropriate information, developing relevant questions, intellectual autonomy, and perseverance. This rubric was only implemented during tutoring sessions to help students recognize their ability to obtain information by putting meaning to the learning. Over a 2 year period, 97 students went through the rubric training with specifically trained tutors. The results indicated that students who utilized the rubric demonstrated a higher course grade and was associated mostly with higher scores on the rubric versus time spent in tutoring sessions (Hohmann & Grillo, 2014). It is important to note that this study did not have many control variables so it was difficult to determine a cause-and-effect as well as no measures to assess each tutors effectiveness with utilizing the rubric with the student.

This research provides evidence to support the methods utilized in the orthopaedic course and determining academic performance. At the beginning of the semester, the students are given the academic performance rubric for their psychomotor practicals. The rubric is discussed in class, item by item, and mock practical examinations are provided to demonstrate to the students how to utilize the rubrics.

Summary and Conclusions

In conclusion, in this chapter I explain the theoretical framework associated with the key variables to explain further how these concepts are important to the research question. An extended elaboration on the concepts, as well as additional information on choking under pressure, was provided. The literature provides empirical evidence on the concepts associated with eustress, flow, CTA, and academic performance to identify gaps in the literature.

From this literature review, it is known that positive psychological traits, such as eustress and flow, are to some extent neglected when researchers are investigating stress associated with students and their performance. For example, over the years the primary focus has been on distress versus eustress (Gibbons, 2015; Hargrove et al., 2015, 2013; Mesurado et al., 2016; Nelson & Simmons, 2011; Quick et al., 2013). This aspect of the positive side of stress could be a major factor in determining how students perform (Mesurado et al., 2016; Selye, 1975). We know that eustress and flow correlate with improved performance in many genres (Cybinski & Selvanathan, 2005; Hargrove et al., 2015; Koehn et al., 2013; Le Fevre et al., 2006; Mesurado et al., 2016), but it is not clear if these variables influence academic performance during a psychomotor practical

examination which is in a temporary moment in time. Most literature is lacking objective measures of academic performance in which they go off subjective input of the participants as it pertains to their performance in academia or utilized some global scale such as GPA or end of term course grades.

CTA has consistently shown to impair performance in the academic setting, particularly for graduate-level students (Cassady & Johnson, 2002; Duty et al., 2015; Khalaila, 2015; Zhang & Henderson, 2014). There is also no direct evidence to indicate the effect of CTA as it relates to the psychomotor competence on a practical examination, particularly in the genre of graduate level physical therapy students. For this study, CTA was used as a control measure against the positive psychology variables. This evidence attempts to further identify variables associated with student performance in academia, especially as pertains to the positive aspects of psychology versus anxiety or distress. Psychomotor competence is imperative in this genre of healthcare, especially for physical therapist performing an orthopaedic clinical exam (Commission on Accreditation in Physical Therapy Education, 2016). This study gives academicians and administrators further insight as to what can influence a student's performance on these clinical skill assessments, i.e. psychomotor practical examination and academic performance.

Chapter 3 will address the study design and methodological procedures to investigate the research question. There will be an explanation of the sampling process, inclusion and exclusion criteria, logistical procedures, ethical considerations, and data collection to be conducted. The instruments used in the study will be operationally defined, and an explanation of each instrument psychometrics is provided. Furthermore,

there will be an explanation of the data analysis procedures. Lastly, a thorough explanation of threats to internal and external validity are provided.

Chapter 3: Research Method

Introduction

Physical therapy students have higher levels of stress and anxiety during their academic studies, especially during examinations such as psychomotor practicals (Chambers et al., 2016; Duty et al., 2015; Frank & Cassady, 2005; Preuss et al., 2010). Studies have shown these levels of negative stress and anxiety have a deleterious effect on academic outcomes; however, evidence in this genre has a primary focus on negative psychological states, and little attention has been given to the positive aspects (Duty et al., 2015; McGowan et al., 2006; Mesurado et al., 2016).

Positive stress, also known as eustress, is known to have a positive correlation with flow states in various environments, including the academic setting (Gaggioli et al., 2013; Mesurado et al., 2016; Peifer et al., 2014). These positive psychological variables have not been assessed under the acute condition of choking pressure in the academic setting for examinations such as psychomotor practicals. During written exams, higher amounts of cognitive test anxiety are exhibited by the student and this will result in lower performance outcomes (Cassady & Johnson, 2002; Duty et al., 2015). However, this does not explain how positive psychological states correlate with academic performance. Based on the lack of research describing how eustress and flow states affect academic performance in excessively stressful practical examinations, the purpose of this study was to determine if eustress and flow, using CTA as a control variable, correlate with academic performance on a psychomotor practical examination (see Mesurado et al., 2016).

In this chapter, I will describe the methodology of the study investigating eustress and flow and their effects on physical therapy students taking a psychomotor practical examination. An overview of the research design, target population, sampling strategy, subject recruitment process, and the data analysis plan will be provided. I will also operationally define the instruments used to measure the variables. Finally, threats to validity and ethical considerations will be considered.

Research Design and Rationale

In this study, I investigated if the presence of eustress, flow, and CTA have a correlation to academic performance for physical therapy students in their second trimester taking a psychomotor practical. At that point in the curriculum, these students have taken approximately 10 different types of practical examinations, and therefore, were familiar with the procedures associated with practical examinations. The dependent variable was academic performance, which was measured by a standardized academic rubric created to assess each student's competence pertaining to the content on the psychomotor practical exam.

I used the independent variables of eustress, flow, and CTA to account for the effect. In this instance, the CTA served as a control variable due to its capability of indicating the effects of negative stress on examination testing (see Cassady & Johnson, 2002; Duty et al., 2015). The measurement scales used to assess eustress, flow, and CTA were identified as psychometrically sound. The independent variables were assessed immediately after the academic performance measurement.

A quantitative research design was the most appropriate to answer the research question. With consideration of the variables, ethical considerations of the population, and the nature of the study, I thought it was best to use a correlation research design (see Campbell & Stanley, 1963). A correlation research design is capable of establishing if there is a correlation between these variables and to what extent (Campbell & Stanley, 1963; Creswell, 2009). Psychometrically sound questionnaires are typically used in a correlation study design and attempt to discover the pattern of relation between variables before an individual can infer a causal effect (Frankfort-Nachmias & Nachmias, 2008).

Within the academic setting, it is important to consider how these variables can affect the student's performance. With this correlation research design, it was possible for me to measure the independent variables after the dependent variable was measured. This design allowed the data to be collected in a standard test setting for the students with little interruption to the standard practical examination procedure. In this instance, I conducted the measurement of academic performance with a standardized academic rubric developed for this psychomotor practical exam.

Immediately following the student's practical examination, the student left the testing room and went to another room or space to receive the measurement scales for eustress, flow, and CTA. The scoring of the academic rubric and feedback from the instructors was delayed until after the questionnaires had been completed or if the participant chose to cease participation in the study. If the student had knowledge of their score or received feedback prior to answering questionnaires it could have been a confounding factor that may have altered the student's perception of their own

psychological state. Results and feedback were provided to the student afterwards via the discretion of the lead instructor of the course.

I asked students to answer the questionnaire by reflecting upon their experience during the practical examination they recently commenced for the Flow Scale and on their general psychological state for the Eustress and CTA Scales. The plan was to have them complete the questionnaires within a 30-minute time frame after taking a psychomotor practical exam. It is important to explain why the constructs were not tested prior to the practical examination. First, the construct of flow can only be measured immediately after an activity because the scale is designed for the individual to reflect upon a performance that recently occurred (CITE). The Eustress and CTA Scales are designed to assess a general trait, and not a state (CITE). Although, these trait measurements could be considered a limitation of the study, they may have also been a strength of the postpractical design because all participants experienced the same situation, the result is still a measurement of a common construct. The validity of a true trait measure can be questioned because an individual is always assessed with the influence of a situation they are currently in (Steyer et al., 2015). Moreover, the immediacy of the state event could reduce the social desirability effect because of increased construct clarity and association evoked by the state event (CITE). Lastly, the partnering organization, the University of St. Augustine, did not allow prepractical administration of the surveys because it may have compromised a student's performance.

My use of a quantitative approach with a correlation research design allowed for an appropriate test of the research hypotheses. This approach consisted of determining if

the levels of eustress, flow, and CTA correlated with academic performance in physical therapy students taking a psychomotor practical examination.

The psychomotor practical examination for the basic orthopaedic course at the University of St. Augustine is conducted twice a semester, with the first practical examination focusing on the upper extremity content and the second on the lower extremity. The university has revolving semesters, which means this course is taught three times a year with a different cohort each semester. Any one of the practical examinations conducted in this orthopaedic course would have sufficed for data collection to obtain the information needed to answer the research question. The organization indicated that the orthopaedic course of the University of St. Augustine would serve as a useful resource to attain data from because it is readily available multiple times throughout the year.

I reserved a designated room in the university for the students to have a quiet location to answer the questionnaires for the measurement of eustress, flow, and CTA following the practical examination. This room was organized and provided by each department's administration assistant and lead instructors of the course at the University of St. Augustine for each program and campus.

This research design was the most appropriate design to answer the research question and hypotheses because it allowed me to measure the levels of eustress, flow, and CTA immediately following the psychomotor practical examination which afforded the most natural and standardized assessment of academic performance to occur before intervening with the subjects. The subjects then reflected upon their experience, so they

could accurately give the measurements of flow during the practical examination and then eustress and CTA as a trait measurement. I then compared the results of the measurement scales to the students' academic performance, allowing me the opportunity to identify if positive psychological states influence academic performance.

Methodology

Population

The participants in the study were from the population of physical therapy doctoral students in the University of St. Augustine for Health Sciences. According to the Commission on Accreditation in Physical Therapy Education (2016), there are 233 accredited physical therapy programs in the United States. The University of St. Augustine for Health Sciences is one of these accredited programs and consists of three different campuses across the country. Unique to University of St. Augustine is that the focus of the education is on entry-level graduate physical therapy and occupational therapy students, which means the only students on campus are graduate-level students earning a clinical doctorate in rehabilitation. This university operates on a trimester schedule, meaning that each course is taught three times a year to three different cohorts. Approximately 55 to 60 students make up each cohort.

In this study, I specifically focused on students obtaining a clinical doctorate of physical therapy who were enrolled in a clinical course known as Musculoskeletal I: Orthopaedics, which takes place in the second trimester of the curriculum. Students enrolled in this orthopaedics course are assessed for competence with written and psychomotor practical examinations. Throughout a single trimester in this orthopaedic

course, each cohort undergoes four written exams and two practical exams. The targeted subjects were the students enrolled in this orthopaedic course in the spring of 2018. The data collection took place during the first practical examination given in this trimester.

Sampling and Sampling Procedures

In this study, I used a nonprobability sampling strategy known as convenience sampling (see Creswell, 2013; Frankfort-Nachmias & Nachmias, 2008; Groves et al., 2009). The population of interest for this study was physical therapy doctoral students who were enrolled in a graduate level program. I used convenience sampling in this study because the physical therapy students were readily available to me at the University of St. Augustine for Health Sciences (see Frankfort-Nachmias & Nachmias, 2008). A probability sampling strategy would not have been appropriate for this correlation research design study because there was no intervention or need to determine a cause-and-effect relationship amongst groups (see Creswell, 2013). A drawback of using a convenience sampling strategy is that the researchers cannot know if the sample is a good representation of the population, making it difficult to infer the results can be generalized across populations (see Creswell, 2009, 2013; Frankfort-Nachmias & Nachmias, 2008). However, I collected certain demographics to calculate proportional representation to known population frequencies.

With this understanding, one reason I chose the University of St. Augustine as the sampling frame was because there are three different campuses across the country located in Florida, Texas, and California with the Florida campus having a satellite campus as well (see Frankfort-Nachmias & Nachmias, 2008). Although the sample strategy is

considered a convenience sampling strategy, physical therapy students from the East, Central, and Western regions of the United States were represented in the study. This sampling of different parts of the country may help improve the ability to generalize the results to other physical therapy students across the country (see Creswell, 2013; Frankfort-Nachmias & Nachmias, 2008).

The sample was taken from doctoral physical therapy students who volunteered to participate in the study. The students were the appropriate population to develop a sample for the study due to the specific research question (see Creswell, 2013; Groves et al., 2009). Even though this is a particular population, this was still considered a voluntary recruitment because subjects were asked to participate and had the volitional opportunity to take part in the study or decline.

The inclusion criteria consisted of students who were enrolled in the Orthopaedics: Musculoskeletal I course, which is in the second trimester of the physical therapy program. All students who were enrolled in this class were invited by the primary course instructor who had no role in the study design as well as no vested interest in the outcomes. Exclusion criteria consisted of students who have a known psychological diagnosis who may have been in jeopardy of increased stress and anxiety or any adverse event from taking the eustress, flow, and CTA questionnaires after the completion of the psychomotor practical exam. I developed the invitation to participate and informed consent forms to clearly present the exclusion criteria, and participants were able to self-exclude themselves from the study.

The sample size for the study consided confidence, precision, and the amount of variation to provide an appropriate number of subjects to estimate a true population mean. The statistical method was a multiple regression analyses. Multiple regression analysis was the most appropriate statistical analysis to determine if there is a correlation between eustress, flow, and cognitive test anxiety and academic performance on psychomotor practical examinations (Field, 2013). The sample needed to be large enough to accurately identify a false null hypothesis (Creswell, 2009, 2013), not just for the overall multiple correlation (i.e., the combined effect of the set of predictors), but also for the effect of individual predictors. With alpha of .05, power of .80, 3 independent variables, a medium-sized population omnibus effect (R^2 = .13), and a medium-sized population individual predictor effect (semipartial squared correlation, sr^2, of .06), a sample of 116 participants with complete data was required.

Procedures for Recruitment, Participation, and Data Collection (Primary Data)

Specifically, subjects were recruited from the musculoskeletal course, known as orthopaedics, one week before the psychomotor practical exam in this course. The subjects were invited to participate in this study via e-mail and as an announcement from the course's online platform. A full description of the study was provided to each subject to satisfy Institutional Review Board (IRB) approval and ethical considerations (Bersoff, 2008). Those who elected to participate in the study gave informed consent by clicking on the link to the survey in the e-mail, which enrolled the subject in the study. The subjects were linked to their unique numerical testing code given to them by the institution upon enrollment of the physical therapy program. This code was utilized for

confidentiality, in which only the lead instructor of the course and the University of St. Augustine for Health Sciences IR had accessed see information that would be able to match the students' data to their name. Demographic information was obtained for age, gender, academic standing in the orthopaedic course, and ethnicity, but participants were not be excluded based upon any demographic information.

The informed consent was provided with the initial invite in the e-mail or from an announcement from the course portal via the lead instructors discretion. If the student did agree to participate in the study, they would then be able to take the questionnaires and the data was collected in the University of St. Augustine for Health Sciences IR's SurveyMonkey account.

The standard practical examination took place for each participant according to how the lead instructor of the course schedules and runs the practical on their campus. The practical exam takes 7-8 minutes per student. During the practical the student had to complete four tasks, each consisting of cognitive and psychomotor components pertaining to content from the orthopaedic physical therapy course. The students were tested in pairs, in which the student performed as the clinician being tested and the partner served as the patient. When the student performing as the clinician was done with the four tasks, the partners switched roles. Meaning the first clinician then served as the patient, and their partner became the clinician.

The students did not receive feedback immediately following the psychomotor practical examination from the grading instructor. Instead, the students were asked to enter a separate room or space to take the three questionnaires on eustress, flow, and

CTA immediately finishing the practical examination. At this point, the students did not know how they performed on the practical. Withholding the results and feedback may have allowed the students to truly reflect on their experience and how they perceived their psychological states, either during the practical or in general according to the questionnaire's measure. Knowledge of their performance and instructor feedback could be a confounding factor that may have jeopardized the accuracy of students answering the questionnaires. The lead instructor of each course was given the freedom to then give feedback however they desire, such as inviting the students to receive feedback immediately after the questionnaires or waiting until the next class period for general feedback to the entire class.

After scoring of the rubric per the student's performance, the grading instructors of the course simply places the academic scores in a chart next to the appropriate code for that subject. The instructor was then asked to remove all names from the chart, leaving only the student test codes and academic scores. This chart was then sent to me for data analysis. This coding and organization allowed the students to maintain anonymity from myself throughout the data collection and analysis.

Data collection used questionnaires for the independent variables designed and implemented through SurveyMonkey. The University of St. Augustine for Health Sciences has a SurveyMonkey account that efficiently submitted the questionnaires to the students who were enrolled in the study. The University of St. Augustine IR agreed to send out the questionnaires through SurveyMonkey utilizing the codes given to maintain anonymity with respect to me as the lead researcher. The University of St. Augustine's IR

received the data via their SurveyMonkey account and transfered this data to a Microsoft Excel document. I then used this Excel document form the IR and the coded academic grading chart from the lead instructors as the raw data to input into SPSS. The Microsoft Excel document only identified the subjects by the code that was given previously to the subject, which was utilized to match the questionnaire to the academic rubric. The data inputted into SPSS was password protected, which was only accessible by myself and chair member.

Debriefing of the subjects was conducted by a short paragraph at the end of the questionnaire. This paragraph thanked them for their time and participation in the study, reassured them that their identification was anonymous to me, as well as guided them to resources for psychological consultation if the subject desired. There also was a statement to notify the subjects that data collected will be stored after the analysis for 5 years and then destroyed. Follow-up procedures are not a necessity for this correlation study due to no implementation of an intervention.

Instrumentation and Operationalization of Constructs

This quantitative research study investigated if there was a correlation between eustress, flow, and CTA and their effects on academic performance. The dependent variable was the academic performance that was measured by an academic rubric established by the University St. Augustine for Health Sciences. Independent variables included psychometrically sound measurement scales for eustress, flow, and CTA. CTA was used as an indicator of negative stress that affects academic performance, while

eustress and flow was used as positive indicators, potentially mitigating the effect of CTA.

The independent variables were assessed immediately after completion of the psychomotor practical examination. Subjects were escorted to a quiet room and asked to complete the questionnaires pertaining to the concepts of eustress, flow, and CTA. The subjects were requested to reflect upon their experience from the psychomotor practical examination just prior for the flow scale, and then in general perceive their state levels for the eustress scale and CTA scale.

Demographic Information

Demographic information was obtained at the beginning of the questionnaires. This information will include the subject's age, gender, ethnicity, and current academic standing in the orthopaedic course. This portion of the questionnaire required approximately 1 to 2 minutes to complete. This information was intended for descriptive purposes, however if a particular demographic was found to be related to the dependent variable of performance grade, it could have been included as a covariate in the regression analysis.

Eustress

Eustress was measured utilizing a scale known as the Eustress Scale (ES). The ES was originally developed by O'Sullivan (2011) when investigating the relationship between hope, eustress, self-efficacy, and life satisfaction among 118 undergraduate students utilizing a convenience sample. For this study, eustress is operationally defined as the process of responding positively to stress, and the positive outcome of this process

(Mesurado et al., 2016; O'Sullivan, 2011). This definition is in comparison to the term distress, which is defined as the process of when an individual has exceeding demands imported on them leading to the inability to expend energy in maintaining homeostasis (Le Fevre et al., 2003; O'Sullivan, 2011).

The ES is a 15-item scale, five of which are fillers, applying a 6-point Likert-type scale design of 1 (*Never*), 2 (*Almost Never*), 3 (*Sometimes*), 4 (*Often*), 5 (*Very Often*), and 6 (*Always*) (O'Sullivan, 2011). Higher scores indicate higher levels of eustress. Example items are:

- "How often do you effectively cope with stressful changes that occur in your academic life?"
- "How often do you feel that stress positively contributes to your ability to handle your academic problems?"
- And "How often do you feel that you perform better on an assignment when under academic pressure?"

An example filler item is: "How often do you speak to your family?" The five filler items were not used to calculate a scale composite score. A mean composite of the other 10 items was calculated to represent an overall ES score.

The ES has been recently used in research to determine the levels of eustress, flow, and self-efficacy in university students (Mesurado et al., 2016). This scale is appropriate for this study because it is specific to the academic setting and measures their general appraisal of eustress (Mesurado et al., 2016; O'Sullivan, 2011; Rodríguez, 2013), which is a variable of interest to determine if there was a correlation with academic

performance during a psychomotor practical exam. As per the PsycTESTS database, written permission was required in order to utilize the ES (O'Sullivan, 2011). A request was sent to the lead author via e-mail and permission for usage of ES awaits this response (see Appendix A for e-mail and ES questionnaire).

Reliability and validity. Estimates of reliability were performed by O'Sullivan (2011) utilizing a paired samples *t*-test analysis for consistency across time. Of the 118 students recruited for the study, 30 students were asked to take a survey twice within a period of 2 weeks to assess the reliability of the eustress measurement scale (O'Sullivan, 2011). It was found that there were no significant differences, $t(28) = -0.418$, $p = .679$, suggesting eustress is a relatively stable state. Also, for the first study there was a Cronbach's alpha coefficient of .766, and .806 for the second administration (O'Sullivan, 2011). These measurements were above the level of .70, indicating the ES is a reliable measure and no items needed to be removed to improve this reliability (Field, 2013). O'Sullivan (2011) reported positive eustress correlations with academic hope (.301) and academic self-efficacy (.208), indicating convergent validity with related constructs.

Flow

The concept known as flow was first introduced by Csikszentmihalyi (1975) as the phenomenology of motivation as a general theory. It is defined as an experiential state which occurs when one attains optimal engagements with a task which occurred from interest in perceiving the experience of optimal performance (Csikszentmihalyi, 1975, 2014). Flow can also be described as an exceptionally positive state that motivates people to perform at a high level and persevere during trying tasks (Csikszentmihalyi, 1990,

2014; Nakamura & Csikszentmihalyi, 2014; Payne et al., 2011). Csikszentmihalyi (1990) explains nine dimensions of flow which include challenge-skill balance, the merging of actions with awareness, having clear task goals, unambiguous feedback, full concentration on the task at hand, a sense of control, a loss of self-consciousness, a perception of the transformation of time, and an autotelic experience.

Flow was measured utilizing a 26-item questionnaire known as the Active Flow State Scale (AFSS) which was developed by Payne et al.(2011). The AFSS was design as an adaptive version of the original Flow State Scale to assess flow states across different activities, such as in nonsporting activities, and in an older population (Payne et al., 2011). The Flow State Scale was utilized to measure high-level athlete, and has construct and predictive validity (Jackson & Marsh, 1996; Jackson, Kimiecik, Ford, & Marsh, 1998). Although the AFSS was designed to measure the nine proposed dimensions of flow (Csikszentmihalyi, 1975; Parr et al., 1998; Payne et al., 2011), Payne et al.concluded via confirmatory factor analysis that the measure could be used multidimensionally or unidimensionally, depending on the purposes of the research. To test the hypothesis and answer the question of the current research, a unidimensional composite was used, though additional analyses may be explored to parse out the relative effects of the nine facets on performance score.

This measurement scale utilizes a Likert scale that measures 1 (*strongly disagree*) through 5 (*strongly agree*) for each item used. This scale will serve as an appropriate method a for the appraisal of flow during a psychomotor practical because it matches the theoretical concepts of interest due to the specific item selection within the scale (Payne

et al., 2011). According to the PsycTESTS database, written permission is not required for noncommercial research and educational purposes for the AFSS (see Appendix B for permission and AFSS questionnaire). However, an appropriate credit line must be provided to contain a citation and copyright of owner (Payne et al., 2011).

Reliability and validity. Estimates of reliability were established among each of the nine dimensions utilizing reliability estimates and intercorrelations among flow factors. Each dimension had Cronbach alpha level above.70, ranging from .71 to .90, and each dimension had large correlations with a global, unidimensional composite of flow ranging from .50 to .72 (Payne et al., 2011). This indicates that the AFSS is a reliable and valid measure to assess the nine dimensions of flow multidimensionally or unidimensionally (Field, 2013).

Cognitive Test Anxiety

CTA was measured utilizing a short form, 17-item, questionnaire known as the Cognitive Test Anxiety Scale (CTAS), which was developed by Cassady and Johnson (2002). The CTAS is designed to focus on measuring the cognitive dimension of test anxiety which has a strong association with the concept of worry (Cassady & Johnson, 2002; Yu, 2015). Emotional and CTA represent the two distinct factors of test anxiety that affect academic performance, but it is confirmed that CTA has the strongest connection with performance (Cassady & Johnson, 2002; Hembree, 1988; Liebert & Morris, 1967). The cognitive aspect of test anxiety has consistently demonstrated adverse effects on academic performance (Cassady & Finch, 2014; Cassady & Johnson, 2002; Duty et al., 2015; Hembree, 1988; Yu, 2015), and it is the reason why this concept was

selected to be the control variable for the negative aspects of the student psychological state. To note, the CTAS measures the general state of CTA for that individual student (Cassady & Johnson, 2002; Yu, 2015).

Cassady and Finch (2014) recognized the 27-item version of the CTAS had limitations with generalizability to other cultures and with valence of some items in the scale. Furthermore, the original 27-item version had items that fit the construct of Test Confidence versus the CTA construct. These items in the scale were reverse coded compared to the rest of the 27-item CTAS, which may not have added to the model fit of CTA (Cassady & Finch, 2014; Cassady & Johnson, 2002). This lead to the exploration of the short 17-item version of the CTAS (Cassady & Finch, 2014). Data were analyzed from the original CTAS of 742 undergraduate different students than the original validity test and determine that only 17-items from the CTAS were required to fulfill the cognitive test anxiety construct.

Cassady and Johnson's (2002) 27-item version revised the original 44-item CTAS to reflect a scoring mechanism utilizing a four-point Likert-type rating of 1 (*not at all typical of me*), 2 (*only somewhat typical of me*), 3 (*quite typical of me*), and 4 (*very typical of me*), which remained the same in the 17-item version (Cassady & Finch, 2014; Cassady & Johnson, 2002). The scale can separate this ranking into high, medium, or low-test anxiety, which is associated with various levels of performance. In the 27-item version the top 33% of the students reporting high scores from the CTAS are considered high CTA, and those representing the middle 33% are present in the average levels of test anxiety. Students in the lower 33% of scoring are considered to have low CTA. In this

developmental study, students with high levels of CTA were significantly outperformed by students with average and low levels of CTA on test scores in both short-term and long-term testing (Cassady & Johnson, 2002). The 27-item scale takes approximately 8 to 15 minutes for undergraduate students to complete (Cassady & Johnson, 2002), and it is reported that the 17 item version does minimize the amount of time and effort by the participants (Cassady & Finch, 2014). Per the PsycTESTS database for the CTAS, written permission is not required for noncommercial research and educational purposes (see Appendix C for permission and CTAS questionnaire).

Reliability and validity.Cassady and Finch (2014) determined a Cronbach's alpha of.933 for the 17-item cognitive test anxiety factor, which is well above the recommended .70, indicating the 17-item CTAS is a reliable measure. The correlation between standard indicators of academic anxiety and performance for the two CTAS factors, 17-item CTA and 9-item test confidence, was explored to determine the criterion validity (Cassady & Finch, 2014). The standard indicators included GPA, college entrance exam scores (SAT), and the Perceived Threat of Tests and Study Skills scale for the measurement of academic anxiety. This analysis revealed that the 9-item Test Confidence factor did not align with the standard construct of CTA, but the 17-item CTA was consistent with prior research indicating a positive correlation with the Perceived Threat of Test and moderately negative relationship with study skills, GPA, and SAT (Cassady & Finch, 2014).

Academic Performance

This rubric is utilized by University of St. Augustine to grade psychomotor practical examination for the first orthopaedic course in the curriculum (see Appendix D). This rubric is the standard for academic performance for this orthopaedic practical at the University of St. Augustine for Health Sciences across all campuses. This practical consists of four tasks that will test the students cognitive and psychomotor skills as it pertains to the content of orthopaedic physical therapy. The rubric breaks down each specific task that needs to be completed by the physical therapy student during the practical exam and the instructor assigns points according to how the student performs. The grading instructor indicates which skill the student is to perform, and minimal interaction occurs between the instructor and the student during the task. There is a summation of points which are calculated to give a total score. For this study, a grading instructor of the course conducted the scoring of the academic rubric, who had been trained and demonstrated competence per academic policy of University. The entire student practical examination and grading of the rubric by the instructor takes approximately 7- 8 minutes in total.

Data Analysis Plan

The dependent variable was the academic performance scores on a psychomotor practical examination, and a regression analysis will be conducted to determine if the independent variables of eustress, flow, and CTA have an effect. Data analysis employed a multiple regression analysis of the data to determine this correlation utilizing the IBM SPSS version 23 (Creswell, 2013; Field, 2013). This investigation was to determine if the

levels of eustress, flow, and CTA in physical therapy students have a correlation to the student's academic performance on a psychomotor practical. Eustress and flow measured the presence of positive psychological concepts during a psychomotor practical examination. CTA measures served as a control variable because it is associated with the concept of negative psychology, worry, and has been previously identified to negatively impact performance (Cassady & Johnson, 2002; Duty et al., 2015; Sarason, 1984; Stöber, 2004).

Data were screened for any errors, missing data, or outliers in an objective manner (Creswell, 2009, 2013; Müller, Freytag, & Leser, 2012). Information was analyzed to describe subjects that did and did not complete the questionnaires, response bias, descriptive analysis, and the results of the reliability analysis for the scales (Creswell, 2009). Violation of assumptions such as additive, linearity, normality, homoscedasticity and homogeneity of variance can be sources of bias and flawed assessment of test statistics (Field, 2013). The screened and cleaned raw data was inputted into the SPSS data analysis system to implement the multiple regression analysis (Field, 2013).

The multiple regression analysis was but the most appropriate analysis to test the hypothesis because there are multiple independent variables (Field, 2013). These independent variables were selected based on sound theoretical rationale to determine the effects of positive psychological states on academic performance (Field, 2013; Frankfort-Nachmias & Nachmias, 2008) while controlling for the expected negative effect of cognitive test anxiety. The partial effect of each independent variable can be analyzed on

its own while utilizing the other independent variables as control variables allowing covariance to be controlled and assessed (Field, 2013). This analysis is the most suitable to address the research question.

Research Question: To what extent is performance on a psychomotor practical exam related to eustress, flow, and cognitive test anxiety?

$H_0$1: While controlling for flow and cognitive test anxiety, eustress does not correlate with performance on a psychomotor practical exam.

H_a1: While controlling for flow and cognitive test anxiety, eustress will correlate with performance on a psychomotor practical exam.

$H_0$2: While controlling for eustress and cognitive test anxiety, flow does not correlate with performance on a psychomotor practical exam.

H_a2: While controlling for eustress and cognitive test anxiety, flow will correlate with performance on a psychomotor practical exam.

$H_0$3: While controlling for eustress and flow, cognitive test anxiety does not correlate with performance on a psychomotor practical exam.

H_a3: While controlling for eustress and flow, cognitive test anxiety will correlate with performance on a psychomotor practical exam.

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Treats to Validity

External Validity

Threats to validity must be addressed to raise questions on the ability to infer a conclusion about the effects from any given study are not the result of some extra factor

(Creswell, 2009). The aspect of being able to generalize the results of the study to the world as a whole is considered external validity, and this can occur if there is incorrect interpretation from the data which leads to concerns of generalizability for the findings beyond the sample population (Creswell, 2009; Persaud & Mamdani, 2006). The natural or standard setting of the testing environment did not allow for treatment diffusion because students were quarantined and unable to communicate with each other prior to and post testing (Creswell, 2009; Persaud & Mamdani, 2006). In addition, follow-up studies could analyze physical therapy students, or other types of professional graduate students, at other programs to increase the generalizability of the research (Creswell, 2009, 2013).

For this study, an identified threat to external validity could be that only physical therapy students are being assessed for the variables. The results may not be generalizable to other graduate-level students because the focus is on physical therapy students. Also, the sampling strategy only utilizes students from the University St. Augustine For Health Sciences and is a voluntary convenience sampling (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). Although this includes students from three separate campuses across the country, all the students were participating in the same curriculum. Generalizing the findings from this study to other physical therapy programs could be difficult because the students are only exposed to the University of St. Augustine's curriculum. In these other curriculums, students may be introduced to various levels curriculum intensity and rigor. This represent a threat to external validity (Creswell, 2009; Persaud & Mamdani, 2006).

Since the students knew they were participating in a research study, another threat to external validity could be the possibility they change their behavior during their psychomotor practical examination. This change in behavior is known as testing reactivity, and could affect the way a student would typically perform (Anthis, 2003). To address testing reactivity, the request for the students to participate in the study was released approximately one week prior to the psychomotor practical examination. Sending the invites out this early gave the students enough time to change their focus to the actual practical examination versus their concerns about being the participant in the study, which may have negated the amount of behavioral change from the research process. The idea was to have the students perform their practical examination in the most normal way possible.

Internal Validity

Internal validity pertains to the researcher's ability to infer the result of the study are indeed correct, or accurate, in accordance with the population of interest (Creswell, 2009; Persaud & Mamdani, 2006). Threats to internal validity for this study include the selection process, in which this is a volunteer convenience sampling (Creswell, 2009). The participants who volunteer to take part in the study may have been those students who have already high levels of positive psychology characteristics because of their enthusiasm and passion for participating. They may have also be the students who know the information well and feel comfortable extending themselves further to participate in the study. Whereas students who might of had more difficulty in the class, and encompassed lower levels of positive psychology, might have been less likely to

volunteer to participate in the study. This lack of participation could have led to a sampling bias and produced results that are not accurate in answering the true research question (Creswell, 2009). This participation issue was be addressed by having a large sample size. Attaining a large sample size is an attempt to obtain a mean, or a good representation of all physical therapy students, to decrease sample bias and threat to internal validity (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008).

Mortality may also be a threat to internal validity because students did have the opportunity to drop out of the study and not take the questionnaires immediately after taking their psychomotor practical exam, even if they had agreed to participate (Creswell, 2009). This could have potentially happened if a student did not perform well on their psychomotor practical and could have been emotionally upset about their performance. They could then have desired not to continue with participation in the study. To address this threat to internal validity, again I relied on a larger sample size than what is required in the power analysis to account for any dropouts (Creswell, 2009).

The instruments used to assess the variables could be a threat to internal validity. Particularly, the academic rubric utilized to measure the student competence on psychomotor practical exam does not have any validation tests, but is a standard rubric utilized by the University of St. Augustine across campuses (Creswell, 2009). However, because this is a standardized and sustained measurement tool to assess student psychomotor competency which has been utilized over 10 years at the University St. Augustine and there are at least 5 years of records kept showing the consistency from cohort to cohort of the rubrics utility.

Also, the measurement scales developed for eustress, flow, and CTA were not specifically validated with physical therapy students, but have utilized undergraduate and graduate students in a variety of professions (Duty et al., 2015; Mesurado et al., 2016; O'Sullivan, 2011; Payne et al., 2011). Although these measurement scales were not specifically tested on physical therapy students, these students were indeed at a graduate-level and the psychometrics of the scales indicate good generalizability for the concepts to other types of students.

Construct Validity

Construct validity means that the investigators utilize appropriate operational definitions and measures to assess the variables based on the theoretical relationship (Creswell, 2009; DeVellis, 2012). Therefore, threats to construct validity could include week operational definitions of the variables which will allow a variety of interpretations of these variables. Also, construct validity could be threatened by poor psychometrics of the instruments used to measure the variables (Creswell, 2009; DeVellis, 2012; Frankfort-Nachmias & Nachmias, 2008; Groves et al., 2009).

Construct validity can be addressed by having clear operational definitions of the variables in which the researcher intends to measure in accordance to the theoretical background of choice, and utilizing scales that are shown to have appropriate reliability and validity measures (Creswell, 2009; DeVellis, 2012; Frankfort-Nachmias & Nachmias, 2008). I have selected measurement scales that positively correlate with the variables of interest for the research question and have appropriate reliability and validity (DeVellis, 2012; Groves et al., 2009). I also attempted to provide peer-reviewed

comprehensive operational definitions of the variables to negate any error in interpretation (Groves et al., 2009).

Another aspect that could be a threat to construct validity is if the participants in the study made educated guesses on the responses that could be inaccurate due to the concern of being a participant in the study (Cook & Campbell, 1979). In other words, a lack of critical thinking of the participants while taking the measurement scale due to the biopsychosocial dynamics of the study design could affect response accuracy (Cook & Campbell, 1979; DeVellis, 2012). I intend to address this biopsychosocial influence by maintaining the test environment as standard as possible and allowing the participants time to take the questionnaires in a comfortable environment to minimize social threat.

Ethical Procedures

Conducting this study on all three campuses of the University St. Augustine required permission from the institution to utilize their students and facilities. A written letter was sent and approved by the president of the university to obtain authorization to use the campuses for the investigation of this variables. IRB approval was obtained through the University St. Augustine for Health Sciences to utilize the students on all three campuses (IRB# UR-0124-280). Following a discussion with a Walden research ethics support specialist, it was determined that only IRB approval from the University of St. Augustine was appropriate to conduct this study since the study was held at the University of St. Augustine. Once the University of St. Augustine approved the IRB process, this approval was then sent to Walden's IRB for notification of approval to move on with data collection. Walden's IRB requested all documentation and extra forms to

ensure all ethical procedures were followed, and Walden's IRB was overseeing the data analysis.

This investigation of eustress, flow, and CTA utilized questionnaires to measure the variables after the students to taking a psychomotor practical examination. Ethical issues related to the student's performance on their psychomotor practical examination could be compromised if the students had increased pressure on them due to their awareness that they were participating in a study (Bersoff, 2008). The structure of the study was designed in a way that students could take a psychomotor practical examination in the most natural way possible to conduct this research. These adult physical therapy graduate students were notified of the study one week before the psychomotor practical examination and agreed to participate when clicking on the survey link. This length of time from the notification of the study could have allowed for a decrease in pressure on the students during a psychomotor practical exam and may have revealed a more accurate performance from the standard process. This standard process also allowed for better data collection from the questionnaires post practical examination because the students were able to reflect on a more natural, or normalized, performance for the flow scale. Eustress and CTA were measures after the practical to assess the constructs in general, again to deter from any compromise to the students' performance on the practical.

The physical therapy students were asked a variety of questions via a questionnaire after taking a psychomotor practical examination to recall their experience during this exam and their general perception of their psychological state to measure the

variables in the study. This questionnaire had a combination of positive and negative psychological reflections which could have led the student to feel either distressed or uplifted. The subjects were offered psychological counseling if they believed they are exposed to a significant amount of psychological trauma from taking the questionnaires (Bersoff, 2008). This was a free counseling service provided by the University of St. Augustine for Health Sciences through the institution's partnership with ComPsych, which is a Student Assistance Program provider.

Concerns about student participation in the study was recruitment. The subjects were given free opportunity to choose to be in the study, as it was on a voluntary basis. There was no guarantee that a significant number of students would agree to participate in the study to have an appropriate sampling size. However, with appropriate planning there was a significant sample size collected. Another concern was attrition. All participants in the study were offered the opportunity to exit the study at any time (American Psychological Association, 2010a, 2010b). The option to volitionally participate and leave the study were in place for ethical concerns for the subjects interested in participating in the study (Bersoff, 2008). Also, the informed consent had a statement that reminded participants they could ask questions at any point during the study to address any concerns they may of had in regards to the research study and process (Bersoff, 2008; Frankfort-Nachmias & Nachmias, 2008)

An ethical issue to discuss was my role at the University of St. Augustine. At that time, I was an instructor at the University of St. Augustine on the Florida campus who engaged in face-to-face teaching with the students in their previous semester. My name

had to be revealed to the students in the consent form given to the students for participation. I was not be an active instructor in the orthopaedic course in which the data was be collected, but the influences of my part as an instructor from the previous semester could have been an ethical consideration for student participation (Bersoff, 2008). The students may have felt obligated to participate in the study in fear of repercussions from the lead instructor who could potentially be their instructor again in the future. A clear explanation in the informed consent letter to the students was provided to manage this ethical consideration, stating there would be no contact or testing done by the lead researcher throughout the data collection process. Other statements in the consent form included an explanation that no repercussions will come from the lead researcher if the participants did or did not decide to participate in the study.

This study design allowed for subject anonymity, as the subjects had a numerical code associated with their academic performance rubric and the questionnaires to measure the variables. The ability to keep each subject completely anonymous from the researcher was possible because information from the questionnaires was matched to the deidentified academic rubric for each student (Bersoff, 2008). The subjects' names were not utilized for this matching.

The anonymous data, which was the questionnaires, were housed in the University of St. Augustine's SurveyMonkey account. This was a password encrypted system that only the institution research coordinators had access to. The academic rubrics were first collected by the lead instructors of the course to follow their standard procedure of grade assessment and grade posting. The scores on the academic rubric were

then be placed by the code provided to the students in a chart by the lead instructors of the course. This chart with information of academic performance was then given to the lead researcher for data interpretation. Once the raw data were converted to digital data into SPSS, this information was protected by a password on my computer. This information was only accessible by me and chair.

Summary

In this chapter I explained the research design and rationale, methodology of the research study, that is the validity and ethical considerations for a study to investigate the effects of eustress, flow, and CTA on academic performance for physical therapy students taking a psychomotor practical exam. The design chosen was a correlation study utilizing a convenience sampling of graduate-level physical therapy students across three campuses of the University of St. Augustine for health sciences. The students first underwent the standard testing for the psychomotor practical examination in a second semester orthopaedic course and then were asked to answer questionnaires while reflecting on their performance and general psychological state to measure the variables of interest.

The scales chosen to measure the variables of eustress (Mesurado et al., 2016; O'Sullivan, 2011), flow (Csikszentmihalyi, 1975; Payne et al., 2011), and CTA (Cassady & Johnson, 2002; Duty et al., 2015) demonstrates appropriate validity and reliability to answer the research question. Academic performance on a psychomotor practical examination was measured by the standard academic rubric utilized by University of St. Augustine for the orthopaedic course. This information was coded for subject

confidentiality and inputted into SPSS for data analysis. A multiple linear regression was used to analyze the data via SPSS v. 25 (International Business Machines, 2015). This was an effective data analysis to determine if the levels of eustress, flow, and CTA had an effect on academic performance (Field, 2013). Important aspects of ethical safeguards were also explained including the informed consent process, the planned IRB process for the study, as well as data storage (American Psychological Association, 2010a; Bersoff, 2008).

In chapter 4, I will provide the details of the data collection process, and an extensive report of the results of the data analysis. Information including the final sample size, aspects of the timeframe utilized, and descriptions of the subjects that participated will also be provided.

Chapter 4: Results

Introduction

Research in the field of academic performance and psychological states has typically focused on written examinations and the negative aspects of stress and anxiety (Duty et al., 2015; Mesurado et al., 2016). Test anxiety has a negative impact on students' performance during written examinations, mostly because this stress affects working memory and executive control (Cassady & Johnson, 2002; Hubbard & Blyler, 2016; Preuss et al., 2010; Yu, 2015). Most of the literature does not take into account the potential effects of positive psychological states on academic performance (Duty et al., 2015; McGowan et al., 2006; Mesurado et al., 2016). In addition, there is a paucity of evidence investigating academic performance for practical exams. Practical exams require both cognitive and psychomotor skills to be demonstrated by the student along with the presence of social evaluative threat from the instructor grading the student one on one (Gordon, Williams, Hudson, & Stewart, 2010; Preuss et al., 2010; Swift, Spake, & Gajewski, 2013).

The pleasant and fulfilling aspect of stress is known as eustress (Selye, 1975, 1980). Eustress has a significant positive correlation with the psychological state known as flow in an academic setting as it pertains to student engagement (Mesurado et al., 2016). Flow is the intense experience and full involvement in a specific activity in which a person can perform at their highest potential (Csikszentmihalyi, 1975, 2014). These two positive psychological variables have not been measured in an academic setting as they relate to performance on a practical exam. Furthermore, this practical exam is unique

because of the presence of the acute condition known as choking under pressure from the social evaluative threat during these practicals (Preuss et al., 2010; Yu, 2015).

High levels of stress and anxiety have been identified in graduate level physical therapy students (Frank & Cassady, 2005), and these students are tested heavily with psychomotor practical exams due to requirements the profession imposes on graduates to sit for licensure exams (Gordon et al., 2010; Nakamo et al., 2011; Price & Tej, 2014). These levels of stress and anxiety and approach to performance testing make graduate level physical therapy students ideal subjects to use to investigate the extent to which positive or negative psychological states correlate with academic performance. The purpose of this study was to investigate if eustress, flow, and CTA were significant predictors of academic performance on a psychomotor practical examination.

In this chapter, I will present the results to determine if there was a relationship between eustress, flow, CTA, and academic performance on a psychomotor practical. The chapter will begin with a discussion of the time frame of data collection and happenings that yielded usable and actual data. Next, I will explain the sample characteristics for baseline descriptive and demographics of the sample. I will also provide the descriptive and inferential statistics that were produced from the multiple regression analysis to answer the research questions. Lastly, I will report the statistical results associated with the research question and pertinent information from the study data analysis.

Data Collection

Time Frame and Actual Recruitment

I collected data for the first practical of the orthopedic course at the University of Saint Augustine for Health Sciences (USAHS), which contains mostly content from the body region of the upper quadrant. This practical exam takes place at approximately Week 7 of each trimester, and this particular practical occurred during the spring of 2018. My original plan was to use four cohorts from four different campuses: (a) Florida, Saint Augustine resident doctor of physical therapy program, (b) Florida, Miami resident doctor of physical therapy program, (c) California, San Marcos resident doctor of physical therapy program, and (d) Texas, Austin resident doctor of physical therapy program. Unfortunately, the instructor of the orthopaedics course at the Austin, Texas resident doctor of physical therapy program denied participation in the study, and no subjects were invited to participate in the study so no data were collected from that campus. The lead instructor of the Texas campus orthopaedics course believed that it was not in the student's best interest to delay feedback after their practical exam and did not have time to assist with data collection. Therefore, I recruited the Florida, Saint Augustine flexible doctor of physical therapy program and California, San Marcos flexible doctor of physical therapy program to achieve the recommended sample size based on the power analysis to compensate for the loss of available participants from the Texas campus. The same operating procedure for data collection occurred for all campuses because all practical exams were conducted via standard procedure according to the USAHS.

Over a period of approximately two weeks, I collected data from the five academic cohorts that participated in the study. In chronological order, the cohorts that participated included (a) Florida, Saint Augustine flexible doctor of physical therapy program (FL_SA_Flex), (b) Florida, Saint Augustine resident doctor of physical therapy program (FL_SA_Resident), (c) California, San Marcos Flexible doctor of physical therapy program (CA_SM Flex), (d) Florida, Miami Resident doctor of physical therapy program (FL_Miami_Resident), (e) California, San Marcos Resident doctor of physical therapy program (CA_SM_Resident). Table 1 delineates when each cohort participated in the study, time of day, and the number of students invited.

Table 1

Time Table and Participation Results

Date of practical	Time of day	Program	# of Students invited
March 4th	10:00 am EST	FL _SA_Flex	37
March 6th	9:00 am EST	FL _SA _Resident	58
March 11th	3:00 pm EST (12:00 pm PST)	CA _SM Flex	29
March 13th	7:30 am EST	FL _ Miami _ Resident	49
March 19th	3:00 pm EST (1:00 pm PST)	CA _SM_ Resident	77
		Total =	250

Discrepancies in Data Collection

My proposed plan for the data collection of this study allowed the subjects to participate in a normal and standard practical examination between the student being tested and the grading instructor. Immediately after the practical was complete, the participants left the testing area and transitioned into a quiet area where the questionnaires could be answered. This planned structure of events was specifically designed so the students did not receive any feedback from the instructor immediately after the practical. The feedback on their performance could have been confounding information to the students' psychological perception and may have altered the way they responded to the questionnaires. Again, the participants did not have to take part in the study but were given the opportunity to either take the questionnaires or use the time as quiet study time.

During the first cohort of data collection for Florida, Saint Augustine flexible doctor of physical therapy program, there was a discrepancy in the process of how students transitioned from the testing room to the quiet area to take the questionnaires. The quiet area for the students to take the questionnaires was a room reserved approximately 200 feet from the testing room. With this geographical distance between the two rooms, the students were exposed to interactions with other students in the hallway on their way to the quiet area. With this exposure to other students, the participants in the study were highly susceptible to cross talk with other students in the course and discussing their practical performance with their colleagues. The cross talk between students is considered a threat to validity (see Campbell & Stanley, 1963). These

participants may have given each other peer feedback, which would have confounded their psychological state prior to taking the questionnaires. This geographical discrepancy may also be the reason why the students in this cohort had a lower participation rate. This cohort had the lowest participation rate of those that were invited, with 37 invited and only 19 participants. This lower number of participating subjects compared to the other cohorts could be attributed to the student exposure to receiving peer feedback and may have led to an emotional state that caused the students to choose not to participate. I resolved the issue of students being able to communicate with each other prior to taking the questionnaires for all the other cohorts by placing the quiet area to take the questionnaires directly next to the testing area. In addition, the lead instructor of each cohort implemented a quiet study time for the subjects that entered the questionnaire testing area to decrease any cross talk amongst students.

There was also a discrepancy in the design of the CTAS for this study in the SurveyMonkey system. The first three cohorts that were tested did not have the last item, Item 17, on the short CTAS and Item 27 on the longer version (see Cassady & Finch, 2014) of the CTAS due to improper input of the questionnaire into SurveyMonkey. This means 90 of the 190 participants had missing data on 1 of the 17 CTA items. To mitigate this, I substituted a participant–specific scale mean score for the missing items. Item 25 from the longer version (Cassady & Finch, 2014) was mistakenly placed in the scale, which was represented as Item 61 on the questionnaire for this study in place of the original Item 15 on the shortened CTAS form. This lead the USAHS IR to input only 17 questions in the scale and leave Item 17 off the total survey. This missing 17th item was

recognized when screening the data after the third cohort data collection, and the item was implemented in the total scale, Item 63 representing Item 17 on short form, for the last two cohorts. This means the last two cohorts received 18 items in the CATS portion of the questionnaires given. Therefore, all of the cohorts received a question in the CTAS that should not have been implemented, Item 61 on this study and 25 on the longer version (see Cassady & Finch, 2014). Cassady and Finch (2014) removed Item 25 from the original scale when developing the shortened form because of a model fit problem found by previous research (Furlan, Cassady, & Perez, 2009).

Participant Demographic Characteristics and Descriptive Characteristics of the Sample

From the five cohorts that agreed to participate in the study, there were 250 students that I invited to take part in the study. Two participants were not present for the scheduled practical due to personal circumstances, so exam scores for 248 students were provided. Of these, 192 elected to participate in the research by clicking on the SurveyMonkey link via the e-mail I sent to all participants who were invited. One of the 192 did not provide a student identification card for matching purposes and was deleted, and one did not complete the survey was deleted resulting in a final sample of 190 participants with complete survey and practical exam data (76.9% response rate).

Table 2 displays the descriptive characteristics of the 190 physical therapy students in the sample. Of the five participating campuses, FL_SA_Flex had 19 (10%), FL_SA_Resident had 44 (23.2%), CA_SM Flex had 24 (12.6%), FL_Miami_Resident had 41 (21.6%), and CA_SM_Resident had 62 (32.6%) physical therapy students that

participated in the study. The sample included 103 females (54.2%) and 87 males (45.8%). Regarding ethnicity, 104 (54.7%) of participants were White, 44 (23.2%) were Asian, 24 (12.6%) were Hispanic or Latino, 10 (5.3%) were African American, and 8 (4.2%) participants reported other.

The distribution of current academic standing in the musculoskeletal I orthopaedic course included 34 participants (18%) with scores ≥ 90 representing an A in the course, 91 participants (48.1%) with scores between an 80 and 89.9 representing a B, 58 participants (30.7%) with scores between 70 and 79.9 representing a C, five participants (2.6%) with scores between a 60 and 69.9 representing a D, one participant (.5%) with a score < 60 representing an F, and one participant (.5%) was missing information on this question. The age distribution reflects the expected population distribution for physical therapy students at a graduate level program. Ages of the participants ranged from 22 to 56 years, with an average age of 26.15 (*SD* = 4.34) and a median age of 25.

Table 2

*Demographics for Overall Sample for Sex, Ethnicity, and Current Academic Standing in the Course (*N = 190*)*

Variable	Frequency	Valid %
Campus		
FL_SA_Flex	19	10.0
FL_SA_Resident	44	23.2
CA_SM Flex	24	4.6
FL_Miami_Resident	41	21.6
CA_SM_Resident	62	32.6
Gender		
Female	103	54.2
Male	87	4518
Ethnicity		
White	104	54.7
Asian	44	23.2

Hispanic or Latino	24	12.6
African American	10	5.3
Other	8	4.2
Current Academic Standing		
(A) > 90	34	18.0
(B) 80-89.9	91	48.1
(C) 70-79.9	58	30.7
(D) 60-69.9	5	2.6
(F) <60	1	0.5

Fifty-seven students received exam scores and did not participate in the survey after their practical examination. I analyzed these nonparticipant scores to see if there was a significant difference in their scores compared to the ones who did participate. Those who did not participate (M = 85.3, SD = 12.7) had significantly lower exam scores than those who did participate (M = 89.7, SD = 8.8), $F(1, 244) = 8.6$, $p = .004$, $\eta^2 = .034$. This result suggests that poorer performing students may be underrepresented in the sample.

External Validity of Sample to Population of Interest

In this study I sought to investigate if positive or negative psychological states were correlated with academic performance on the psychomotor practical examination. The sampling method was a purposive sample due to the nature of the study to investigate students who were going to take a psychomotor practical. Graduate level physical therapy students pursuing a doctorate undergo multiple psychomotor practical examinations throughout their physical therapy curriculum (Commission on Accreditation in Physical Therapy Education, 2016; Price & Tej, 2014). The University of St Augustine for Health Sciences has three graduating cohorts per year on four different campuses in five different locations across the United States. I believed that the physical therapy students enrolled in this university would serve as a sample that could

represent graduate level physical therapy students across the country and across other graduate programs. Although Texas campus did not participate, the population was represented in California, and two locations in Florida which means that the sample may not be representative of physical therapy students across United States (Creswell, 2013; Frankfort-Nachmias & Nachmias, 2008).

Other studies that have used graduate level students and, particularly, physical therapy students as the sample to investigate psychological variables had a-similar demographic distributions for age, gender, and geographic location (Chambers et al., 2016; Hope & Henderson, 2014; Stallman, 2010). However, my study had a clear advantage of getting students from opposite sides of the country for generalization of the sample and has a larger sample size than most psychological studies done on physical therapy students per country (Chambers et al., 2016; Jacob et al., 2012). Therefore, the sample for this study is suitable for generalizing the findings of the study to the population of graduate level physical therapy students in the United States. The ability to generalize the findings from this study to all graduate level programs in other disciplines such as medical, nursing, speech language pathologist, dentistry, etc. may not be as probable (Frankfort-Nachmias & Nachmias, 2008).

Screening for Covariates

Effects of age, course grade, sex, and campus. It is of value to disseminate the findings from screening for covariates that could be confounding. Age was not related to any of the measures in the study: (a) $r(189) = -.094$, $p = .200$ with exam score; (b) $r(189) = .097$, $p = .182$ with eustress; (c) $r(189) = -.001$, $p = .989$ with flow; and (d) $r(189) = -$

.117, $p = .109$ with CTA. As expected, current course grades did show a positive correlation with the exam score and flow state measures and were negatively correlated with CTA measures. When screening for sex, males had significantly higher eustress scores (males, $M = 3.95$, $SD = .75$; females, $M = 3.63$, $SD = .63$; $p = .001$, $\eta^2 = .053$) and flow state scores than females (males, $M = 3.57$, $SD = 0.49$; females, $M = 3.40$, $SD = 0.41$; $p = .015$, $\eta^2 = 0.031$). Males also had significantly lower scores on cognitive test anxiety as compared to females (males, $M = 1.99$, $SD = 0.61$; females, $M = 2.41$, $SD = 0.66$; $p = .000$, $\eta^2 = .097$). There was no significant difference between male and females regarding practical exam scores (males, $M = 90.65$, $SD = 6.45$; females, $M = 88.88$, $SD = 10.32$; $p = .168$, $\eta^2 = .01$).

Exam scores did vary by campus (see Table 3). From a UNIANOVA analysis, FL Miami Resident had higher scores than CA SM Resident ($MD = 5.56$, $p < .001$), FL SA Flexible ($MD = 10.93$, $p = .003$), and FL SA Resident ($MD = 8.49$, $p < .001$).

Table 3

Exam Score Differences by Campus

Campus	*M*	*SD*	*N*
CA _SM_ Resident	89.56	4.95	62
CA _SM Flex	90.71	10.14	24
FL _SA_Flex	84.19	10.64	19
FL _ Miami _ Resident	95.12	3.72	41
FL _SA _Resident	86.64	11.75	44
Total	89.69	8.79	190

Note. $p = .000$, $\eta^2 = 0.152$

Study Results

I proposed a multiple regression enter method to evaluate one distinct research question and three hypotheses. IBM SPSS 25 was used for data analysis. My aim was to answer the research question, which asked to what extent is performance on a psychomotor practical exam related to eustress, flow, and CTA.

Null Hypothesis #1: While controlling for flow and cognitive test anxiety, eustress does not correlate with performance on a psychomotor practical exam.

Null Hypothesis #2: While controlling for eustress and cognitive test anxiety, flow does not correlate with performance on a psychomotor practical exam.

Null Hypothesis #3: While controlling for eustress and flow, cognitive test anxiety does not correlate with performance on a psychomotor practical exam.

The first hypothesis was to investigate if there is a correlation between scores of eustress, utilizing the ES, and scores on the practical examination (Mesurado et al., 2016; O'Sullivan, 2011). The second hypothesis utilized scores the AFSS to attain the amount of flow each participant was in during the practical exam to see if there is any correlation

with academic performance (Payne et al., 2011). Lastly, the third hypothesis used scores on the CTAS to investigate if cognitive test anxiety had any correlation with a student performance on the practical exam (Cassady & Finch, 2014).

Scale Reliability

The three composite scales of eustress, flow, and CTA were analyzed for reliability and any outliers. Table 4 has the summary of the descriptive statistics for the scales and a written explanation of each scale's outliers are provided in this section.

Table 4

Descriptive Statistics for Eustress Scale (ES), Active Flow State Scale (AFSS), and Cognitive Test Anxiety Scale (CTAS)

IV	Number of items	Cronbach's alpha value	Inter-Item Correlation		
			Min	Max	*M*
ES	7	.78	.193	.593	.331
AFSS	25	.87	-.146	.827	.222
CTAS	17	.94	.198	.757	.477

Note. N=190

Eustress scale. The ES was delivered in Survey Monkey as the first of the three measurement scales. Three of the 190 participants had missing data on 1 of the 15 eustress items. For this missing data, the participant-specific scale mean score was substituted for the missing value.

The items in the scale were also screened for reliability and covariates. Five of the 15 eustress items were fillers and were not included in scale analysis. To be consistent with the eustress direction of measurement, Items 9 and 10 were reverse coded.

Reliability analysis for the eustress items indicated that ES2, ES10r, and ES13 violated scalability due to negative loadings. These items were eliminated, and scale

reliability was based on the remaining seven items. The internal consistency of the ES is considered acceptable with a measure of Cronbach's α = .78 (Field, 2013).

Flow Scale. The AFSS was delivered in Survey Monkey as the second of the three measurement scales. Six of the 190 participants had missing data on 1 of the 26 flow items, and one participant had missing data on three of the items. For this missing data, the participant-specific scale mean score was substituted for the missing items. The AFSS Item 18 had a negative corrected item-total correlation, violating additivity. Therefore, Item 18 was removed from the scale. Internal consistency for the AFSS is considered good with a measure of Cronbach's α = .87 (Field, 2013).

Cognitive Test Anxiety. The CTAS was delivered in Survey Monkey as the third of the three measurement scales. Ninety of the 190 participants had missing data on 1 of the 17 CTA items; four participants had missing data on two items; and one participant had missing data on Three items. The reason 90 participants had missing data on 1 of the 17 cognitive test anxiety items was due to an error in the input of the scale items into the Survey Monkey system. In the old item, Item 25 from the longer version (Cassady & Finch, 2014) was mistakenly placed in the scale which left Item number 17 off of the total CTA survey. This inaccurate input of the scale was recognized during a brief screening of the data after the second cohort of participants, in which corrections were made and the rest of the sample was tested with the correct version. Again, for all missing data the participant-specific scale mean score was substituted for the missing items. The internal consistency is considered excellent with a measure of Cronbach's α = .94 (Field, 2013).

Table 5 presents the statistics associated with the eustress scale, active flow state scale, and cognitive test anxiety scale. All three scales had acceptable normal distribution with skewness and kurtosis values less than ±0.60.

Table 5

*Means, Standard Deviations, Skewness, Kurtosis, Minimum, and Maximum (*N = 190*)*

Variable	*M*	Median	*SD*	Skewness	Kurtosis	Min.	Max.
ES	3.78	3.86	.70	-.18	.40	1.43	5.57
AFSS	3.48	3.46	.46	-.01	.51	2.12	5.00
CTAS	2.22	2.18	.67	.59	-.06	1.00	4.00

Regression Diagnostics

Prior to conducting the regression analysis, exam score was screened for potential covariates, the composite variables were screened for univariate and multivariate outliers, multicollinearity, linearity with the dependent variable, and residuals analyses (including normality, homoscedasticity, and outlier cases). Age, sex, and campus were assessed as potential covariates. Age was not related to exam score, $r(187) = -.094$, $p = .200$. Sex was also unrelated to exam score, $p = .168$.

For all three composite variables the distributions were not discontinuous and the minimum and maximum values were acceptably within ±3.3 standard deviations. Multivariate outliers were examined following Tabachnick and Fidell's (2007) procedure of regressing the three composites on a random variable and observing the Mahalanobis distance. The maximum Mahalanobis value of 15.63 was less than the critical value of 16.27 for $df = 3$ at alpha = .001, so no multivariate outliers were evident (Tabachnick & Fidell, 2007). Variance inflation factor values were used to examine multicollinearity. All

values were acceptably below 1.4. Linearity of independent variables with the dependent variable was examined by scatterplots. As shown in Figure 1, there were no obvious curvilinear relationships, but there were possible outlier cases, which were further examined in residuals analyses.

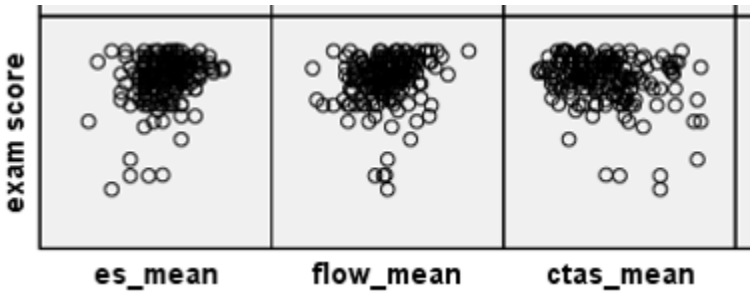

Figure 1. Scatterplots of independent variables with dependent variable.

Minimum and maximum values of standardized and Studentized residuals should be within ±3.0. As depicted in Figure 2, six cases (65, 67, 81, 103, 105, 141) had standardized residuals near to or in excess of 3.0 and were eliminated from further analyses. Subsequently, the standardized and Studentized residuals were within ±2.9, were reasonably normally distributed (see Figure 3), and reasonably homoscedastic (see Figure 4).

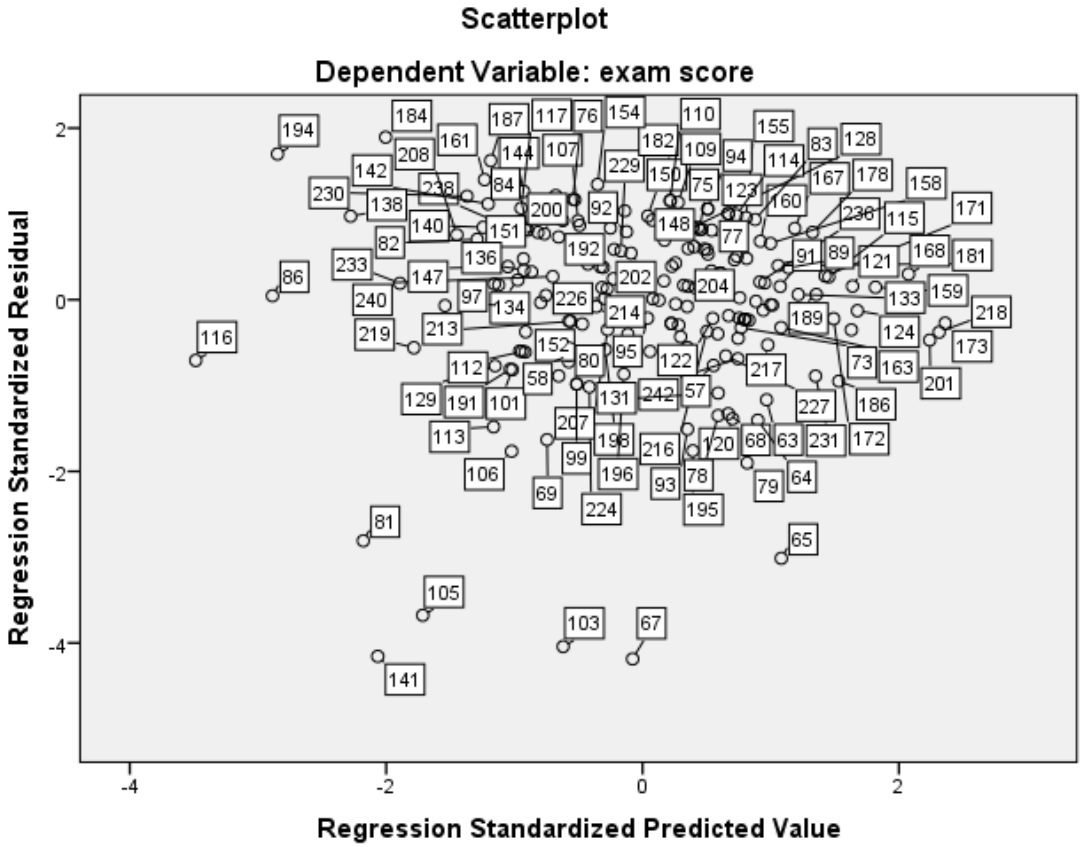

Figure 2. Scatterplot of standardized residuals by standardized predicted values showing outlier cases unduly influencing the regression analysis.

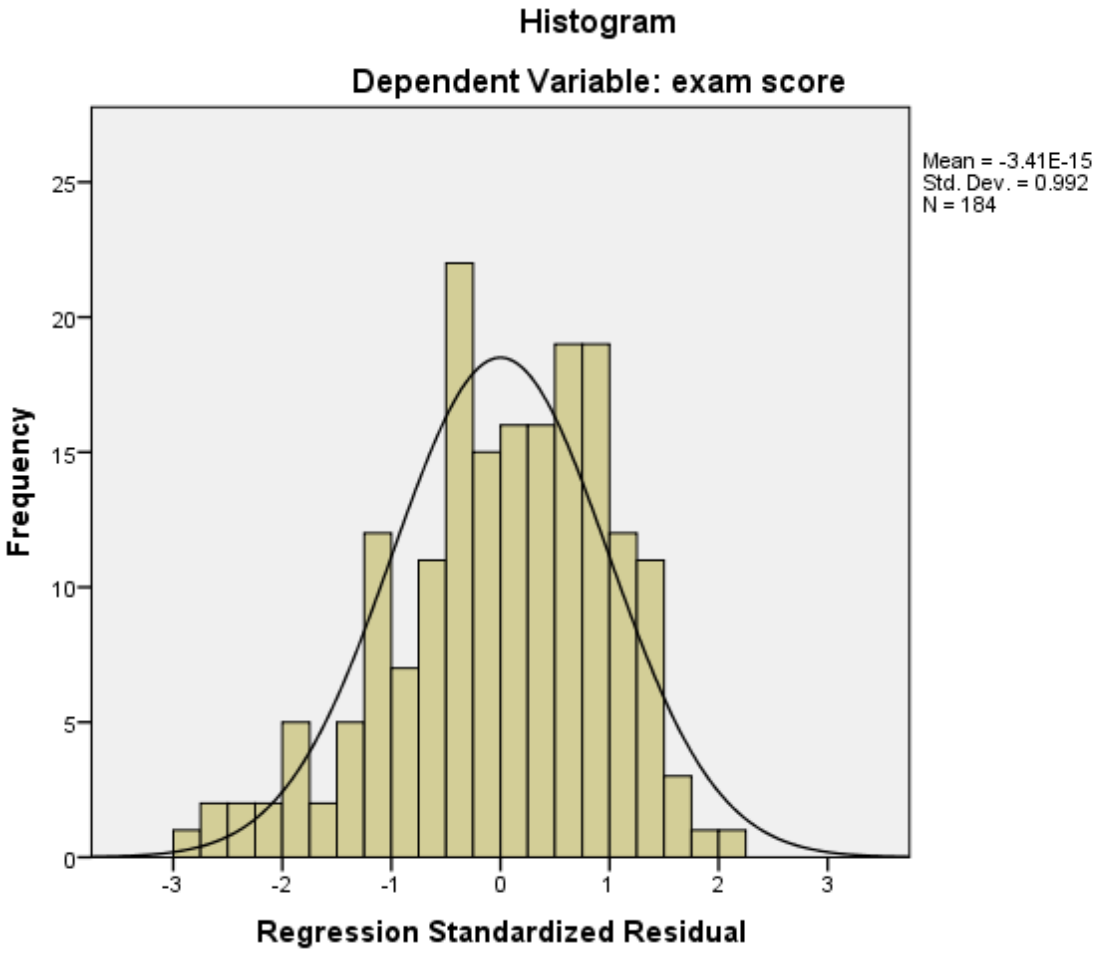

Figure 3. Histogram of standardized residuals indicating reasonably normal distribution.

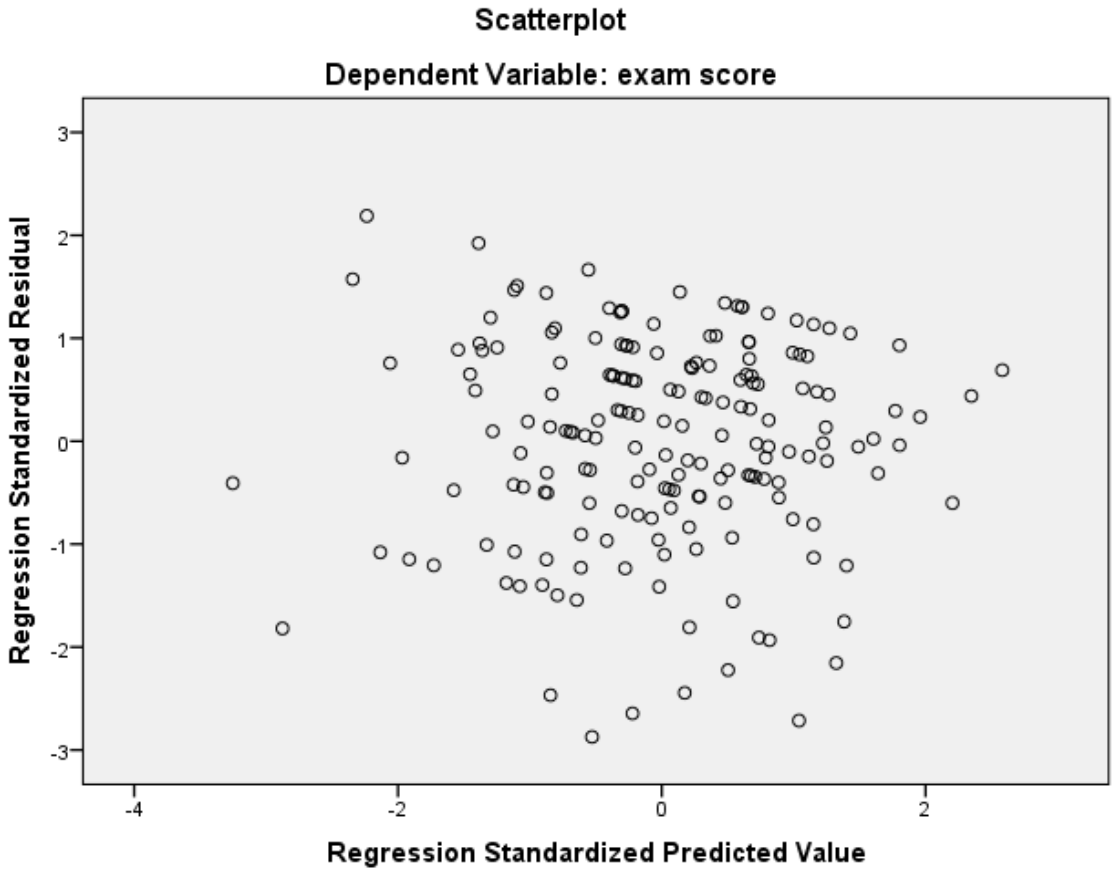

Figure 4. Scatterplot of standardized residuals by standardized predicted values indicating reasonable homoscedasticity.

Study Variable Means, Standard Deviations, and Intercorrelations After Data Cleaning

Because six exam score outlier cases were eliminated, descriptive statistics for the key study variables were recalculated and are shown in Table 6. The six excluded cases had failing exam scores, so, as expected, exam score mean increased from 89.69 to 90.78 and standard deviation decreased from 8.79 to 6.43. The effect on each of the three predictor variables was minimal, with no more than a ±.02 effect on any mean and no more than a ±.01 effect on the standard deviation (cf. Table 5).

All pairwise correlations were statistically significant. Of the three predictors, flow had the largest correlation with exam score, $r(182) = .263$; followed by cognitive test anxiety, $r(182) = -.215$; then eustress, $r(182) = .201$. In their respective univariate relationships with exam score: as flow increased, exam score increased; as cognitive test anxiety increased, exam score decreased; and, as eustress increased, exam score increased. Each of these relationships were in the expected direction.

Table 6

*Cleaned Study Variable Means, Standard Deviations, and Intercorrelations (*N *= 184)*

Variable	*M*	*SD*	Exam score	ES	AFSS	CTAS
Exam score	90.78	6.43		.201	.263	-.215
ES	3.80	0.69	.003		.413	-.404
AFSS	3.48	0.46	< .001	< .001		-.373
CTAS	2.20	0.66	.002	< .001	< .001	

Note. Upper-diagonal contains Pearson *r* values; the lower-diagonal contains *p* values.

Regression analysis

The combined effects of eustress, flow, and CTA accounted for 9% of the variance in exam scores. As noted in Table 7, only flow was a statistically significant predictor, $B = 2.62$, $p = .020$, semipartial correlation = .167, uniquely accounting for 2.8% of the variance in exam scores. Flow was measured on a 1-5 Likert-type scale. Holding eustress and CTA statistically constant, students with a flow value of 1 were predicted to have an exam score of 83.98, while those with a flow value of 5 were predicted to have an exam score of 94.46. Various combinations of values across all three predictors can be used to predict exam score by the following equation:

Predicted exam score = 81.36 + 0.72(eustress) + 2.62(flow) -1.10(cognitive test anxiety)

It is interesting to note that flow values of 2 through 5 more than make up for even the highest possible measured value of 4 on CTA, which predicts a 4.40 point decrease in exam score compared to predicted increases of 5.24, 7.86, 10.48, 13.10 for flow values of 2 through 5, respectively.

Table 7

*Standard Regression Summary of Results (*N = *184)*

Variable	*B*	95% CI	β	*sr*	*p*
Constant	81.36	[71.32, 91.40]			
Eustress	0.72	[-0.78, 2.22]	.077	.067	.346
Flow	2.62	[0.42, 4.82]	.189	.167	.020
Cognitive test anxiety	-1.10	[-2.64, 0.45]	-.133	-.100	.162

Note. CI = confidence interval for *B*; *sr* = semipartial correlation (aka, part correlation). $F(3, 180) = 5.9$, $p = .001$, $R^2 = .09$.

Regression Follow-Up Analyses

Because the bivariate relationships of each of the predictors with exam score were statistically significant, but only flow was statistically significant in the multiple regression, several follow-up analyses were warranted to more fully understand these results. The following three sections examine and provide rationale for dominance analysis, principal components regression, and mediation analysis.

Dominance Analysis: Overall Usefulness of Eustress, Flow, and Cognitive Test Anxiety

The importance of each predictor in a multiple linear regression cannot be adequately indexed by its unique effect (sr^2) or the statistical significance of its unique

effect when predictors are correlated (Budescu, 1993; Johnson, 2010). This is evident in the fact that with correlated predictors the sum of the unique effects will be less than R^2. The sum of the unique effects of eustress, flow, and cognitive test anxiety in accounting for variance in exam score was .04, while $R^2 = .09$. So, 55.6% of exam score variance was accounted for by common variance among the predictors. Relative importance based solely on unique effects will exaggerate the importance of the predictor most highly correlated with the dependent variable and diminish the importance of the other predictors (Johnson, 2010). Budescu (1993) developed a dominance analysis procedure to consider each predictors direct, partial, and total effects to determine the "usefulness" of each predictor.

A predictor's direct effect is its squared correlation with the dependent variable. The partial effect is conditional on all possible pairwise subsets of a model. With three predictors there are three pairwise subsets ($X_1 + X_2$; $X_1 + X_3$; $X_2 + X_3$). The total effect is conditional on all other predictors (the difference between the model with all predictors and the model with all except the predictor of interest) and is equal to each predictor's unique effect (sr^2).

Following Budescu (1993), the direct, partial, and total effects of eustress, flow, and cognitive test anxiety are compiled in Table 8. Dominance analysis ranks each predictor by the values of the three effects. Flow dominated both eustress and cognitive test anxiety, and cognitive test anxiety dominated eustress. This rank ordering is consistent with the rank ordering of the unique effects (sr^2) from the regression results. However, the portion of the sum of unique effects is exaggerated for flow and diminished

for eustress and cognitive test anxiety compared to the portion of the sum of usefulness effects (as Johnson [2010] noted would be the case). Flow accounted for 65.81% of the sum of unique effects, but only 50.56% of the sum of usefulness effects that considers the direct effects and the intercorrelations of predictors in partial and total effects. Of the 9% variance in exam score accounted for by the three predictors, flow explained 50.56% (.046÷.090), CTA explained 27.78% (.025÷.090), and eustress explained 21.67% (.020÷.090). These percentages of usefulness for each predictor, whether statistically significant or not, need to be considered in a full interpretation of the regression results.

Table 8

Usefulness of Eustress, Flow, and Cognitive Test Anxiety in Accounting for Exam Score

Usefulness	ES	AFSS	CTAS
Direct	.040	.069	.046
Partial	.014	.040	.019
Total	.005	.028	.010
Average	.020	.046	.025
Overall relative %	21.67	50.56	27.78
% of unique (sr^2)	10.59	65.81	23.60

Note. N = 184

Principal Components Regression

Significance tests for the full usefulness of a predictor as indexed in dominance analysis is not easily conducted without specialized software or programming skills. A comparable, but not exact, procedure that captures and statistically tests a predictor's full contribution by eliminating collinearity with other predictors is regressing the dependent variable on the predictors' orthogonal (i.e., uncorrelated) principal components (Tabachnick & Fidell, 2007).

A principal components analysis with varimax rotation to maximize the differentiation of eustress, flow, and cognitive text anxiety was conducted and the component scores were saved for reanalysis in a regression. The component loadings are listed in Table 9. Component 1 is clearly associated with cognitive test anxiety, Component 2 with flow, and Component 3 with eustress.

Table 9

Principal Component Loadings of Eustress, Flow, and Cognitive Test Anxiety

	Principal component		
Predictor	1	2	3
ES	-.193	.199	**.961**
AFSS	-.174	**.965**	.196
CTAS	**.966**	-.174	-.191

Note. N = 184

The regression results predicting exam scores by the principal components of eustress, flow, and CTA are reported in Table 10. The omnibus regression results were, and mathematically must be, identical to the original standard regression that used correlated composite scores for each predictor, $F(3, 180) = 5.9$, $p = .001$, $R^2 = .09$. Because the component versions of each predictor are uncorrelated, the standardize

coefficient (β), bivariate correlation (*r*), partial correlation (*pr*), and semipartial correlation (*sr*) are equal. The square of these sum to .090, compared to the standard regression in which the sum of sr^2 = .04. This is evidence that the principal components regression is proportionally weighting the total variance accounting for in exam score across the full contribution of each predictor. The squared values can be directly interpreted as the proportion of variance in exam score explained by each predictor. Flow explained 48%, p = .003l CTA explained 25%, p = .029; and eustress explained 18%, p = .064. So, when the full contribution of each predictor is considered and tested in a principal components regression, it becomes evident that cognitive test anxiety's full contribution is statistically significant, and eustress's full contribution approached statistical significance. This is evidence that the more exact usefulness values computed in the dominance analysis should not be minimized just because a predictor's unique effect (sr^2) in the standard regression was not statistically significant.

Table 10

*Exam Score Regressed on Principal Components of Eustress, Flow, and Cognitive Test Anxiety (*N = *184)*

Variable	β, *r, pr, sr*		β^2, r^2, pr^2, sr^2	*p*
ES-PC	.133		.018	.064
AFSS-PC	.218		.048	.003
CTAS-PC	-.157		.025	.029
		R^2	.090	.001

Note. Note. N = 184; β = standardized regression coefficient; *r* = bivariate correlation with exam score; *pr* = partial correlation with exam score; *sr* = semipartial correlation with exam score.
$F(3, 180) = 5.9$, p = .001, R^2 = .09.

Mediation Analysis

All three predictors—eustress, flow, and CTA—had statistically significant bivariate correlations with exam score. In the standard multiple regression, only flow was statistically significant. This suggests that flow may have mediated the effects of eustress and cognitive text anxiety on exam score. A follow-up mediation analysis using Hayes's (2013) PROCESS macro for IBM SPSS was conducted to examine the extent of mediation. Mediation makes conceptual sense in that eustress and cognitive test anxiety, which already exist at the start of an exam because they are trait variables, temporally precede flow, which occurs while taking an exam.

In mediation analysis the terms direct effect and total effect differ from their usage in dominance analysis. In a simple mediation—one independent variable and one mediator—the total effect is a variable's unstandardized or standardized coefficient with the dependent variable from a simple regression. The total effect is partitioned into its direct effect on the dependent variable and its indirect effect on the dependent variable through the mediating variable in multiple regression. In this case, with two simultaneous independent variables—eustress and cognitive test anxiety—the coefficients for each independent variable are partialled with respect to controlling for the other (i.e., not the simple coefficients from separate mediation analyses).

As detailed in Table 11, 43.42% of the total effect of eustress on exam score was mediated by flow, and 29.34% of the total effect of cognitive test anxiety was mediated by flow. Flow completely mediates the effects of both eustress and cognitive test anxiety on exam score according to Baron and Kenny's (1986) criteria: (a) independent variable

correlated with dependent variable, (b) independent variable correlated with mediator, (c) mediator correlated with dependent variable, and (d) independent variable not statistically significant in the mediation model (Baron & Kenny, 1986). Each of these were previously established. Sobel's normal theory test of the indirect effect with respect to eustress was statistically significant, $p = .043$; but feel short with respect to cognitive test anxiety, $p = .059$. Nonetheless, it can be concluded that the nonsignificance of eustress and cognitive test anxiety in the standard regression was, in part, due to substantial proportions of their effect on exam score being mediated by flow.

Table 11

*Mediating Effect of Flow on the Relationships Between Eustress and Cognitive Test Anxiety With Exam Score (*N = *184)*

Variable	Total effect	Direct effect	Direct effect % of total	Indirect effect	Indirect effect % of total	*p*[a]
ES	1.27	0.72	56.58	0.55	43.42	.043
CTAS	-1.55	-1.10	70.66	-0.46	29.34	.059

Note. % of total calculated from many more decimal places for total, direct, and indirect effects shown in the table.
[a] *p* is the significance of the indirect effect based on Sobel's test.

General Linear Model Regression Controlling for Campus

Because statistically significant differences in exam score**s** were found between campuses, an additional regression analysis was conducted to control for the campus effect. However, rather than a least squares regression analysis, a general linear model regression was conducted because it more easily accommodates a multiple-categorical variable and yields more precise maximum likelihood coefficients. In this model, CA SM Resident was used as the reference campus against which the other campuses were

compared. As noted in Table 12, all campuses other than FL SA Resident were statistically significantly different from CA SM Resident. FL Miami Resident and CA SM Flexible were predicted to have exam scores 4.67 and 3.59 points, respectively, higher than CA SM Resident; and FL SA Flexible were predicted to have exam scores 3.46 points lower.

Flow was statistically significant and predicted an increase in exam score of 2.43 points for each 1-point increase in flow score. CTA approached significance (p = .059) and predicted a decrease in exam score of 1.34 points for each 1-point increase in anxiety score. Eustress was not statistically significant.

Various combinations of values across all three predictors and campuses can be used to predict exam score by the following equation:

Predicted exam score =

83.11 + .30(eustress score) + 2.43(flow score) – 1.34(cognitive test anxiety score)

-0.56(if in FL SA Resident)

+ 4.672(if in FL Miami Resident)

– 3.464(if in FL SA Flexible)

+ 3.589(if in CA SM Flexible)

As in the previous model without the campus variable, flow scores of 2 through 5 more than make up for any predicted decrease in score resulting from cognitive test anxiety.

Table 12

General Linear Model Regression Summary of Results Controlling for Campus

Variable	*B*	95% CI	*p*
Constant	83.11	[73.90, 92.33]	
Eustress	0.30	[-1.07, 1.66]	.671
Flow	2.43	[0.35, 4.52]	.022
Cognitive test anxiety	-1.34	[-2.73, 0.05]	.059
FL SA Resident	-0.56	[-2.79, 1.66]	.622
FL Miami Resident	4.67	[2.41, 6.93]	< .001
FL SA Flexible	-3.46	[-6.50, -0.43]	.025
CA SM Flexible	3.59	[0.90, 6.28]	.009
CA SM Resident	0.00[a]		

Note. CI = Wald confidence interval for *B*. Likelihood ratio $\chi^2(7, N = 184) = 52.23$, $p < .001$.

[a] CA SM Resident is the reference category against which the other campuses were compared.

Summary

In this chapter I explained the details associated with data collection and analysis as it pertains to timeframes, discrepancies, descriptive statistics, and results of a multiple regression analysis for a study investigating the correlation between eustress, flow, and CTA with academic performance on a psycho motor practical examination. The results from this correlational study indicated there was a significant positive relationship between flow and academic performance. CTA and eustress were not significant predictors of academic performance.

In chapter 5, I will provide a concise explanation of the findings from this study. A discussion on the interpretation of these findings will be provided to compare to previous research and indicate the addition of knowledge this study provides. The limitations and recommendations associated with the study design and actual happenings will be covered. Lastly, I will cover the implications for the application of this study's findings.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Graduate-level students have consistently shown higher levels of stress and anxiety during their academic studies, and this has been identified explicitly in physical therapy students who were the subjects of this study (see Chambers et al., 2016; Duty et al., 2015; Frank & Cassady, 2005). Evidence also suggests that these levels of stress and anxiety can be higher during examinations that involve social-evaluative threat such as oral examinations (Preuss et al., 2010; Sparfeldt et al., 2013). These increased levels of negative stress and anxiety have harmful effects on academic performance, yet most of the evidence to support this notion of impaired performance focuses on written examinations and the negative aspect of the subjects' psychological perception of performance and the exam itself (Duty et al., 2015; Mesurado et al., 2016). Little research attention has been given to psychomotor practical exams or the effects of positive psychological characteristics on academic performance.

In the literature review in Chapter 2, I provided evidence to suggest that positive psychological traits have not been extensively investigated as much as negative traits. Positive psychological variables, such as eustress and flow, have shown some promise in influencing students' performance in an academic setting (Mesurado et al., 2016; Nelson & Simmons, 2011). Until now, these positive psychological variables have not been measured from an objective standpoint on academic performance, particularly during a psychomotor practical examination.

Practical examinations utilize both cognitive and psychomotor components to test the students' competence in a subject matter and are used extensively in doctorate of physical therapy programs (Commission on Accreditation in Physical Therapy Education, 2016). The practical exams involve one-on-one grading with the student and the instructor. As compared to written examinations, this type of testing has a significant amount of monitoring and outcome pressure and can lead to the concept known as choking under pressure (Belletier et al., 2015). There is a paucity of research looking at the effects of negative or positive psychological traits during a psychomotor practical exam.

In this study, I aimed to determine if there was a correlation between eustress, flow, and CTA with the objective academic performance measure of a psychomotor practical exam. Eustress and flow constituted the positive psychological variables, and CTA served as the negative construct. I used a quantitative correlation study design to investigate the research question in an academic setting using graduate-level physical therapy students from the University of St. Augustine for Health Sciences on three different campuses across the United States. The students were in their second trimester and enrolled in the first orthopaedic course of the curriculum.

I measured academic performance using the standard academic rubric used by the University St. Augustine for Health Sciences and the practicals were administered via the standard university procedure with no interruptions. Immediately after the standard practical examination and before receiving performance feedback, the students were offered the opportunity to participate in the study by answering three psychometrically

sound measurement scales for eustress, flow, and CTA. Eustress was assessed with the ES, which has been used in the academic setting (see Mesurado et al., 2016; O'Sullivan, 2011). I assessed flow states with the AFSS that measures nine proposed dimensions of flow, but the primary analyses used an overall score (see Csikszentmihalyi, 1975; Parr et al., 1998; Payne, Jackson, Noh, & Stine-Morrow, 2011). Lastly, the CTAS was used to measure the control variable of CTA (see Cassady & Finch, 2014; Cassady & Johnson, 2002).

The findings of this study indicated that eustress, flow, and CTA each had statistically significant bivariate correlations with exam score. As eustress increased, the exam score tended to increase; as flow increased, exam score tended to increase; and as CTA increased, exam score tended to decrease. In the multiple linear regression, only flow was statistically significant while controlling for eustress and CTA. The pattern of having a significant bivariate correlation but nonsignificant partial correlations in the regression suggested that flow might mediate the relationships between eustress and CTA with exam score, which was confirmed in a follow-up mediation analysis.

The linear regression and the mediation analysis tests partial effects of variables, which does not tell the full story. I conducted a dominance analysis to better gauge the full contribution of each predictor in explaining variance in exam score. Flow was the dominant predictor, but eustress and CTA substantially contributed to explaining exam score. Because there is no statistical test of the usefulness of predictors in dominance analysis, a roughly comparative principal components procedure was used. Principal components remove the shared correlations among predictors and when the uncorrelated

principal components of eustress, flow, and CTA, both flow and CTA were statistically significant.

Interpretation of Findings

In the academic setting, there has been a plethora of research conducted to investigate the effects of negative stress and student outcomes with less interest in the concept of positive stress and its impact (Gibbons, 2012; Mesurado et al., 2016). I conducted this study specifically to investigate if the positive psychological variables of eustress and flow, as compared to a negative psychological variable of CTA, correlated with academic performance on a graduate level physical therapy psychomotor practical exam. In the following subsections, I will compare the results of my study to the findings of previous research.

Academic Performance and Eustress

Mesurado et al. (2016) discovered that more academic engagement was related to higher measures if self-efficacy and flow were found to be high in students. They also measured the amount of eustress, which had a statistically significant bivariate correlation with engagement, but did not have a direct effect on student engagement in a path model that included self-efficacy and flow; eustress did have an indirect effect on the amount of engagement because it increased the amount of flow. My results of a statistically significance bivariate correlation between eustress and exam score and indirect effect through flow in the mediation analysis is consistent with Mesurado et al.'s findings. Mesurado et al. argued that this lack of direct effect between eustress and academic engagement was because engagement is a prolonged and more stable state, whereas

eustress may be a more immediate perception of a momentary stressor and, if positively cognitively appraised, indicative of a state-specific phenomenon. While eustress, as a general trait or a state-specific response, may not have a direct effect on student performance in either a prolonged or transient state of perception.

However, eustress may have an impact on other variables that can contribute to better performance as demonstrated in the Mesurado et al. (2016) study on engagement and in this study on exam score because eustress has been shown to affect the amount of flow a student can enter. There is a fundamental need for a challenge to be introduced to the individual to experience eustress (Hargrove et al., 2013, 2015). The results of this study may indicate that challenge, if positively appraised, triggers eustress, enhances flow, and improves academic performance.

Nelson and Simons (2011) published evidence demonstrating how eustress is associated with occupational performance. Their work focused on differentiating the savoring of eustress or coping with distress by instilling positive physical, mental, and spiritual well-being in a combination of avoiding distress to improve performance and reduce disease and dysfunction (Nelson & Simmons, 2011). Their study found that eustress had a positive capacity to enhance human performance in the occupation environment and provided information that eustress could be a psychological variable which could increase student performance on a psychomotor practical.

Crego et al. (2016) discovered that dental students' stress levels and perceived efficiency have a predictable effect on the amount the students' self-report of higher academic performance. I used their findings as substantial support to utilize eustress as a

variable in my study because it implied that if there are high levels of positive aspects of stress, then academic performance should improve.

Gibbons (2010) found that eustress levels among nursing students had less of an impact on well-being as did the negative distress variables such as coping, self-efficacy, and burnout. This finding of the negative psychological characteristics having a stronger correlation with the student's well-being does have some similarities to the results of my study in that CTA did have a slightly stronger bivariate correlation with academic performance than eustress and was more dominant than eustress in the dominance analysis. However, it cannot be inferred that academic performance is the same measure as student well-being because these are two different outcome measurements.

Academic Performance and Cognitive Test Anxiety

CTA is synonymous with the term worry in the literature and is the concept that is known to have a negative impact on academic performance (Cassady, 2004; Cassady & Finch, 2014, 2015; Duty et al., 2015). Worry and emotionality are the two primary principles associated with test anxiety, and I used worry as a negative psychological variable for this study because of its history of negative influences on students' performance (see DeCaro et al., 2011; Duty et al., 2015; Sarason, 1984). The results of my study indicated that CTA did have a statistically significant bivariate correlation with academic performance, but its direct effect was mediated by flow in the mediation analysis.

Sarason (1984) identified worry and test-irrelevant thinking as factors that affect test anxiety for students, which led to a plethora of follow-up research. The literature

demonstrated that CTA affects individuals differently in a range of different areas (see Chapter 2 for more explanation; Cassady & Johnson, 2002; Duty et al., 2015). CTA is thought to elicit inferior academic performance due to a lack of organization skills, poor encoding of information, and inadequate comprehension of content, which are believed to be derived from a lack of executive processing in the student's mind during the exam (Cassady & Finch, 2015; Naveh-Benjamin, 1991).

One of the gaps in the literature was that there was a paucity of evidence looking at CTA associated with a skill-based psychomotor practical examination. Hence, it is plausible that with high levels of CTA, a student would have reduced executive processing which would lead to lower performance on the practical exam, especially if there is the addition of monitoring pressure from an instructor in a face-to-face, practical exam. However, some studies reported students with high levels of CTA did not show a reduction in working memory during high stakes performance that include the presence of evaluative threat (Cassady, 2004; Cassady & Finch, 2015; Putwain et al., 2014). These findings may give explanation to the results of my study that found a negative bivariate correlation between CTA and students' scores in a practical examination, but which was diminished when controlling for eustress and mediated by flow. That is, regardless of whether CTA reduces executive processing, even in the presence of social evaluative threat, eustress and flow can mitigate the negative impact.

Zhang and Henderson (2014) found that worry was the most reliable indicator of test anxiety that affected chiropractic student academic outcomes. Zhang and Henderson looked at more of a trait anxiety aspect as their study was conducted over an entire

semester. Their scale of choice was the Test Anxiety Inventory, which mesures both primary principles of test anxiety, worry, and emotinality. Their findings concluded a significant negative correlation with Test Anxiety Inventory scores and written exam scores but did not achieve a significant correlation on the skill-based objective structured clinical examination scores. This is one of the very few studies that also looked at skill-based or psychomotor practicals as the outcome measure for academic performance. The difference between my research and the work done by Zhang and Henderson was that I specifically investigated a psychomotor practical exam and CTA (i.e., worry) at a specific moment in time. Zhang and Henderson measured both written examinations and skills performance assessments combined over an entire semester and measured both worry and emotionality with the Test Anxiety Inventory. Zang and Henderson found worry and emotionality to be statistically significant predictors of written exam scores but not of objective structured clinical examination scores in regression models controlling for several demographics.

It is of interest to discuss a recent study conducted by Hubbard and Blyler (2016) who looked at academic performance and working memory for health science graduate students utilizing an intervention of progress of muscle relaxation. Over a semester, 128 health science graduate students were randomly divided into a control group or an intervention group for progressive muscle relaxation interventions. Pre- and posttest measures of perceived stress, state-trait anxiety, and a trial marking test for working memory were conducted in the fourth week of the semester and after three practical examinations over nine weeks. Findings indicated there was a significant correlation

between state anxiety and academic performance. The state anxiety measurement scale does not separate the two components of test anxiety, worry and emotionality (Eysenck & Calvo, 1992; Sarason, 1984), which may be one reason their study demonstrated a significant correlation between anxiety and academic performance compared to Zhang and Henderson (2014) who used worry and emotionality as separate, but correlated, predictors weakening the partial effects. Their study was over a period of time in which students took three different practical examinations and did not account for any positive psychological variables. Therefore, it is difficult to compare the result of the Hubbard and Blyler study with mine because of the time frame and specific measurement scales, but one can see there is a pattern of a negative correlation that has questionable significance between psychomotor practical examinations and cognitive test anxiety.

Academic Performance and Flow

Flow is the term used to describe a cognitive state that involves the positive and intense involvement in a task where time appears to be extraneous, which induces complete immersion in that activity generating optimal performance (Cseh et al., 2016; Csikszentmihalyi, 1975, 2014; Harris, Vine, & Wilson, 2017). There are nine dimensions to flow that are measured in the flow state scale, which has the capability of determining if a person is indeed in this state (Cseh et al., 2014). The measures of the flow state scale have been comparable to brain activity visualized with functional near-infrared spectroscopy (Hirao, 2014; Yoshida et al., 2014) and MR-based perfusion imaging (Ulrich et al., 2014), meaning the scale is a sensitive and reliable measure.

Verbal based task performance was shown to significantly correlate with flow state levels for occupational therapy students if there were high levels of subject skill and complex levels of challenge during the task given (Hirao, 2014). These findings from the Hirao (2014) study align with the current results in that flow state levels significantly predicted academic performance on the practical exam. The verbal-based task performance has some similarities to the psychomotor practical examination, as students are required to verbally state findings and answer questions associated with the psychomotor performance task. Thus, flow may activate the portions of the brain that promote improved verbal, psychomotor, and cognitive aspects of performance. However, Hirao used near-infrared spectroscopy to look at brain activation during the performance tasks of the students and found a negative correlation between the amount of flow and prefrontal cortex activity. These results are different from the findings of the work done by Yoshida et al. (2014) who also used the same imaging techniques to investigate flow states in the brain and found there was a positive correlation of prefrontal brain activity and flow levels. Hirao noted a limitation of near-infrared spectroscopy is that it only measures superficial brain activity, which means it may not adequately measure aspects of the brain that are activated during flow state.

The findings from my study also align with studies investigating flow using MR-based perfusion imaging while individuals are performing arithmetic calculations that continuously altered in levels of difficulty. Levels of flow were found to be highest when the challenge matched the individual's skill level and was less if the task was easy or too challenging (Ulrich et al., 2014), supporting my finding that eustress, which positively

appraises the challenge-skill match, affects flow. A significant interest is the imaging findings which showed that higher flow levels were related to increased cerebral blood flow to the left anterior inferior frontal gyrus which links to an increase in sense of control, and a decrease blood flow to the amygdala indicating the presence of positive emotions (De Baene et al., 2012; Straube et al., 2008; Ulrich et al., 2014). These findings in brain activity demonstrated the physiological and cognitive capabilities of flow to induce optimum performance during academic activities if the perceived challenge matches the skill level of the student.

Refuting evidence of flow and positive effects on academic performance can be discussed with the work done by Rossin et al. (2009). Their work investigated MBA students in an online program taking multiple choice quizzes. The subjects were measured pre and post for two different 2-week module classes testing the same content for both measures. After the posttest academic quiz, the students were measured via surveys for levels of flow activity, perceptions of learning and skill development, and student satisfaction with regards to their experience in the modules. Findings revealed that flow scores had no significant relationship with learning performance, and only the dimension of flow known as autotelic involvement had predictive capabilities for the amount of perceived learning and student satisfaction (Rossin et al., 2009). Meaning, flow did not appear to corelate with learning performance as seen in my study. Although it was not significant, flow had some ability to predict the students' perceived skill development because there was a positive relationship between these variables (Rossin et al., 2009). My study implemented objective measures to test if the students had skill

development and the amount of flow correlated with the ability to demonstrate competence in this skill achievement (i.e., academic performance scores on a psychomotor practical examination). The evidence from my study might suggest that flow state levels have more of an impact on educational outcomes that require a physical component to cognitive-based tasks, but more specific research would need to be implemented by manipulating the physical versus cognitive components of various types of practical examinations.

Cseh et al. (2014) found that undergraduate psychology students had increased creativity efficiency and self-rated creativity during a mental creative drawing task with higher flow levels. Using pre and posttest questionnaires to measure flow revealed flow was significantly correlated with self-rated creativity but may not have been related to an external performance measure of creativity. This study was one of the few that demonstrated the possibility of flow not being correlated with academic performance from an objective measurement versus the perception of the student. However, the findings in my study indicated if the students are in a state of flow there is a correlation with increased performance on a cognitive psychomotor practical examination. My results may appear to refute the findings from the Cseh et al. study, but it is difficult to compare results. The outcome measure of a creativity drawing task is a different performance activity compared to a psychomotor practical exam because the students did not have to create information during the practical exam abstractly. Hence, flow state may have more of an effect on external based performance tasks versus a self-paced performance task.

This finding of flow affecting different types of performance is in direct support with the athletic-based performance studies done by Koehn et al. (2013) with tennis players. External based activities such as reacting to a groundstroke or returning a ball in tennis had a significant positive association with six of the nine dimensions of flow. Whereas, self-paced activities such as the initial serve in tennis had a significant positive relationship with three of the nine dimensions (Koehn et al., 2013). A psychomotor practical examination has a closer resemblance to the external based activity as the students being tested with a time limit to perform their tasks, and they are not aware of precisely which functions they will have to complete until the instructor gives directions when they enter for testing. This explanation of the tasks that are performed during my study and the findings from the work of Koehn et al. could be a plausible reason why flow dominated eustress and cognitive test anxiety to significantly predict academic performance in my study.

Academic Performance, Flow, and Eustress

Yielding similar results to my study, previous work looking at eustress and flow as variables in a study investigating academic engagement showed that flow was a stronger predictor (Mesurado et al., 2016). Mesurado et al. found that eustress only had an indirect effect on academic engagement through its common dimension of positive appraisal with flow, which is consistent with my mediation results. A distinctive difference between my work and the study by Mesurado et al. is that, for the first time, academic performance was assessed using an objective measure to determine the relationship between flow, eustress, and academic performance in a university setting.

It is thought that a critical connection between eustress and flow involves an appropriate amount of challenge for the individual's skill level (Mesurado et al., 2016; Peifer et al., 2014), but this is only one of the nine dimensions that are thought to comprise flow states (Csikszentmihalyi, 2014; Payne et al., 2011). It is plausible that because flow may represent more dimensions of positive psychological characteristics than eustress that flow would have a stronger correlation with the outcome measures.

Academic Performance, Flow, and Cognitive Test Anxiety

An interest in my study was to determine if positive or negative psychological variables would correlate with academic performance. Tying in evidence that investigated CTA and intrinsic motivation, Khalaila (2015) discovered undergraduate nursing students who had a positive perception toward their skills and accomplishments were more likely to have higher academic attainment. Also, high levels of intrinsic motivation and high measures of test anxiety explained the relationship between academic self-concept and academic achievement (Khalaila, 2015). Since intrinsic sense of reward is one of the components of flow (Csikszentmihalyi, 2014), and cognitive test anxiety is one of the aspects of test anxiety (Liebert & Morris, 1967), it is evident why the results from my study are in alignment with the findings of the Khalaila study. Meaning both CTA and positive psychological variables have some correlation with academic performance, but flow mitigated and mediated the effect of cognitive test anxiety on exam score.

Relationship Between Study Findings and Theoretical Framework

Graduate students in a physical therapy program must be assessed with psychomotor practical examinations for competence in the profession (Price & Tej, 2014). Performing well on these psychomotor practical exams requires the students to comprehend and reason through available information and perform psychomotor tasks (Conway et al., 2007; Hubbard & Blyler, 2016). Additional factors that play a role in affecting these psychomotor practical exams include monitoring pressure and outcome pressure. In this context, the presence of monitoring pressure aligns with the grading instructor watching and evaluating their performance and outcome pressure aligns with the incentives for performing well on the exam (Belletier et al., 2015; DeCaro et al., 2011). This understanding of the psychological requirements placed on the students during a psychomotor practical exam conceptualizes the high-stakes situation the students experience. A discussion of theoretical concepts around the variables in this study will now be used to analyze and interpret the findings of this study.

Fit of Findings and Theories on Eustress

I stated before, most of the literature on stress focuses on the negative aspects, which means that most of the research focuses on the adverse human response to stress with little attention given to the potential positive influences (Beilock & Decaro, 2007; Hargrove et al., 2015; Mesurado et al., 2016). The positive components of stress, known as eustress, has some support in the literature and has demonstrated the potential improvement in human performance and wellbeing (Nelson & Simmons, 2011). Theories such as Yerkes-Dodson curve law (Selye, 1975; Yerkes & Dodson, 1908), the cybernetic

theory of stress (Edwards, 1992), and COR theory (Morelli & Cunningham, 2012) share some aspect of a potential positive response to stress. The findings of this study have the potential to relate to each of these theories.

Yerkes-Dodson curve law. Yerkes and Dodson (1908) found that there is an optimal amount of stress in which human performance can increase, but if the stress levels are too high or too low, then performance may be diminished. Their work led to the famous bell curve chart to demonstrate this notion that peak performance occurs somewhere in the moderate range of stress measurements. Another aspect of this theory is that everyone responds differently to stress and other factors may play a role in how they react to these levels of stress (Yerkes & Dodson, 1908). The findings of my study indicated that two of these other factors that play a role are eustress and flow.

To examine the level of cognitive test anxiety on performance with respect to levels of eustress and flow, participants were grouped by quartile on CTA. As shown in Figure 5, those in the lower two quartiles on CTA had substantially higher eustress and flow scores than those in the two upper quartiles. The lower two quartiles did not statistically differ on either eustress or flow, but both had statistically significant differences on both eustress and flow with respect to each of the upper two quartiles. With respect to performance, only the most highly anxious group had substantially decreased exam scores. This suggests, in this sample, that eustress and flow peaked at very little and low test anxiety levels, while performance was relatively equivalent across very little, low, and moderate test anxiety levels, partially consistent with the Yerkes-Dodson curve law that too much stress diminishes performance.

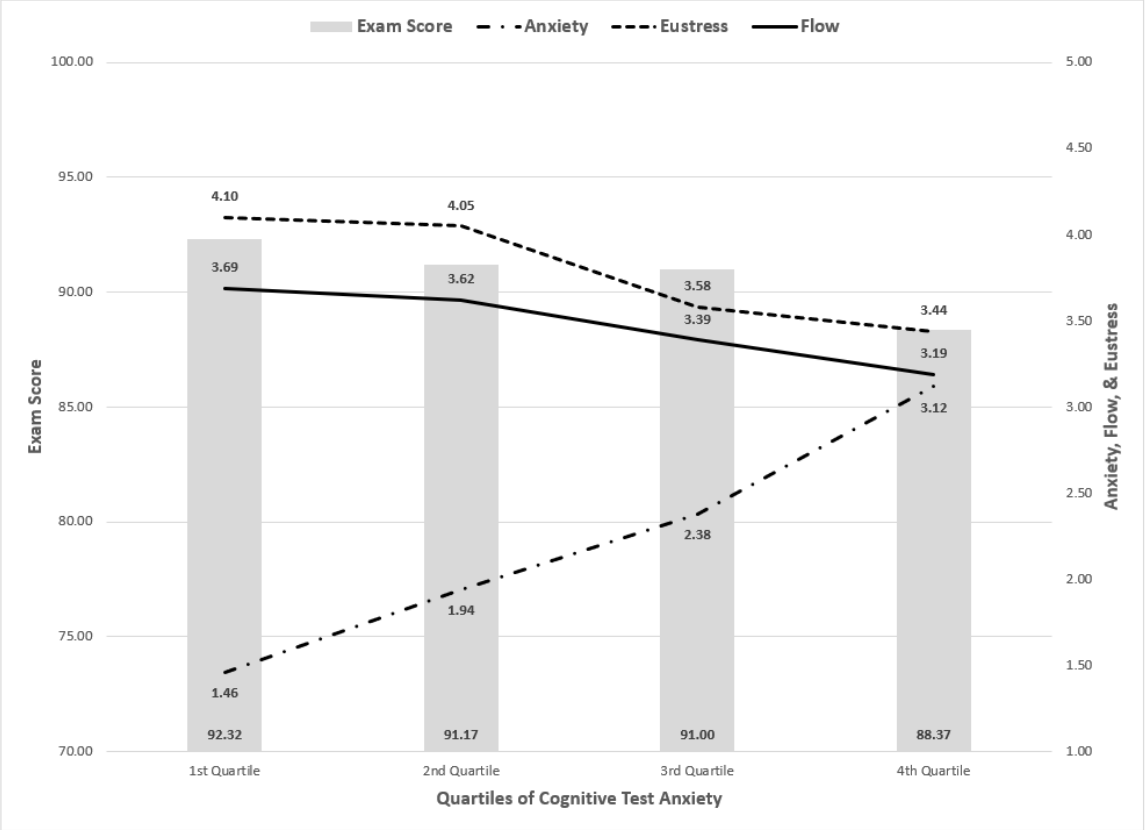

Figure 5. Comparative exam score, cognitive test anxiety, eustress, and flow scores across cognitive test anxiety quartiles.

Cybernetic theory of stress. The cybernetic theory of stress is best explained as a negative feedback loop of an individual's desired state and the perception of what they are experiencing (Edwards, 1992; Edwards & Cooper, 1988). This theory indicates that if a person's cognitive understanding of physical and social surroundings is negatively appraised concerning their desired state, then this individual would experience stress leading to undesired physiological and psychological functions for mental and physical health (Edwards & Cooper, 1988; Katz & Kahn, 1978). On the contrary, if the states are perceived as a positive appraisal concerning their desired state, then it is possible to have positive changes in physiological and psychological function (Edwards & Cooper, 1988).

Therefore, if students taking a psychomotor practical examination perceived a positive outlook on physical and social influencers that met their desired state, then positive changes could arise from this experience leading to higher levels of eustress, flow, and improved performance, (i.e., a positive feedback loop). However, if these students had a negative appraisal that failed to meet the individuals desired state, then there could be detrimental effects on performance.

My findings are consistent with the cybernetic theory of stress in that students with higher eustress and flow, presumably from a positive appraisal of the exam situation, had better performance than students with lower eustress and flow, presumably from a negative appraisal of the exam situation. This is evident in the previously presented Figure 5.

Conservation of resources. CoR theory portrays that stress can be experienced when an individual's mental resources or valued material are perceived as threatened or lost (Morelli & Cunningham, 2012). When these mental threats or potential loses are deterred from becoming negative stress, it can create intrinsic motivation for this individual (Hobfoll, 2001; Morelli & Cunningham, 2012). A critical component of this theory is the individual's perceived value of these available resources, meaning that there will be different levels and magnitudes of stress response pertaining to the individual's perception of the value of the threatened resources (Morelli & Cunningham, 2012). In Chapter 2, an explanation was given connecting eustress and CoR theory by the ability of a student to attain better resources over time by reinvesting the gained adequate resources from previous experiences. In my study, the participants were in their second trimester of

graduate school meaning that they had some experience with practical examinations but were not at the level of expertise of a seasoned graduate student. Here one can see these students may not have all had proper available resources to reinvest in this practical exam situation that would deter them from becoming negatively stressed. Additionally, it would vary from student to student depending on how much they valued the threatened resources during the practical exam. This variance in the value may be a plausible explanation as to why eustress had a statistically significant positive bivariate correlation with academic performance, but not when controlling for CTA because of the possible individualized perception of threat to resources and value placed on those resources.

Fit of Findings and Flow Theory

Csikszentmihalyi (1975) established the concept of flow theory based on nine dimensions. Flow is the optimal and positive experience that leads to an individual's complete focus and concentration, mental and physical efficiency, intrinsic motivation, and transcendence of the task into an enjoyable activity (Csikszentmihalyi, 2014; Culbertson, Fullagar, Simmons, & Zhu, 2015). Other indicators of flow experience included a loss of self-consciousness, loss of anxiety limitation, decreased awareness of time, and an increase in stimulation, absorption, and sense of control over action and environment (Csikszentmihalyi, 2014; Nakamura & Csikszentmihalyi, 2014). One of the most notable aspects of flow theory that can be directly related to the results of my study is the concept of balance between challenge and skill (Csikszentmihalyi, 1975; Moneta & Csikszentmihalyi, 1996; Santosa, 2015). Csikszentmihalyi (1975, 2014) explained that if an individual has too much skill in relation to the challenge at hand then the individual

may experience boredom, and if the skill level is insufficient for the challenge given, then the individual may experience anxiety or distress.

This concept of the challenge and skill balance is logically consistent with the results of my study that indicated that students with higher levels of flow had higher levels of academic performance (see previously presented Figure 5). If a student was well prepared and had attained the skills necessary before entering the practical exam, it is likely they meet the standard of the challenge given to them. This appropriate amount of skill development may have led to increased flow and, simultaneously, increased performance on the practical examination.

Conversely, if the student did not prepare well enough and did not obtain the skills necessary to meet the challenge of the practical examination, it is likely they had higher CTA, lower flow, and lower levels of performance as evidenced by the 4th quartile results depicted in Figure 5. Csikszentmihalyi's (1975, 2014) notion that those with too much skill in relation to the challenge at hand was not evident in my findings. This may be because the practical exam, even for those over prepared, had academic consequences and motivated those in the lowest quartile of CTA to perform well.

Fit of Findings and Theories on Cognitive Test Anxiety

Cassady and Johnson (2002) used the term CTA to represent the dimension of worry from the overarching concept of test anxiety. Worry can be described as the cognitive interference experienced when an individual fixates on non-relevant thoughts such as comparing themselves to others, feelings of unpreparedness, lack of confidence, decreased self-worth, or concerns about the evaluation process (Cassady & Johnson,

2002; Duty et al., 2015). One of the most substantial influences for this negative impact on test performance from worry is known as anxiety blockage (Cassady & Finch, 2015; Sarason, 1984). Research in the field of anxiety blockage has led to a term called choking under pressure (Beilock et al., 2002; DeCaro et al., 2011). The concept of choking under pressure and worry can be compared to the cognitive test anxiety results found in my study. CTA had a statistically significant negative bivariate correlation with academic performance, was a substantially useful predictor in the dominance analysis controlling for eustress and flow, and was statistically significant in a principal components regression. In the previously presented Figure 5, choking under pressure and worry seems a logical explanation for the performance of those in the 4th quartile of CTA.

CTA can be viewed as a performance inhibitor because it blocks the individual's ability to efficiently and effectively code, organize, or comprehend the content needed during a testing procedure leading to poor executive functioning and self-regulation (Cassady & Finch, 2015; Owens et al., 2008). Most research looking at CTA and performance in academia focus on written examinations versus practical exams that require both cognition and psychomotor skills, and there is a plethora of this literature that demonstrates its negative impact on academic performance (Cassady & Finch, 2015; Owens et al., 2008).

From a theoretical perspective, and consistent with my findings, it may be that eustress and flow states have the potential to alleviate the effects from CTA, leading to more direct and efficient cognition thus reducing the negative effects that are typically seen with CTA during performance. One of the most recent models to explain how CTA

may result in performance deficits from test anxious students is known as the skill deficit model (Putwain et al., 2014). If the skill deficit model explains CTA as interfering with effective coding and executive processing secondary to attention drawn to irrelevant thoughts or choking under pressure and flow theory pulls an individual into deep focus and merges action and awareness then it is evident that these two psychological factors counteract each other (Belletier et al., 2015; Cassady & Finch, 2015; Csikszentmihalyi, 2014; Harris et al., 2017).

The results of my study indicated the strongest partial correlation was with flow and academic performance, suggesting that the construct of flow, a positive psychology variable, has a stronger influence than CTA on academic performance pertaining to tasks using both cognition and psychomotor skills. This notion is consistent with the theoretical construct of flow in that the ability of the individual and challenge of the task must match for peak performance to occur. Thus, if the student did not obtain the skills necessary to meet the challenge of the psychomotor practical exam it is likely the presence of CTA would increase, leading to poorer performance, which is consistent with the pattern of results depicted in the previously presented Figure 5.

Limitations of the Study

Research done in the domain of academic performance and health psychology that utilize participants' self-report as the primary data collection are indeed subject to limitations (Boissonnault & Badke, 2005; Frankfort-Nachmias & Nachmias, 2008) and rely on reliability and validity measures of various constructs to draw inferences from the

results of the studies (Bradburn, Sudman, & Wansink, 2004). This study had a few limitations that merit discussion.

The measurement scales used for the independent variables in this study do have adequate validity and reliability as discussed in Chapters 3 and 4, but the measure for academic performance did not have established reliability and validity data, which is a threat to internal validity (Creswell, 2013). An additional finding from the statistical analysis revealed a significant difference in exam scores amongst the campuses. All the students admitted to the University of St. Augustine undergo a standard admissions process on all campuses, which means students should be of similar academic profiles as it pertains to previous achievements in Graduate Record Examinations, Grade Point Average, and curriculum completions and rigor to be accepted into the program. This standard admissions process indicates the caliber of students on each campus should not be significantly different from campus to campus. This alludes to a potential reliability issue amongst instructors at the different locations when utilizing the standard institutional rubric for the orthopedic practical because there was no significance between measures of the other variables in the study from campus to campus which used psychometrically sound instruments. Careful consideration must be made with the interpretation of the results of this study due to variability among campus exam scores.

Another limitation regarding the statistical analysis that is of concern was the significantly lower exam scores for the students that did not participate in the study. This lack of participation was particularly true for the Florida, Saint Augustine Flexible doctor of physical therapy program cohort. Across all campuses 57 students did not participate

in the study yet did receive exam scores from the practical performance. This is a concern because I do not know the levels of CTA, flow, or eustress to see if these measures correlate to the poorer performance for these nonparticipants, and the lower scoring students were underrepresented in the data analysis. It is plausible to consider this unobtained data could have altered the results of the study.

The limitation related to generalizability is worthy of discussion. One reason I choose the University of Saint Augustine for Health Sciences for data collection is because it had strong potential to allow generalization of a student population because this university has programs across the East, Central, and Western parts of the country. Unfortunately, the Central portion, specifically the Texas campus, did not participate in the study. This lack of participation from this central region of the country decreases the generalizability of the study results. However, there is still generalization capability of the results because data were collected on opposite ends of the country (Frankfort-Nachmias & Nachmias, 2008). The results of this study can be generalized to other graduate programs that incorporate psychomotor practical examinations in their curriculum, but specific research should be done in each professional genre and different physical therapy programs to improve the generalization of these results.

Treatment diffusion was reduced because the procedure followed a standard testing environment where the students were quarantined and unable to communicate with each other before and post-testing (Creswell, 2009; Persaud & Mamdani, 2006). However, a threat to validity was noted when this procedure was not entirely followed for the Florida, Saint Augustine Flexible cohort and this led to potential crosstalk of students

before taking the psychological questionnaires. This peer feedback could have altered the students' psychological perception of their performance before taking the questionnaires and could have compromised the validity of the measures.

There is also a limitation in the logistical implementation of the cognitive test anxiety scale. Participants in the study received a CTAS that was missing the last item of the shortened version of the CTAS scale, which was accidentally replaced with a question from the old and longer version (Cassady & Finch, 2014). This occurred for the first three cohorts of data collection. This error was recognized and corrected for the remaining two groups.

Lastly, the measurement scales used for CTA and eustress are designed to obtain an individual's trait measure of these constructs versus a state moment in time as the flow state scale is designed. Although the CTAS and the eustress scale are intended to capture a general trait of the individual, it was still measured at a time where this trait may have been slightly altered due to the practical examination. However, the flow state scale was designed to be implemented immediately after a task to measure the levels of flow during the practical examination. Therefore, it is a plausible threat to validity that the CTAS and eustress scale did not specifically measure levels of anxiety and eustress that were present immediately prior to or during the practical examination.

Recommendations

Recommendations for future research vary from methodology to the implementation of different variables. This study investigated the relationship between academic performance on a practical exam with the levels of eustress, flow, and CTA

utilizing graduate level physical therapy students. This correlational study found statistically significant bivariate correlations of eustress, flow, and CTA with academic performance on the practical exams. Although flow dominated eustress and CTA in the dominance analysis, both eustress and cognitive test anxiety were substantially useful predictors, which was statistically significantly confirmed for CTA in a principal components version of multiple regression. Although eustress and flow were not statistically significant in the standard multiple regression, their fall from bivariate correlation significance to partial correlation nonsignificance was explained by flow's complete mediation of these predictors' relationships with exam score—their effects flowed through flow.

This study provides information to develop better hypotheses for an experimental design study utilizing an intervention strategy to improve flow states in students and testing this against different forms of academic performance. Suggested interventions could include flow state hacking programs, mindfulness-based training, exercise and is flow states, or other more technologically enhanced interventions such as transcranial direct current stimulation to the pre-frontal cortex (Bullard et al., 2011; Csikszentmihalyi, 2014; Harris et al., 2017; Van Dijk, Lucassen, & Speckens, 2015). I also recommend a methodology that would allow flow state training for different groups of subjects at different levels of training and challenge demands. For instance, if a student could generate flow even in the presence of low skills, it may be possible for them to perform better because of the potential for flow to negate cognitive test anxiety.

Finally, a recommendation to enhance the findings of this study could be to add the variable of preparedness to determine the level of prior skill. For instance, preparedness was not measured in this study which has potential to improve the findings of this study because this could give more insight as to the possible skill level of the students going into the practical exam (Murayama et al., 2015; Nelson, 2014). With this additional information, we may be able to examine the main components of the theoretical constructs associated with eustress, flow, and CTA pertaining to the skill and challenge levels for each student.

Also, Cassady and Finch (2015) found that students with high levels of CTA perceived this anxiety as cognitive interference and focusing on deficits in their skills for test taking. This difference in perception of CTA between students with high levels of cognitive test anxiety and students with low CTA measures suggests that this variable may need to be analyzed in subgroups, more purposefully than was done with the quartile splits, to determine more precisely the effect of different levels of CTA on academic performance (Cassady & Finch, 2015). Future research could also be designed to measure eustress and CTA immediately prior to an exam so they are not potentially conflated with the measurement of flow after the exam. Lastly, because of exam score differences across campuses that may be attributable to instructor inconsistencies in grading performance, I recommend the use of multiple raters of each student's performance, which would serve as a reliability check of instructor differences and a validity check of the grading rubric.

Implications

The implications of this study span across multiple levels including the individual, organization, and society. This study revealed a better understanding of how positive and negative psychological characteristics correlate with academic performance on a less understood assessment tool. These findings can lead to positive social change for students, institutions, and human performance.

Implication for Students

Students at the graduate level are known to have high levels of stress and anxiety as compared to their peers, and this has been associated with poor health and decreased academic performance (Hubbard & Blyler, 2016; Jacob et al., 2013; Lin & Huang, 2014). The results of this study indicated there-are potential psychological constructs influential in the students' ability to overcome stressors and perform better in the academic setting. Flow, a positive psychological variable, had the strongest relationship with academic performance on the psychomotor practical examination. Higher levels of reported flow state during the practical exam resulted in higher scores on the practical examination. Therefore, students in graduate school should consider implementing training to improve variables associated with positive psychology, particularly flow, which has the potential to enhance academic performance on a psychomotor practical. Positive psychological characteristics such as flow could be implemented in their daily routines to improve their performance in other courses and their overarching goal of becoming a clinician. If this enhanced performance transitions into the clinical setting, then a notable societal impact

could occur because each of the students would then perform better as a clinician when treating all their patients.

Typically, students' focus is on reducing the negative psychological concepts to improve performance (Cassady & Johnson, 2002; Edwards & Cooper, 1988; Mesurado et al., 2016). The results from the current study show promise that positive psychological concepts do correlate with academic performance, and thus there may be a need to shift the training focus from reducing negative psychological characteristics to producing and instilling more positive psychological characteristics for students. Specifically, the implications of the findings of this study could be for students to focus their efforts on improving eustress and flow states instead of trying to reduce CTA. These findings serve as the preliminary evidence to guide future research to determine how eustress and flow can transition from one classroom genre to the next and from the classroom to daily tasks. This current study does show promise for the implication of positive psychology for students in the graduate level programs.

Implications for Human Performance

Improvements in human performance via psychology research are of particular interest in modern times (Bernier, Thienot, Codron, & Fournier, 2009). It is known that changes in the brain can be associated with a positive mindset, which can lead to an improvement in clarity and focus that carries over into improved performance (Harris et al., 2017; Murayama et al., 2015). The findings from the study pragmatically solidify the potential for positive psychology to impact human performance. Although the focus of the study was on graduate-level students participating in a psychomotor practical exam,

my study can add to the evidence in the areas of work or sports settings. My research can also serve as the groundwork for further exploration of the possibility to improve performance outside of the classroom environment due to the presence of the concept of choking under pressure or social-evaluative threat (Belletier et al., 2015). For instance, if an employee is being audited or evaluated by regulating bodies to determine competence in their current position or an athlete is performing in front of thousands of people there is the potential for negative and psychological variables to play a role in their performance. Flow states have been shown to increase employee and athlete's motivation and engagement (Koehn et al., 2013; Seemann & Seemann, 2015), but my study indicates the potential for this positive psychological variable to correlate with performance even under the high possibility of choking under pressure.

Implications for Institution

The primary focus is on written examinations for most studies investigating cognitive test anxiety in the academic setting (Cotton et al., 2002; Dickerson & Kemeny, 2004; Preuss et al., 2010). In this study, neither eustress nor CTA had significant partial correlations with academic performance on the psychomotor practical exam when controlling for flow. Meaning, academic performance is multiply determined by combinations of psychological variables. An understanding, in particular, that the positive psychological variable of flow's significant partial correlation with academic performance on a practical examination can guide administration and policies to better prepare students for different types of assessments and academic success.

The knowledge that positive psychological variables, particularly flow states, may have the strongest correlation with academic performance it may be of interest to institutions to begin investigating the utility in training of positive psychology constructs with their student populations instead of focusing on the negative constructs. This information can also serve as guiding evidence for future research to determine if training students with positive psychology can transfer over to clinical practice and performance post-graduate school.

Conclusions

The purpose of this current study was to determine if positive psychological variables, eustress and flow, and a negative psychological variable, CTA, had any correlation with academic performance on a psychomotor practical for graduate level students. I found statistically significant positive bivariate correlations between eustress and flow with academic performance, and statistically significant negative bivariate correlation of CTA with academic performance. Flow was the star, dominating the other two with the only statistically significant partial correlation in regression, and mediating the relationships of eustress and CTA with academic performance.

This study lends support to the notion that there is a difference between the impact of positive and negative psychological variables in relation to different types of academic assessments. Efforts to improve academic performance on practical exams may not need to focus on combatting negative psychological variables as once thought for written exams. The results of my study indicate this focus should be directed towards the

implementation of positive psychological constructs, such as eustress and flow states, for academic assessments that involve both cognitive and psychomotor tasks.

References

Al-kuraishy, H. M., & Al-gareeb, A. I. (2017). Eustress and malondialdehyde (MDA): Role of panax ginseng: Randomized, placebo controlled study. *Iranian Journal of Psychiatry*, *12*(3), 194–200.

Allison, M. T., & Duncan, M. C. (1988). Women, work, and flow. In *Optimal experience: Psychological studies of flow in consciousness* (pp. 118–137). https://doi.org/10.1017/CBO9780511621956.007

American Physical Therapy Association. (2001). Guide to physical therapist practice. Second edition. *Physical Therapy*, *81*(1), 9–746. http://search.proquest.com.prx-usa.lirn.net/docview/223117276?accountid=158603

American Psychological Association. (2010a). 2010 Amendments to the 2002 Ethical principles of psychologists and code of conduct. *American Psychologist*, *65*(5), 493. https://doi.org/10.1037/a0020168

American Psychological Association. (2010b). Report of the Ethics Committee, 2009. *American Psychologist*, *65*(5), 483–492. https://doi.org/10.1037/a0019515

Anthis, K. S. (2003). Test reactivity: Does the measurement of identity serve as an impetus for identity exploration? *Journal of Articles in Support of the Null Hypothesis*, *2*(2), 86–91.

Arter, J. A., & Chappuis, J. (2007). *Creating and recognizing quality rubrics*. *A study guide from Pearson Assessment Training Institute*. Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

Asakawa, K. (2010). Flow experience, culture, and well-being: How do autotelic

Japanese college students feel, behave, and think in their daily lives? *Journal of Happiness Studies*, *11*(2), 205–223. https://doi.org/10.1007/s10902-008-9132-3

Bakker, A. B. (2005). Flow among music teachers and their students: The crossover of peak experiences. *Journal of Vocational Behavior*, *66*(1), 26–44. https://doi.org/10.1016/j.jvb.2003.11.001

Bandalos, D. L., Yates, K., & Thorndike-Christ, T. (1995). Effects of math self-concept, perceived self-efficacy, and attributions for failure and success on test anxiety. *Journal of Educational Psychology*, *87*(4), 611–623. https://doi.org/10.1037/0022-0663.87.4.611

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Baumeister, R. F. (1984). Choking under pressure: Self-consciousness and paradoxical effects of incentives on skillful performance. *Journal of Personality and Social Psychology*, *46*(3), 610–620. https://doi.org/10.1037/0022-3514.46.3.610

Bay, E., & Kotaman, H. (2011). Examination of the impact of rubric use on achievement in teacher education. *New Educational Review*, *24*(2), 283–292.

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

Beilock, S., & Decaro, M. (2007). From poor performance to success under stress:

Working memory, strategy selection, and mathematical problem solving under pressure. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(6), 983–998. https://doi.org/10.1037/0278-7393.33.6.983

Beilock, S. L., & Carr, T. H. (2001). On the fragility of skilled performance: What governs choking under pressure? *Journal of Experimental Psychology General*, *130*(4), 701–725. https://doi.org/10.1037/0096-3445.130.4.701

Beilock, S. L., Carr, T. H., MacMahon, C., & Starkes, J. L. (2002). When paying attention becomes counterproductive: Impact of divided versus skill-focused attention on novice and experienced performance of sensorimotor skills. *Journal of Experimental Psychology: Applied*, *8*(1), 6–16. https://doi.org/10.1037//1076-898X.8.1.6

Belletier, C., Davranche, K., Tellier, I. S., Dumas, F., Vidal, F., Hasbroucq, T., & Huguet, P. (2015). Choking under monitoring pressure: Being watched by the experimenter reduces executive attention. *Psychonomic Bulletin & Review*, *22*(5), 1410–1416. https://doi.org/10.3758/s13423-015-0804-9

Bernier, M., Thienot, E., Codron, R., & Fournier, J. F. (2009). Mindfulness and acceptance approaches in sport performance. *Journal of Clinical Sports Psychology*, *4*, 320–333.

Bersoff, D. N. (2008). *Ethical conflicts in psychology* (4th ed.). Washington, DC: American Psychological Association.

Boissonnault, W. G., & Badke, M. B. (2005). Collecting health history information: The accuracy of patient self-administered questionnaire in orthopedic outpatient

setting. *Physical Therapy*, *85*(6), 531–543.

Boud, D., Keogh, R., & Walker, D. (1985). Promoting reflection in learning: A Model. *Learning*, *170*. Retrieved from http://www.amazon.com/Reflection-Turning-Experience-into-Learning/dp/0850388643/ref=sr_1_1?s=books&ie=UTF8&qid=1281704712&sr=1-1

Bradburn, N., Sudman, S., & Wansink, B. (2004). *Asking questions: The definitive guide to questionnaire design—For market research, political polls, and social and health questionnaires* (Revised). San Francisco, CA: Jossey-Bass.

Branch, W. B., Cohen, M. J., & Hynd, G. W. (1995). Academic achievement and attention-deficit/hyperactivity disorder in children with left- or right-hemisphere dysfunction. *Journal of Learning Disabilities*. https://doi.org/10.1177/002221949502800106%5Cn

Breedlove, S. M., & Watson, N. V. (2013). *Biological psychology: An introduction to behavioral, cognitive, and clinical neuroscience. Biological psychology: An introduction to behavioral, cognitive, and clinical neuroscience* (7th ed). Sunderland, MA: Sinauer Associates, Inc.

Budescu, D. V. (1993). Dominance analysis: A new approach to the problem of relative importance of predictors in multiple regression. *Psychological Bulletin*, *114*(3), 542–551. https://doi.org/10.1037/0033-2909.114.3.542

Bullard, L. M., Browning, E. S., Clark, V. P., Coffman, B. A., Garcia, C. M., Jung, R. E., … Weisend, M. P. (2011). Transcranial direct current stimulation's effect on

novice versus experienced learning. *Experimental Brain Research*, *213*(1), 9–14. https://doi.org/10.1007/s00221-011-2764-2

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental design for research*. *Handbook of research on teaching*. Boston, MA: Houghton Mifflin. https://doi.org/10.1037/022808

Cassady, J. C. (2004). The influence of cognitive test anxiety across the learning-testing cycle. *Learning and Instruction*, *14*(6), 569–592. https://doi.org/10.1016/j.learninstruc.2004.09.002

Cassady, J. C., & Finch, W. H. (2014). Confirming the factor structure of the Cognitive Test Anxiety Scale: Comparing the utility of three solutions. *Educational Assessment*, *19*(3), 229–242. https://doi.org/10.1080/10627197.2014.934604

Cassady, J. C., & Finch, W. H. (2015). Using factor mixture modeling to identify dimensions of cognitive test anxiety. *Learning and Individual Differences*, *41*, 14–20. https://doi.org/10.1016/j.lindif.2015.06.002

Cassady, J. C., & Johnson, R. E. (2002). Cognitive test anxiety and academic performance. *Contemporary Educational Psychology*, *27*, 270–295. https://doi.org/10.1006/ceps.2001.1094

Chambers, J., Phillips, B., Burr, M., & Xiao, D. (2016). Effects of meditation on stress levels of physical therapist students. *Journal Of Physical Therapy Education*, *30*(3), 33–40.

Commission on Accreditation in Physical Therapy Education. (2016). Retrieved from

http://www.capteonline.org/home.aspx

Conway, A. D. A., Jarrold, C., Kane, M. J., Miyake, A., & Towse, J. N. (2007). Variation in working memory: An introduction. In A. R. A. Conway, C. Jarrold, M. J. Kane, A. Miyake, & J. Towse (Eds.), *Variation in working memory* (pp. 3–20). New York, NY: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195168648.001.0001

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis for field settings*. Boston, MA: Houghton Mifflin. Retrieved from http://scholar.google.de/scholar?q=Quasi-Experimentation%3A+Design+and+Analysis+Issues+for+Field+Settings&btnG=&hl=en&as_sdt=0%2C5#2

Costello, R. (2012). *Union and nonunion employment: An investigative study of factors in the employment setting that may influence the development of burnout*. Walden University. Retrieved from ProQuest.UMI No. 3511669.

Cotton, S. J., Dollard, M. F., & De Jonge, J. (2002). Stress and student job design: Satisfaction, well-being, and performance in university students. *International Journal of Stress Management, 9*(3), 147–162. https://doi.org/10.1023/A:1015515714410

Crego, A., Carrillo-Diaz, M., Armfield, J. M., & Romero, M. (2016). Stress and academic performance in dental students: The role of coping strategies and examination-related self-efficacy. *Journal of Dental Education*, *80*(2), 165–172. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-

84958951511&partnerID=40&md5=7a5af2868515402bceb6a5b3854a9bc1

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc. https://doi.org/10.1016/j.math.2010.09.003

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Cseh, G. M., Phillips, L. H., & Pearson, D. G. (2014). Flow, affect and visual creativity. *Cognition & Emotion*, *29*(2), 281–291. https://doi.org/10.1080/02699931.2014.913553

Cseh, G. M., Phillips, L. H., & Pearson, D. G. (2016). Mental and perceptual feedback in the development of creative flow. *Consciousness and Cognition*, *42*, 150–161. https://doi.org/10.1016/j.concog.2016.03.011

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety: The experience of play in work and games.* San Francisco, CA: Jossey-Bass Publishers.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper & Row. https://doi.org/10.5465/AMR.1991.4279513

Csikszentmihalyi, M. (2014). *Flow and the foundations of positive psychology: The collected works of Mihaly Csikszentmihalyi*. New York, NY: Springer Publishing Company. https://doi.org/10.1007/978-94-017-9088-8

Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the experience-sampling method. *Journal of Nervous and Mental Disease*, *175*(9), 526–536. https://doi.org/10.1017/CBO9780511663246

Csikszentmihalyi, M., Rathunde, K., & Whalen, S. (1994). *Talented teenagers. The roots of success & failure*. Cambridge, MA: Cambridge University Press.

Culbertson, S. S., Fullagar, C. J., Simmons, M. J., & Zhu, M. (2015). Contagious flow: Antecedents and consequences of optimal experience in the classroom. *Journal of Management Education, 39*(3), 319–349. https://doi.org/10.1177/1052562914545336

Cummings, T. G. (1979). A cybernetic framework for studying occupational stress. *Human Relations*, *32*(5), 395–418. https://doi.org/10.1177/001872677903200504

Cybinski, P., & Selvanathan, S. (2005). Learning experience and learning effectiveness in undergraduate statistics: Modeling performance in traditional and flexible learning environments*. *Decision Sciences Journal of Innovative Education*, *3*(2), 251–271. https://doi.org/10.1111/j.1540-4609.2005.00069.x

Dale, A. (2006). Quality issues with survey research. *International Journal of Social Research Methodology*, *9*(2), 143–158. https://doi.org/10.1080/13645570600595330

Davis, R., & Wong, D. (2007). Conceptualizing and measuring the optimal experience of the eLearning environment. *Decision Sciences Journal of Innovative Education*, *5*(1), 97–126. https://doi.org/10.1111/j.1540-4609.2007.00129.x

De Baene, W., Albers, A. M., & Brass, M. (2012). The what and how components of cognitive control. *NeuroImage*, *63*(1), 203–211. https://doi.org/10.1016/j.neuroimage.2012.06.050

DeCaro, M. S., Thomas, R. D., Albert, N. B., & Beilock, S. L. (2011). Choking under

pressure: Multiple routes to skill failure. *Journal of Experimental Psychology: General*, *140*(3), 390–406. https://doi.org/10.1037/a0023466

Deinzer, R., Kirschbaum, C., Gresele, C., & Hellhammer, D. H. (1997). Adrenocortical responses to repeated parachute jumping and subsequent h-CRH challenge in inexperienced healthy subjects. *Physiology and Behavior*, *61*(4), 507–511. https://doi.org/10.1016/S0031-9384(96)00465-9

Dell, R. B., Holleran, S., & Ramakrishnan, R. (2002). Sample size determination. *ILAR Journal*, *43*(4), 207–213. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3275906&tool=pmcentrez&rendertype=abstract

Depreeuw, E. A. M. (1984). A profile of the test-anxious student. *Applied Psychology*, *33*(2), 221–232. https://doi.org/10.1111/j.1464-0597.1984.tb01430.x

DeVellis, R. F. (2012). *Scale development: Theory and application* (3rd ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*(3), 355–391. https://doi.org/10.1037/0033-2909.130.3.355

Dietrich, A. (2004). Neurocognitive mechanisms underlying the experience of flow. *Consciousness and Cognition*, *13*(4), 746–761. https://doi.org/10.1016/j.concog.2004.07.002

Drageset, J., Espehaug, B., & Kirkevold, M. (2012). The impact of depression and sense of coherence on emotional and social loneliness among nursing home residents

without cognitive impairment - A questionnaire survey. *Journal of Clinical Nursing*, *21*(7–8), 965–974. https://doi.org/10.1111/j.1365-2702.2011.03932.x

Duty, S. M., Christian, L., Loftus, J., & Zappi, V. (2015). Is cognitive test-taking anxiety associated with academic performance among nursing students? *Nurse Educator*, *41*(2), 1–5. https://doi.org/10.1097/NNE.0000000000000208

Edwards, J. R. (1992). A cybernetic Theory of stress, coping, and well-being in organizations. *The Academy of Management Review*, *17*(2), 238. https://doi.org/10.2307/258772

Edwards, J. R., & Cooper, C. L. (1988). The impacts of positive psychological states on physical health: A review and theoretical framework. *Social Science & Medicine*, *27*(12), 1447–1459. https://doi.org/10.1016/0277-9536(88)90212-2

Engeser, S., & Rheinberg, F. (2008). Flow, performance and moderators of challenge-skill balance. *Motivation and Emotion*, *32*(3), 158–172. https://doi.org/10.1007/s11031-008-9102-4

Esteban-Millat, I., Martínez-López, F. J., Huertas-García, R., Meseguer, A., & Rodríguez-Ardura, I. (2014). Modelling students' flow experiences in an online learning environment. *Computers and Education*, *71*, 111–123. https://doi.org/10.1016/j.compedu.2013.09.012

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & Emotion*, *6*(6), 409–434. https://doi.org/10.1080/02699939208409696

Faraji, J., Soltanpour, N., Jafari, S. Y., Moeeini, R., Pakdel, S., Moharreri, A., & Metz, G.

A. S. (2014). Stress inhibits psychomotor performance differently in simple and complex open field environments. *Hormones and Behavior*, *65*(1), 66–75. https://doi.org/10.1016/j.yhbeh.2013.11.007

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). London, England: Sage Publication.

Folkman, S., & Moskowitz, J. T. (2000). Positive affect and the other side of coping. *The American Psychologist*, *55*(6), 647–654. https://doi.org/10.1037/0003-066X.55.6.647

Forgas, J. P., Brennan, G., Howe, S., Kane, J. F., & Sweet, S. (1980). Audience effects on squash players' performance. *The Journal of Social Psychology*, *111*(1), 41–47. https://doi.org/10.1080/00224545.1980.9924271

Francis-Coad, J., & Hill, A. (2014). Discovering what experiences physical therapist students identify as learning facilitators in practical laboratories. *Journal Of Physical Therapy Education*, *28*(3), 42–49.

Frank, L., & Cassady, S. (2005). Health and wellness in entry-level physical therapy students: Are measures of stress, anxiety, and academic performance related? *Cardiopulmonary Physical Therapy Journal*, *16*(4), 5–13.

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth Publishers.

Fullagar, C. J., Knight, P. A., & Sovern, H. S. (2013). Challenge/skill balance, flow, and performance anxiety. *Applied Psychology*, *62*(2), 236–259. https://doi.org/10.1111/j.1464-0597.2012.00494.x

Furlan, L. A., Cassady, J. C., & Perez, E. R. (2009). Adapting the cognitive test anxiety scale for use with Argentinean university students. *International Journal of Testing, 9*(5000), 3–19. https://doi.org/10.1080/15305050902733448

Gaggioli, A., Cipresso, P., Serino, S., & Riva, G. (2013). Psychophysiological correlates of flow during daily activities. *Studies in Health Technology and Informatics, 191*, 65–69. https://doi.org/10.3233/978-1-61499-282-0-65

Gandhe, R. J. (2014). Positive stress: Review of relevant theories and an alternative conceptualization. *Indian Journal of Positive Psychology, 5*(3), 260–266. http://search.proquest.com.ezp.waldenulibrary.org/docview/1629407837?accountid=14872%255Cnhttp://sfxhosted.exlibrisgroup.com/waldenu?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=unknown&sid=ProQ:ProQ:psychology&atitle=Positive+stress

Geiger, M. A., & Cooper, E. A. (1996). Using expectancy theory to assess student motivation. *Issues In Accounting Education, 11*(1), 113–129.

Gibbons, C. (2010). Stress, coping and burn-out in nursing students. *International Journal of Nursing Studies*, *47*(10), 1299–1309. https://doi.org/10.1016/j.ijnurstu.2010.02.015

Gibbons, C. (2012). Stress, positive psychology and the national student survey. *Psychology Teaching Review*, *18*(2), 22–30.

Gibbons, C. (2015). Stress, eustress and the national student survey. *Psychology Teaching Review, 21*(2), 86–92. Retrieved from http://www.sps.ed.ac.uk/about/news/2015/national_student_survey_2015

Gibbons, C., Dempster, M., & Moutray, M. (2008). Stress and eustress in nursing students. *Journal of Advanced Nursing*, *61*(3), 282–290. https://doi.org/10.1111/j.1365-2648.2007.04497.x

Gilbert-Ouimet, M., Trudel, X., Brisson, C., Milot, A., & Vézina, M. (2014). Adverse effects of psychosocial work factors on blood pressure: Systematic review of studies on demand-control-support and effort-reward imbalance models. *Scandinavian Journal of Work, Environment and Health*. https://doi.org/10.5271/sjweh.3390

Gimmig, D., Huguet, P., Caverni, J. P., & Cury, F. (2006). Choking under pressure and working-memory capacity: When performance pressure reduces fluid intelligence. *Psychonomic Bulletin & Review*, *13*(1), 1–5. https://doi.org/10.1007/s13398-014-0173-7.2

Gordon, C. D., Williams, S. K., Hudson, G. a, & Stewart, J. (2010). Factors associated with academic performance of physical therapy students. *The West Indian Medical Journal*, *59*(2), 203–208. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-79952258399&partnerID=40&md5=123e0b51d4c830151f292a78c65166dc

Green, R., & Bowser, M. (2006). Observations from the field: Sharing a literature review rubric. *Journal of Library Administration*, *45*(1/2), 185–202. https://doi.org/10.1300/J111v45n01

Groves, R. M., Fowler, F. J., Couper, M. P., Lepkowski, J. M., Singer, E., & Tourangeau, R. (2009). *Survey methodology* (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Hargrove, M. B., Becker, W. S., & Hargrove, D. F. (2015). The HRD eustress model: Generating positive stress with challenging work. *Human Resource Development Review*, *14*(3), 279–298. https://doi.org/10.1177/1534484315598086

Hargrove, M. B., Nelson, D. L., & Cooper, C. L. (2013). Generating eustress by challenging employees. Helping people savor their work. *Organizational Dynamics*, *42*(1), 61–69. https://doi.org/10.1016/j.orgdyn.2012.12.008

Harmat, L., de Manzano, O., Theorell, T., Hogman, L., Fischer, H., & Ullen, F. (2015). Physiological correlates of the flow experience during computer game playing. *International Journal of Psychophysiology*, *97*(1), 1–7. https://doi.org/10.1016/j.ijpsycho.2015.05.001

Harris, D. J., Vine, S. J., & Wilson, M. R. (2017). Neurocognitive mechanisms of the flow state. *Progress in Brain Research.* 1(234), 221-243. https://doi.org/10.1016/bs.pbr.2017.06.012

Hatfield, B. D., Haufler, A. J., Hung, T.-M., & Spalding, T. W. (2004). Electroencephalographic studies of skilled psychomotor performance. *Journal of Clinical Neurophysiology*, *21*(3), 144–156. https://doi.org/10.1097/00004691-200405000-00003

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.

Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research, 58*(1), 47–77. https://doi.org/10.3102/00346543058001047

Hirao, K. (2014). Prefrontal hemodynamic responses and the degree of flow experience

among occupational therapy students during their performance of a cognitive task. *Journal of Educational Evaluation for Health Professions*, *11*(24), 1–5. https://doi.org/10.3352/jeehp.2014.11.24

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, *44*(3), 513–524. https://doi.org/10.1037/0003-066X.44.3.513

Hobfoll, S. E. (2001). The influence of culture, community, and the nested-self in the stress process: Advancing conservation of resources theory. *Applied Psychology: An International Review*, *50*(3), 337–421. https://doi.org/10.1111/1464-0597.00062

Hohmann, J., & Grillo, M. (2014). Using critical thinking rubrics to increase academic performance. *Journal of College Reading and Learning*, *45*(1), 35–51. https://doi.org/10.1080/10790195.2014.949551

Hope, V., & Henderson, M. (2014). Medical student depression, anxiety and distress outside North America: A systematic review. *Medical Education*, *48*(10), 963–979. https://doi.org/10.1111/medu.12512

Hubbard, K., & Blyler, D. (2016). Improving academic performance and working memory in health science graduate students using progressive muscle relaxation training. *The Amercan Journal of Occupational Therapy*, *70*(6), 7006230010p1-7006230010p8. https://doi.org/10.5014/ajot.2016.020644

Hubbard, K. K. (2015). *The impact of stress and anxiety and effects of progressive muscle relaxation on working memory and academic performance in health*

science graduate students. Retrieved from ProQuest Dissertations & Theses Global. http://search.proquest.com/docview/1669495240?accountid=14872

International Business Machines. (2015). IBM SPSS Statistics for Windows, Version 23.0. Retrieved from http://www-01.ibm.com/software/analytics/spss/products/statistics/

Irwin, M. R. (2008). Human psychoneuroimmunology: 20 years of discovery. *Brain, Behavior, and Immunity*, *22*(2), 129–139. https://doi.org/10.1016/j.bbi.2007.07.013

Jackson, S. A., & Marsh, H. W. (1996). Development and validation of a scale to measure optimal experience: The Flow State Scale. *Journal of Sport & Exercise Psychology*, *18*, 17–35. https://doi.org/10.1080/15298860309027

Jackson, S., Kimiecik, J., Ford, S., & Marsh, H. (1998). Psychological correlates of flow in sport. *Journal of Sport & Exercise Psychology, 4(20), 358-378*. https://doi.org/10.1177/017084068800900203

Jacob, T., Gummesson, C., Nordmark, E., El-Ansary, D., Remedios, L., & Webb, G. (2012). Perceived stress and sources of stress among physiotherapy students from 3 countries. *Journal of Physical Therapy Education*, *26*(3), 57–65.

Jacob, T., Itzchak, E. B., & Raz, O. (2013). Stress among healthcare students – A cross disciplinary perspective. *Physiotherapy Theory and Practice*, *29*(5), 401–412. https://doi.org/10.3109/09593985.2012.734011

Johnson, J. W. (2010). A heuristic method for estimating the relative weight of predictor variables in multiple regression. *Multivariate Behavioral Research*, *35*(1), 1–19.

https://doi.org/10.1207/S15327906MBR3501

Jones, C. D., Hollenhorst, S. J., Perna, F., & Selin, S. (2000). Validation of the flow theory in an on-site whitewater kayaking setting. *Journal Of Leisure Research*, *32*(2), 247–261. http://go.galegroup.com.ezp.waldenulibrary.org/ps/i.do?p=EAIM&u=minn4020&id=GALE%7CA64151270&v=2.1&it=r&sid=ebsco&authCount=1

Karlen, E., & Mccathie, B. (2015). Implementation of a quality improvement process aimed to deliver higher-value physical therapy for patients with low back pain: Case report. *Physical Therapy*, *95*(12), 1712–1721.

Katz, D., & Kahn, R. L. (1978). The social psychology of organizations (Chapter 13). In *The Social Psychology of Organizations* (pp. 397–425).

Kendall-Tackett, K. (2009). Psychological trauma and physical health: A psychoneuroimmunology approach to etiology of negative health effects and possible interventions. *Psychological Trauma: Theory, Research, Practice, and Policy*, *1*(1), 35–48. https://doi.org/10.1037/a0015128

Kenwright, K., Liddell, P. W., Bloom, L., Zucker-Levin, A., Nolen, A. H., Faulkner, L. W., & Batorski, R. E. (2011). Salivary cortisol levels in students challenged with a testing stressor. *Clinical Laboratory Science*, *24*(4), 221–226. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22288220

Khalaila, R. (2015). The relationship between academic self-concept, intrinsic motivation, test anxiety, and academic achievement among nursing students: Mediating and moderating effects. *Nurse Education Today*, *35*(3), 432–438.

https://doi.org/10.1016/j.nedt.2014.11.001

Kiecolt-glaser, J. K., Glaser, R., & Christian, L. M. (2014). Omega-3 fatty acids and stress-induced immune dysregulation : implications for wound healing. *Military Medicine*, *179*(11), 129–134. https://doi.org/10.7205/MILMED-D-14-00167

Koehn, S., Morris, T., & Watt, A. P. (2013). Flow state in self-paced and externally-paced performance contexts: An examination of the flow model. *Psychology of Sport and Exercise*, *14*(6), 787–795. https://doi.org/10.1016/j.psychsport.2013.06.001

Kringelbach, M. L., & Rolls, E. T. (2004). The functional neuroanatomy of the human orbitofrontal cortex: Evidence from neuroimaging and neuropsychology. *Progress in Neurobiology*, 72(5),341-372. https://doi.org/10.1016/j.pneurobio.2004.03.006

Kupriyanov, R., & Zhdanov, R. (2014). The eustress concept : Problems and outlooks. *World Journal of Medical Sciences*, *11*(2), 179–185. https://doi.org/10.5829/idosi.wjms.2014.11.2.8433

Langford, N. J., Landray, M., Martin, U., Kendall, M. J., & Ferner, R. E. (2004). Testing the practical aspects of therapeutics by objective structured clinical examination. *Journal of Clinical Pharmacy & Therapeutics*, *29*(3), 263–266. https://doi.org/10.1111/j.1365-2710.2004.00561.x\rJCP561 [pii]

Le Fevre, M., Kolt, G. S., & Matheny, J. (2006). Eustress, distress and their interpretation in primary and secondary occupational stress management interventions: which way first? *Journal of Managerial Psychology*, *21*(6), 547–565. https://doi.org/10.1108/02683940610684391

Le Fevre, M., Matheny, J., & Kolt, G. S. (2003). Eustress, distress, and interpretation in occupational stress. *Journal of Managerial Psychology*, *18*(7), 726–744. https://doi.org/10.1108/02683940310502412

Lee, W., Lee, M. J., & Bong, M. (2014). Testing interest and self-efficacy as predictors of academic self-regulation and achievement. *Contemporary Educational Psychology*, *39*(2), 86–99. https://doi.org/10.1016/j.cedpsych.2014.02.002

Lewis, B. P., & Linder, D. E. (1997). Thinking about choking? Attentional processes and paradoxical performance. *Personality and Social Psychology Bulletin*, *23*(9), 937–944. https://doi.org/10.1177/0146167297239003

Liao, L.-F. (2006). A flow theory perspective on learner motivation and behavior in distance education. *Distance Education*, *27*(1), 45–62. https://doi.org/10.1080/01587910600653215

Liebert, R. M., & Morris, L. W. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. *Psychological Reports*, *20*, 975–978.

Lin, S.-H., & Huang, Y.-C. (2014). Life stress and academic burnout. *Active Learning in Higher Education*, *15*(1), 77–90. https://doi.org/10.1177/1469787413514651

Llorens, S., Salanova, M., & Rodríguez, A. M. (2013). How is flow experienced and by whom? Testing flow among occupations. *Stress and Health*, *29*(2), 125–137. https://doi.org/10.1002/smi.2436

Lundberg, U., & Frankenhaeuser, M. (1980). Pituitary-adrenal and sympathetic-adrenal correlates of distress and effort. *Journal of Psychosomatic Research*, *24*(3–4), 125–130. https://doi.org/10.1016/0022-3999(80)90033-1

Marden, N. Y., Ulman, L. G., Wilson, F. S., & Velan, G. M. (2013). Online feedback assessments in physiology: Effects on students' learning experiences and outcomes. *Advances in Physiology Education*, *37*(2), 192–200. https://doi.org/10.1152/advan.00092.2012

McGowan, J., Gardner, D., & Fletcher, R. (2006). Positive and negative affective outcomes of occupational stress. *New Zealand Journal of Psychology*, *35*(2), 92–98. https://doi.org/10.1093/occmed/kqr036

Mcquillan, J., & Conde, G. (1996). The conditions of flow in reading: two studies of optimal experience. *Reading Psychology*, *17*(2), 109–135. https://doi.org/10.1080/0270271960170201

Mesurado, B., Richaud, M. C., & Mateo, N. J. (2016). Engagement, flow, self-efficacy, and eustress of university students: A cross-national comparison between the Philippines and Argentina. *The Journal of Psychology*, *150*(3), 281–299. https://doi.org/10.1080/00223980.2015.1024595

Moneta, G. B., & Csikszentmihalyi, M. (1996). The effect of perceived challenges and skills on the quality of subjective experience. *Journal of Personality*, *64*(2), 275–310. https://doi.org/10.1111/j.1467-6494.1996.tb00512.x

Montero, B. G. (2015). Is monitoring one's actions causally relevant to choking under pressure? *Phenomenology and the Cognitive Sciences*, *14*(2), 379–395. https://doi.org/10.1007/s11097-014-9400-0

Morelli, A. N., & Cunningham, J. L. C. (2012). Not all resources are created equal: CoR theory, values, and stress. *The Journal of Psychology*, *146*(4), 393–415.

https://doi.org/10.1080/00223980.2011.650734

Müller, H., Freytag, J.-C., & Leser, U. (2012). Improving data quality by source analysis. *Journal of Data and Information Quality*, *2*(4), 1–38. https://doi.org/10.1145/2107536.2107538

Murayama, K., Matsumoto, M., Izuma, K., Sugiura, A., Ryan, R. M., Deci, E. L., & Matsumoto, K. (2015). How self-determined choice facilitates performance: A key role of the ventromedial prefrontal cortex. *Cerebral Cortex*, *25*(5), 1241–1251. https://doi.org/10.1093/cercor/bht317

Mustapha, A., Samsudin, N. A., Arbaiy, N., Mohamed, R., & Hamid, I. R. (2016). Generic assessment rubrics for computer programming courses. *Turkish Online Journal of Educational Technology*, *15*(1), 53–61. https://doi.org/10.1017/CBO9781107415324.004

Nakamo, Y., Yamasaki, H., Sakai, S., Hiraga, Y., KuriYama, H., & Shigeshima, K. (2011). Physical therapy students' stress response after practical training —focus on the stress event and resilience. *Rigakuryoho Kagaku*, *26*(3), 429–433. https://doi.org/10.1589/rika.26.429

Nakamura, J., & Csikszentmihalyi, M. (2002). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). New York, NY: Oxford University Press. https://doi.org/10.1007/978-94-017-9088-8_16

Nakamura, J., & Csikszentmihalyi, M. (2009). Flow theory and research. *Oxford Handbook of Positive Psychology*. https://doi.org/10.1093/oxfordhb/9780195187243.013.0018

Nakamura, J., & Csikszentmihalyi, M. (2014). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi* (pp. 239–263). New York, NY: Oxford University Press. https://doi.org/10.1007/978-94-017-9088-8_16

Naveh-Benjamin, M. (1991). A comparison of training programs intended for different types of test-anxious students: Further support for information-processing model. *Journal of Educational Psychology, 83*(1), 134–139. https://doi.org/10.1037/0022-0663.83.1.134

Nelson, D. L., & Simmons, B. L. (2011). *Savoring eustress while coping with distress: The holistic model of stress*. *Handbook of Occupational Health Psychology*. Washington, DC: American Psychological Association. Retrieved from http://ezproxy.massey.ac.nz/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,cookie,url,uid&db=psyh&AN=2010-06010-004&site=ehost-live&scope=site

Nelson, K. (2014). *Academic progress in doctoral students: Levels of hope, subjective well-being, and stress*. *Dissertation Walden*. Available from ProQuest Dissertations & Theses Global (3640059).

Nielsen, K., & Cleal, B. (2010). Predicting flow at work: investigating the activities and job characteristics that predict flow states at work. *Journal of Occupational Health Psychology*, *15*(2), 180–190. https://doi.org/10.1037/a0018893

O'Sullivan, G. (2011). The relationship between hope, eustress, self-efficacy, and life satisfaction among undergraduates. *Social Indicators Research*, *101*(1), 155–172.

https://doi.org/10.1007/s11205-010-9662-z

Owens, M., Stevenson, J., Norgate, R., & Hadwin, J. A. (2008). Processing efficiency theory in children: Working memory as a mediator between trait anxiety and academic performance. *Anxiety, Stress & Coping*, *21*(4), 417–430. https://doi.org/10.1080/10615800701847823

Pace, S. (2004). A grounded theory of the flow experiences of web users. *International Journal of Human Computer Studies*, *60*(3), 327–363. https://doi.org/10.1016/j.ijhcs.2003.08.005

Palekar, T. J., & Mokashi, M. G. (2014). Perceived stress , sources and severity of stress among physiotherapy students in an indian college. *Indian Journal Of Physiotherapy & Occupational Therapy*, *8*(3), 170–175. https://doi.org/10.5958/0973-5674.2014.00377.3

Parr, G. D., Montgomery, M., & DeBell, C. (1998). Flow theory as a model for enhancing student resilience. *Professional School Counseling*, *1*(5), 26–31. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc3&NEWS=N&AN=1998-04378-005

Payne, B., Jackson, J., Noh, S., & Stine-Morrow, E. (2011). Activity Flow State Scale. https://doi.org/http://dx.doi.org/10.1037/t06855-000

Payne, B. R., Jackson, J. J., Noh, S. R., & Stine-Morrow, E. A. L. (2011). In the zone: Flow state and cognition in older adults. *Psychology and Aging*, *26*(3), 738–743. https://doi.org/10.1037/a0022359

Peifer, C., Schachinger, H., Engeser, S., & Antoni, C. H. (2015). Cortisol effects on flow-

experience. *Psychopharmacology*, *232*(6), 1165–1173. https://doi.org/10.1007/s00213-014-3753-5

Peifer, C., Schulz, A., Schächinger, H., Baumann, N., & Antoni, C. H. (2014). The relation of flow-experience and physiological arousal under stress - Can u shape it? *Journal of Experimental Social Psychology*, *53*, 62–69. https://doi.org/10.1016/j.jesp.2014.01.009

Persaud, N., & Mamdani, M. M. (2006). External validity: The neglected dimension in evidence ranking. *Journal of Evaluation in Clinical Practice*, *12*(4), 450–453. https://doi.org/10.1111/j.1365-2753.2006.00730.x

Petkov, D., & Petkova, O. (2006). Development of scoring rubrics for IS projects as an assessment tool. *Issues in Informing Science and Information Technology*, *3*, 499–510. Retrieved from http://proceedings.informingscience.org/InSITE2006/IISITPetk214.pdf

Preuss, D., Schoofs, D., Schlotz, W., & Wolf, O. T. (2010). The stressed student: influence of written examinations and oral presentations on salivary cortisol concentrations in university students. *Stress*, *13*(3), 221–229. https://doi.org/10.3109/10253890903277579

Price, E., & Tej, C. (2014). CAPTE: Commission on accreditation in physical therapy education. In *Aggregate Program Data: 2014 – 15 Physical Therapist Education Programs Fact Sheets* (p. 24). Alexandria, VA. Retrieved from http://www.capteonline.org/uploadedFiles/CAPTEorg/About_CAPTE/Resources/Aggregate_Program_Data/AggregateProgramData_PTPrograms.pdf

Putwain, D. W., Shah, J., & Lewis, R. (2014). Performance-evaluation threat does not adversely affect verbal working memory in high test-anxious persons. *Journal of Cognitive Education and Psychology*, *13*(1), 120–137. https://doi.org/10.1037/t06497-000

Quick, J. C., Wright, T. A., Adkins, J. A., Nelson, D. L., & Quick, J. D. (2013). *Preventive stress management in organizations (2nd ed.)* Washington, DC: American Psychological Association. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc10&NEWS=N&AN=2012-10497-000

Raelin, J. A. (1997). A model of work-based learning. *Organization Science, 8*(6), 563–578. https://doi.org/10.2307/2635156

Rana, R., & Mahmood, N. (2010). The relationship between test anxiety and academic achievement. *Bulletin of Education and Research, 32*(2), 63–74. Retrieved from http://results.pu.edu.pk/images/journal/pesr/PDF-FILES/4-Rizwan Akram Rana.pdf

Reddy, Y. M., & Andrade, H. (2010). A review of rubric use in higher education. *Assessment & Evaluation in Higher Education*, *35*(4), 435–448. https://doi.org/10.1080/02602930902862859

Reynolds, W. M. (1988). Measurement of academic self-concept in college students. *Journal of Personality Assessment*, *52*(2), 223–240. https://doi.org/10.1207/s15327752jpa5202_4

Rodríguez, I. (2013). Development and validation of the Valencia Eustress-Distress

Appraisal Scale. *International Journal of Stress Management, 20*(4), 279–308. https://doi.org/10.1037/a0034330

Rossin, D., Ro, Y. K., Klein, B. D., & Guo, Y. M. (2009). The effects of flow on learning outcomes in an online information management course. *Journal of Information Systems Education, 20*(1), 87–98.

Salanova, M., Schaufeli, W., Martínez, I., & Bresó, E. (2010). How obstacles and facilitators predict academic performance: The mediating role of study burnout and engagement. *Anxiety, Stress & Coping, 23*(1), 53–70. https://doi.org/10.1080/10615800802609965

Salazar, W., Landers, D. M., Petruzzello, S. J., Han, M., Crews, D. J., & Kubitz, K. A. (1990). Hemispheric asymmetry, cardiac response, and performance in elite archers. *Research Quarterly for Exercise and Sport, 61*(4), 351–359. https://doi.org/10.1080/02701367.1990.10607499

Santosa, P. I. (2003). Applying flow theory and technology acceptance model to improve student performance in a web-based course: A conceptual framework. *Proceedings of the 2nd International Conference on Multi Media and Information & Communication Technologies in Education*, 524–529.

Santosa, P. I. (2015). Student Engagement with Online Tutorial: A Perspective on Flow Theory. *International Journal Of Emerging Technologies In Learning, 10*(1), 60–68. https://doi.org/10.3991/ijet.v10i1.4348

Sarason, I. G. (1984). Stress, anxiety, and cognitive interference: reactions to tests. *Journal of Personality and Social Psychology, 46*(4), 929–938.

https://doi.org/10.1037/0022-3514.46.4.929

Schuler, R. S. (1982). An integrative transactional process model of stress in organizations. *Journal of Organizational Behavior*, *3*(1), 5–19. https://doi.org/10.1002/job.4030030103

Seemann, M., & Seemann, T. (2015). New perspectives on employee motivation: Balancing the big four. *International Journal Of Knowledge, Culture & Change In Organizations: Annual Review*, *13*, 131–137. https://doi.org/10.1007/978-94-017-9088-8_16

Selye, H. (1975). *Stress without distress*. Philadelphia, PA: Lippincott Publishing.

Selye, H. (1980). The stress concept today. In I. L. Kutash et.al (Ed.), *Handbook on stress and anxiety* (pp. 127–129). San Francisco, CA: Jossey–Bass.

Selye, H. (1983). The stress concept: Past, present and future. In C. L. Cooper (Ed.), *Stress Research Issues for the Eighties* (pp. 1–20). New York, NY: John Wiley & Sons.

Selye, H. (1987). Stress without distress. In *Society, stress, and disease* (pp. 257–262). London, England: Transworld. https://doi.org/10.1080/00228958.1983.10517713

Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly*, *18*(2), 158–176. https://doi.org/10.1521/scpq.18.2.158.21860

Simmons, B. L. (2000). *Eustress at work: Accentuating the positive*. Available from ProQuest Dissertations & Theses Global. https://search-proquest-

com.ezp.waldenulibrary.org/docview/250671514?accountid=14872. (Order No. 3013753)

Simmons, B. L., & Nelson, D. L. (2001a). Eustress at work: The relationship between hope and health in hospital nurses. *Health Care Management Review*, *26*(4), 7–18. https://doi.org/10.1097/00004010-200110000-00002

Simmons, B. L., & Nelson, D. L. (2001b). Eustress at work: The relationship between hope and health in hospital nurses. *Health Care Management Review*, *26*(4), 7–18.

Sparfeldt, J. R., Rost, D. H., Baumeister, U. M., & Christ, O. (2013). Test anxiety in written and oral examinations. *Learning and Individual Differences*, *24*, 198–203. https://doi.org/10.1016/j.lindif.2012.12.010

Spielberger, C. D. (1983). State-Trait Anxiety Inventory (STAI). *Mind Garden*, *94061*(650), 261–3500.

Stallman, H. M. (2010). Psychological distress in university students: A comparison with general population data. *Australian Psychologist*, *45*(4), 249–257. https://doi.org/10.1080/00050067.2010.482109

Steele, J. P., & Fullagar, C. J. (2009). Facilitators and outcomes of student engagement in a college setting. *The Journal of Psychology*, *143*(1), 5–27. https://doi.org/10.3200/JRLP.143.1.5-27

Steyer, R., Mayer, A., Geiser, C., & Cole, D. A. (2015). A theory of states and traits—revised. *Annual Review of Clinical Psychology*, *11*(1), 71–98. https://doi.org/10.1146/annurev-clinpsy-032813-153719

Stöber, J. (2004). Dimensions of test anxiety: Relations to ways of coping with pre-exam anxiety and uncertainty. *Anxiety, Stress & Coping*, *17*(3), 213–226. https://doi.org/10.1080/10615800412331292615

Straube, T., Pohlack, S., Mentzel, H. J., & Miltner, W. H. R. (2008). Differential amygdala activation to negative and positive emotional pictures during an indirect task. *Behavioural Brain Research, 191*(2), 285–288. https://doi.org/10.1016/j.bbr.2008.03.040

Swift, M., Spake, E., & Gajewski J., B. (2013). Student performance and satisfaction for a musculoskeletal objective structured clinical examination. *Journal of Allied Health*, *42*(4), 214–222. http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=2012416228&site=ehost-live

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivaraite statistics* (5th ed.). Boston, MA: Pearson.

Tozman, T., Magdas, E. S., MacDougall, H. G., & Vollmeyer, R. (2015). Understanding the psychophysiology of flow: A driving simulator experiment to investigate the relationship between flow and heart rate variability. *Computers in Human Behavior*, *52*, 408–418. https://doi.org/10.1016/j.chb.2015.06.023

Türksoy, A., Altıncı, E. E., & Üster, U. (2015). Relationship between motivation and dispositional flow state on football players participating in the U13-U16 football leagues. *Procedia - Social and Behavioral Sciences, 185*, 301–306. https://doi.org/10.1016/j.sbspro.2015.03.423

Ulrich, M., Keller, J., Hoenig, K., Waller, C., & Grön, G. (2014). Neural correlates of experimentally induced flow experiences. *NeuroImage*, *86*, 194–202. https://doi.org/10.1016/j.neuroimage.2013.08.019

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Brière, N. M., Senécal, C., & Vallières, E. F. (1992). The academic motivation scale: a measure of intrinsic, extrinsic, and amotivation in education. *Educational and Psychological Measurement*, *52*, 1003–1007. https://doi.org/0803973233

van Dijk, I., Lucassen, P. L., & Speckens, A. E. (2015). Mindfulness training for medical students in their clinical clerkships: Two cross-sectional studies exploring interest and participation. *BMC Medical Education*, *15*(24), 1–8. https://doi.org/10.1186/s12909-015-0302-9

Venkatesh, B. (2015). Eustress: A unique dimension to stress management. *Voice of Research*, *4*(2), 26–29. https://doi.org/ISSN No. 2277-7733

Walsh, J. M., Feeney, C., Hussey, J., & Donnellan, C. (2010). Sources of stress and psychological morbidity among undergraduate physiotherapy students. *Physiotherapy*, *96*(3), 206–212. https://doi.org/10.1016/j.physio.2010.01.005

Wine, J. (1971). Test anxiety and direction of attention. *Psychological Bulletin*, *76*(2), 92–104. https://doi.org/10.1037/h0031332

Wolf, S., Brölz, E., Keune, P. M., Wesa, B., Hautzinger, M., Birbaumer, N., & Strehl, U. (2015). Motor skill failure or flow-experience? Functional brain asymmetry and brain connectivity in elite and amateur table tennis players. *Biological Psychology*, *105*, 95–105. https://doi.org/10.1016/j.biopsycho.2015.01.007

Wrigley, W. J., & Emmerson, S. B. (2013). The experience of the flow state in live music performance. *Psychology of Music*, *41*(3), 292–305. https://doi.org/10.1177/0305735611425903

Xanthopoulou, D., Bakker, A. B., Heuven, E., Demerouti, E., & Schaufeli, W. B. (2008). Working in the sky: a diary study on work engagement among flight attendants. *Journal of Occupational Health Psychology*, *13*(4), 345–356. https://doi.org/10.1037/1076-8998.13.4.345

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology*, *18*(5), 459–482. https://doi.org/10.1037/h0073415

Yoshida, K., Sawamura, D., Inagaki, Y., Ogawa, K., Ikoma, K., & Sakai, S. (2014). Brain activity during the flow experience: A functional near-infrared spectroscopy study. *Neuroscience Letters*, *573*, 30–34. https://doi.org/10.1016/j.neulet.2014.05.011

Yu, R. (2015). Choking under pressure: The neuropsychological mechanisms of incentive-induced performance decrements. *Frontiers in Behavioral Neuroscience*, *9*(February), 1–8. https://doi.org/10.3389/fnbeh.2015.00019

Zhang, N., & Henderson, C. N. R. (2014). Test anxiety and academic performance in chiropractic students. *The Journal of Chiropractic Education*, *28*(1), 2–8. https://doi.org/10.7899/JCE-13-20

Zhu, F. F., Poolton, J. M., Wilson, M. R., Maxwell, J. P., & Masters, R. S. W. (2011). Neural co-activation as a yardstick of implicit motor learning and the propensity

for conscious control of movement. *Biological Psychology, 87*(1), 66–73. https://doi.org/10.1016/j.biopsycho.2011.02.004

Zwaanswijk, M., & van Dulmen, S. (2014). Advantages of asynchronous online focus groups and face-to-face focus groups as perceived by child, adolescent and adult participants: A survey study. *BMC Research Notes, 7*(756), 1–7. https://doi.org/10.1186/1756-0500-7-756

Appendix A: Permission and Eustress Scale

2/29/16

Good afternoon,

Feel free to use my questionnaire. When I administered it, I did it in person among undergraduates in popular areas such as dining halls and dorm common areas.

Thanks,
Geraldine

Sent via the Samsung Galaxy S® 6, an AT&T 4G LTE smartphone

-------- Original message --------
From: Todd Bourgeois < XXXXXXXX>
Date: 12/29/16 1:11 PM (GMT-08:00)
To: XXXXXXXX
Subject: Use of Eustress Scale Request

Dr. O'Sullivan,
I am currently working on my dissertation for a PhD in health psychology. I would like to investigate the correlation of eustress, flow, and cognitive test anxiety as it relates to academic performance for graduate-level physical therapy students taking a psychomotor practical examination.
This email is to obtain permission to utilize your Eustress measurement scale. If granted permission, how do you disperse your questionnaire?
Thank you very much for your time and consideration,

Todd Bourgeois <XXXXXXXX> 12/29/16 (10 days ago)

Dr. O'Sullivan,
Thanks you very much for your permission. I sincerely appreciate this.
Have a great New Years!
Thanks,

Todd Bourgeois PT, DPT
Board Certified in Orthopaedic Physical Therapy

Fellowship Trained in Orthopaedic Manual Physical Therapy
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Eustress scale (ES)

How often do you effectively cope with stressful changes that occur in your academic life?
Never, Almost Never, Sometimes, Often, Very often, Always
How often do you deal successfully with irritating academic hassles?
Always, Very often, Often, Sometimes, Almost Never, Never
Do you read books for pleasure? **(FILLER QUESTION)**
Always,Very often, Often, Sometimes, Almost Never, Never
How often do you feel that stress positively contributes to your ability to handle your academic problems?
NeverAlmost Never Sometimes Often Very often Always
In general, how often do you feel motivated by your stress?
Never Almost Never Sometimes Often Very often Always
Do you go out with friends during the week? (**FILLER QUESTION**)
Always Very often Often Sometimes Almost Never Never
In general, how often are you able to successfully control the irritations in your academic life?
Never Almost Never Sometimes Often Very often Always
In general, how often do you speak with your family? (**FILLER QUESTION**)
Never Almost Never Sometimes Often Very often Always
In general, how often do you fail at an academic task when under pressure?
Never, Almost Never Sometimes Often Very often Always
In general, how often are you unable to control the way you spend your time on schoolwork?
Always Very often Often Sometimes Almost Never Never
How often do you feel comfortable in your surroundings? (**FILLER QUESTION**)
Never, Almost Never Sometimes Often Very often Always
When faced with academic stress, how often do you find that the pressure makes you more productive?
Never, Almost Never Sometimes Often Very often Always
How often do you feel that you perform better on an assignment when under academic pressure?
Always, Very often Often Sometimes Almost Never Never
How often do you practice meditation? (**FILLER QUESTION**)
Always, Very often Often Sometimes Almost Never Never
How often do you feel that stress for an exam has a positive effect on the results of your exam?
Never, Almost Never Sometimes Often Very often Always

Appendix B: Permission and Active Flow State Scale

PsycTESTS®

Activity Flow State Scale
Version Attached: Full Test

PsycTESTS Citation:
Payne, B. R., Jackson, J. J., Noh, S. R., & Stine-Morrow, E. A. L. (2011). Activity Flow State Scale [Database record]. Retrieved from PsycTESTS. doi: http://dx.doi.org/10.1037/t06855-000

Test Format:
Items are rated on a 5-point Likert ranging from 1 (strongly disagree) to 5 (strongly agree).

Source:
Payne, Brennan R., Jackson, Joshua J., Noh, Soo Rim, & Stine-Morrow, Elizabeth A. L. (2011). In the zone: Flow state and cognition in older adults. Psychology and Aging, Vol 26(3), 738-743. doi: 10.1037/a0022359

Activity Flow State Scale (AFSS)

Items

MAA- merging attention and awareness

I performed automatically, without having to think about it.
Things just seem to happen automatically.
I did things spontaneously without having to think.

CG-clear goals

I had a strong sense of what I want to accomplish.
I knew what I want to achieve
my goals were clearly defined

CO- concentration on task at hand

my attention was focused entirely on what I was doing.
It was no efforts to keep my mind on what was happening.
I had total concentration.
I had no difficulty concentrating.

UF- unambiguous feedback

it was really clear to me how my performance was going.
I had a good idea while I was performing about how well I was doing.

CS - challenge skill balance

I was challenged, but I believe my skills will allow me to meet that challenge.
The challenge in my skills were at an equally high level.
I felt just the right amount of challenge.

TT- transformation of time

time seemed to alter (either slows down or speed up).
The way time passed seemed to be different from normal.
I lost my normal awareness of time.

CN - sense of control

I felt as though I had everything under control.
I felt that I had everything under control.

SC- loss of self-consciousness

I was not concerned with how others might be evaluating me.
I was not concerned with how I was presenting myself.
I was not worried about what others might be thinking of me.

AE- autotelic experience

I really enjoyed the experience.
The experience left me feeling great.
The experience was extremely rewarding.

Appendix C: Permission and Cognative Test Anxiety Scale

PsycTESTS®

Cognitive Test Anxiety Scale
Version
Attached:
Full Test

PsycTESTS Citation:
Cassady, J. C., & Johnson, R. E. (2002). Cognitive Test Anxiety Scale [Database record]. Retrieved from PsycTESTS. doi: http://dx.doi.org/10.1037/t13906-000

Test Format:
Responses are provided on the following 4-point rating scale: A = "Not at all typical of me," B = "Only somewhat typical of me," C = "Quite typical of me," and D = "Very typical of me.".

Source:
Cassady, Jerrell C., & Johnson, Ronald E. (2002). Cognitive test anxiety and academic performance. Contemporary Educational Psychology, Vol 27(2), 270-295. doi: 10.1006/ceps.2001.1094, © 2002 by Elsevier. Reproduced by Permission of Elsevier.

Cognitive Test Anxiety Scale (CTAS)
(A: Not at all typical of me, B: Only somewhat typical of me, C: Quite typical of me, and D: Very typical of me.)

1. 1. I lose sleep over worrying about examinations.
2. 2. While taking an important examination, I find myself wondering whether the other students are doing better than I am.
3. 4. I tend to freeze up on things like intelligence tests and final exams.
4. 6. During tests, I find myself thinking of the consequences of failing.
5. 7. At the beginning of a test, I am so nervous that I often can’t think straight.
6. 11. My mind goes blank when I am pressured for an answer on a test.
7. 12. During tests, the thought frequently occurs to me that I may not be too bright.
8. 14. During a course examination, I get so nervous that I forget facts I really know.
9. 15. After taking a test, I feel I could have done better than I actually did.
10. 16. I worry more about doing well on tests than I should.
11. 19. During tests, I have the feeling that I am not doing well.

12. 20. When I take a test that is difficult, I feel defeated before I even start.
13. 22. I am a poor test taker in the sense that my performance on a test does not show how much I really know about a topic.
14. 23. I am not good at taking tests. 24. When I first get my copy of a test, it takes me a while to calm down to the point where I can begin to think straight.
15. 25. I feel under a lot of pressure to get good grades on tests.
16. 26. I do not perform well on tests.
17. 27. When I take a test, my nervousness causes me to make careless errors.

Appendix D: Academic Rubric for MSK I USAHS

XXXXXXXXMusculoskeletal I

PRACTICAL EXAMINATION CRITERIA CHECKLIST

Name:_____ Score: /50 = %

MANIPULATION

	Technique 1:		Technique 2:	
	Y/N	Comments	Y/N	Comments
Patient Position (1)				
PT Position (1)				
Loose-packed/appropriate Position (2)				
Palpation for Joint Alignment (1)				
Hand Placement: Stabilization Hand (2)				
Hand Placement: Manipulation Hand (2)				
Direction of Force (3)				
Amount of Force - assessment (1)				
Determines Quality (End Feel)(1)				
Determines Quantity (1)				
Communication with pt. regarding symptoms (1)				
Amount of Force – graded manipulation (2)				
SUBTOTAL	**__/18**		**__/18**	

ISOMETRIC SELECTIVE TISSUE TENSION TESTING CRITERIA (MSTT)

	Y/N	Comments
Joint in Neutral Position (loose-packed) (1 pt)		
Performs Isometric Contraction (1 pt)		
Isolates Components of One Muscle (1 pt)		
Interprets correctly (1pt)		
Appropriate communication (1 pt)		

SUBTOTAL	**/5**

PALPATION CRITERIA

	Y/N	Comments
Position Structure Appropriate to Palpate (1 pt)		
Uses One Finger (1 pt)		
Isolates One Structure (1 pt)		
Accurately identifies structure (1 pt)		
SUBTOTAL	**/4**	

SPECIAL TESTS

	Test 1: Y/N	Comments	Test 2: Y/N	Comments
Performs the test accurately (3 pts)				
Interprets the test correctly (2 pts)				
SUBTOTAL	___		___	