

2016

Psychological and Environmental Predictors of Test Anxiety: A Structural Equation Model

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PSYCHOLOGICAL AND ENVIRONMENTAL PREDICTORS OF TEST ANXIETY:
A STRUCTURAL EQUATION MODEL

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by

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B.A., Louisiana Tech University, 2012
M.A., Louisiana State University, 2014
August 2017

ACKNOWLEDGEMENTS

As I reflect on my five years of graduate training, I am privileged to have shared this journey with so many. First, I must extend my deepest gratitude to my graduate advisor Dr. George Noell who generously guided me with wisdom and encouragement. Thank you for challenging me to welcome discomfort in order to grow professionally and personally.

I must also thank Dr. Tyler Renshaw for his continued mentorship, particularly for his guidance while learning the statistical analyses required of this dissertation. Additionally, many thanks are owed to Dr. Frank Gresham for serving on my committee, providing valuable suggestions and much needed humor. Finally, thank you to Dr. Birgitta Baker, my dean's representative, for her openness and positive energy during our meetings.

I would also like to recognize my colleagues, Elise McIver, Rachel Olinger Steeves, and Ashley Bordelon. Thank you for assistance with various projects, as well as your friendship as we faced this challenge together. To my childhood and college friends, thank you for your patience as I learned to navigate balancing graduate studies and personal life. You blessed me with unconditional love, and for that I am forever thankful.

I must thank Kevin Wiese for his unwavering patience through the late nights, persistent stress, and long distance. Your support made each day a little easier, and I am so thankful to have had your steadfast encouragement. To my brother, Austin Harris, thank you for your quiet support and humor throughout this process. Lastly, to my parents Wayne and Margaret Harris, thank you for your unwavering grace and love. You are shining examples of the person I hope to become.

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ABSTRACT

Test anxiety is a construct that includes cognitive, physiological, and behavioral symptoms occurring in response to anxiety prior to, during, or following examinations. The current literature on test anxiety has evaluated a number of possible predictors, including demographic variables, academic indicators, and self-perceptions. The movement toward school accountability and higher academic expectations of students has increased the severity of consequences occurring as a result of poor academic achievement. Thus, test anxiety is a critical concern that may impact student academic success. The current study evaluated a structural equation model to determine the strength of associations between trait anxiety, academic achievement, academic self-efficacy, and parental pressure, as well as how each of these variables predicted test anxiety among college undergraduates. The results indicated that trait anxiety and academic achievement predicted academic self-efficacy, and trait anxiety and academic self-efficacy predicted test anxiety. Factors that may have influenced the need for modifications to the structural model will be discussed, including psychometric concerns and theoretical implications.

Keywords: test anxiety, predictors, structural equation model

INTRODUCTION

Over the past few decades, emphasis on improving American students' academic performance has garnered the attention of policymakers and the public. There has been some concern that, in comparison to other countries, achievement among American students is mediocre at best. For example, of the 65 countries participating in the Program for International Student Assessment in 2012, academic achievement among Americans was comparable to the international average in reading achievement, but below the average in math and science (Kena et al., 2014). In an attempt to keep in stride with countries like China and Japan, more pressure has been placed on students to achieve at a higher level and teachers to cultivate academically successful classrooms. While well intended, not all outcomes of this campaign for academic excellence have been positive.

Focus on the outcomes of high-stakes testing has strengthened recent interest in test anxiety and its effects on students of all ages. In addition to the already grueling college entrance exams, the introduction of the No Child Left Behind Act of 2001 (NCLB, 2002) resulted in more standardized testing at younger ages. Specifically, NCLB required that students participate in standardized testing annually from 3rd through 8th grades, as well as a minimum of once in high school. Given that students now experience increased academic pressure in early elementary school, it is possible that students who are more susceptible to environmental stressors and poor self-perceptions are at increased risk of test anxiety.

Anxiety

Anxiety is considered to be an internalizing behavior. Internalizing behaviors are those behaviors that are directed toward the self, including worry, hopelessness, and withdrawal from social interaction (Kazdin & Weisz, 1998). Internalizing behaviors are often accompanied by debilitating emotional symptoms that obstruct adaptive functioning in daily life. In contrast,

externalizing behaviors are those observable behaviors that are directed toward the environment and other persons, including hyperactivity, noncompliance, and aggression (Kazdin & Weisz, 1998). Because internalizing behaviors are often difficult to directly observe, those concerns are less often referred for treatment.

Anxiety is a natural response to environmental stressors that is generally adaptive and developmentally appropriate. Though anxiety may be constructive in certain situations, a threshold exists at which anxiety becomes harmful and inhibits adaptive functioning across various contexts (Kazdin & Weisz, 1998; Kendall, 1993). Individuals with maladaptive anxiety experience cognitive dysfunction in which the individual misrepresents the environmental threat as well as his or her ability to cope (Kendall, 1993). That cognitive misrepresentation influences an individual's ability to recognize unrealistic thoughts and make a functional response.

From a behavior analytic perspective, anxious responses may be maintained by negative reinforcement in the form of avoidance or escape (Dymond & Roche, 2009). Cognitive and physiological symptoms may evoke behaviors that result in the avoidance or escape from an anxiety-provoking stimulus (Kazdin & Weisz, 1998). When the aversive stimulus is avoided or removed contingent on the anxious response, the likelihood of those responses occurring in the future is increased. The earlier this contingency is established, the longer the learning history and more difficult the behaviors are to treat.

Anxiety is the most prevalent topographical class of psychiatric diagnoses, affecting numerous children, adolescents, and adults across the lifespan. Merikangas and colleagues (2010) conducted a study of lifetime prevalence of psychiatric disorders in over 10,000 American adolescents. They found that anxiety disorders were the most common diagnoses, with a prevalence rate of 31.9%, and all anxiety disorders (e.g., generalized anxiety disorder, specific

phobia) were more common among females. Similar results were found in a large scale study of American adults, with a 12-month prevalence rate of 18.1% (Kessler, Chiu, Demler, & Walters, 2005). Although prevalence rates varied by the type of anxiety disorder, it is apparent that anxiety is a significant concern for many individuals across their lifetime. Test anxiety, however, is not a formal diagnosis recognized by the American Psychiatric Association. Given this, what is known about the prevalence, predictors, and consequences of test anxiety?

High-Stakes Testing

Throughout a student's formal education, he or she is required to participate in a number of high-stakes exams that are mandated by both state and federal guidelines. Historically, standardized tests were intended to evaluate progress in closing the achievement gap between American students and those from other countries (Amrein & Berliner, 2002). Since the passage of NCLB, standardized tests have been used as indicators of student achievement, teacher effectiveness, and school success (Segool, von der Embse, Mata, & Gallant, 2014). The belief is that high-stakes tests should boost student achievement because incentives for high-performing schools and sanctions for low-performing schools would increase initiative for students to learn and teachers to provide more rigorous instruction (Amrein & Berliner, 2002).

While the potential consequences of high-stakes test outcomes (e.g., retention, college entry) are intended to motivate students to achieve academically, some critics suggest high-stakes tests do not improve achievement. In fact, high-stakes tests have been criticized for their association with increased retention and dropout rates, as well as narrowing of the curricula taught in the classroom (Amrein & Berliner, 2002). Recent research found that students perceived themselves as experiencing more anxiety during standardized tests than typical classroom tests (Segool, Carlson, Goforth, von der Embse, & Barterian, 2013). Additionally,

though some states have observed improvements in their respective standardized test scores, these scores do not always generalize to assessments of broader learning domains such as the ACT, SAT, and NAEP (Amrein & Berliner, 2002).

Though beneficial for monitoring academic progress, high-stakes tests have the potential to negatively impact certain students and schools. For example, they may differentially impact students from certain demographic groups, such as minorities and students of low socioeconomic status. These groups may be more likely to experience negative effects, such as a higher rate of failing test scores (Amrein & Berliner, 2002). In an analysis of the correlates of 16 state high school graduation exams, Amrein and Berliner found higher rates of suspension, expulsion, and testing exemption for low achieving students prior to testing (2003). It is possible that school sanctions were taken that deterred these students from taking high-stakes tests, though the effects may have been unintentional. Additionally, poor-performing schools are more likely to narrow their instructional curricula in order to increase time for test preparation and improve test scores the following year (von der Embse & Hasson, 2012). These findings demonstrate a few of the concerns that may influence the well-being of students and how students fare academically and behaviorally during testing situations.

Although some students experience test anxiety in response to typical classroom tests, increases in the prevalence and severity of test anxiety may be an unanticipated effect of high-stakes testing (Putwain, 2007). To date, studies of students' subjective experiences during high-stakes testing have demonstrated mixed results, with some students reporting increased stress and isolation while others report positive feelings (Segool et al., 2013). For example, Segool and colleagues conducted a study comparing elementary students' test anxiety during typical classroom testing and high-stakes standardized testing. Across both self-report measures,

students endorsed significantly more cognitive and physiological symptoms of test anxiety during high-stakes testing. However, no differences were found in off-task behavior between testing contexts. Within the sample, 68% of students were classified as moderate to highly test-anxious during high-stakes tests, an increase over the 55% who did so during classroom tests. In sum, it is clear that test anxiety is a critical concern for students of all ages, and those concerns are compounded when the consequences of tests scores have powerful implications.

Test Anxiety

Over the past several decades, the definition of test anxiety has varied based on the theoretical zeitgeist of the time. A generally accepted definition of test anxiety is “the set of phenomenological, physiological, and behavioral responses that accompany concern about possible negative consequences or failure on an exam or similar evaluative situation” (Sieber, O’Neal, & Tobias, 1977; as cited in Zeidner, 1998, p.17). Zeidner defines evaluative situations as those in which an individual’s performance is compared to an existing criterion, and test anxiety as a context-specific evaluation anxiety that occurs prior to, during, and/or following a test. The general consensus among psychometric research is that test anxiety is a combination of three facets: cognitive, physiological, and behavioral (Zeidner, 1998).

Though test anxiety is considered a tridimensional construct, symptom manifestation is likely to look different across individuals and testing situations. At the individual level, each test may evoke the expression of all or some combination of these three facets (Zeidner, 1998). Cognitive symptoms of test anxiety may include self-deprecating thoughts, expectations of failure, low self-esteem, and other off-task thoughts that detract attention from the task at hand. Physiological (i.e., emotional) symptoms may consist of increased heart rate, perspiration, stomachaches, headaches, or other somatic symptoms occurring in response to evaluative

situations. Lastly, behavioral symptoms may include a number of observable behaviors such as looking around the room, fidgeting, or chewing fingernails and pencils. It is necessary to note that symptoms may occur outside of the testing environment as well, including procrastination and poor study skills. Procrastination may function as a way for the individual to decrease test anxiety by avoiding stimuli associated with anxiety-provoking test situations.

The impact of classroom and high-stakes tests on symptoms of test anxiety is apparent in the variability in reported rates of test anxiety. Prevalence rates are estimated to range anywhere between 10 to 40 percent of school-aged children (Segool et al., 2013). Hill and Wigfield (1984) hypothesized that four to five million elementary and secondary students are negatively impacted by test anxiety, and rates may be even higher among college students. Research suggests that test anxiety begins to manifest during the preschool to early elementary years as this is the time parents may establish unrealistic expectations or demands of their child's academic performance (Hembree, 1988; Hill & Wigfield, 1984). According to Hill and Wigfield, students begin to experience increased academic pressure around 2nd grade because they begin to compare their academic performance to that of their peers. Thus, students may develop test anxiety in response to an increased perception of social evaluation. According to Hembree (1988), test anxiety trends appear to increase from 3rd to 5th grade before leveling off in high school and decreasing slightly during college. It is important to recognize, however, that prevalence rates are likely affected by variations in measurement reliability as well demographic characteristics of each sample.

Test anxiety can be detrimental for a number of reasons. For example, a frequent concern is the extent to which test anxiety affects academic achievement. In an early meta-analysis of 562 studies conducted between 1952 and 1986, Hembree (1988) found test anxiety to be negatively

correlated with test performance by the 3rd grade. This held true of performance on a number of indicators including intellectual ability and grade point average. Notably, test anxiety was significantly correlated with academic achievement across subject areas, including reading/English ($r = -.15$ to $-.24$), math ($r = -.22$), natural sciences ($r = -.21$), social sciences ($r = -.25$), and foreign languages ($r = -.12$). The effect size for math achievement in 2nd grade was the only nonsignificant correlation. Further analysis of effect sizes suggested that the relationship between test anxiety and achievement was weakest during 2nd grade and increased substantially in 3rd grade and above.

A study by Hancock (2001) examined how test anxiety and evaluative threat affected performance on a criterion-referenced classroom test for post-baccalaureate and graduate students. Participants engaged in a high or low evaluative threat class for 12 weeks. In the high evaluative threat condition, the professor followed scripts that emphasized academic competition, strict rule enforcement, and punishment for rule-breaking. Interestingly, the main effect of test anxiety on test performance was nonsignificant, and students with high and low test anxiety demonstrated near equivalent test performance. However, the main effect of evaluative threat on test performance was significant, with students in the high threat condition performing significantly worse than those in the low threat condition ($d = .57$). The interaction between test anxiety and evaluative threat showed that highly test-anxious students in the high evaluative threat condition performed the worst. The results of this study contradicted Hembree's meta-analytic findings by demonstrating that high test anxiety alone may not impair test performance. Rather, it suggested that the interaction between high test anxiety and the perception of evaluative threat from teachers and peers produced the worst test outcomes.

Given the complex dimensionality of test anxiety, it is plausible that its relationship with test performance is predicated on a number of interactions between variables. It is likely that the nature of this relationship is affected by qualities of the test, the testing environment, and the characteristics of the test-taker (Hembree, 1988). The findings discussed above lead one to question the moderators that may affect the test anxiety – test performance relationship. A moderator is a third variable that alters the direction or magnitude of the relationship between a predictor and criterion variable (i.e., specifies *when* a relationship exists; Baron & Kenny, 1986). This review will not address all proposed moderators, but is meant to provide examples that emphasize the complexity in understanding which test-anxious students actually exhibit impairments in test performance.

The interactional effect of evaluative threat found by Hancock (2001) is an example of a moderator. When the perception of evaluative threat was high, highly test-anxious individuals performed more poorly. When the perception of evaluative threat was low, highly test-anxious individuals performed similarly to their low-anxious counterparts. Therefore, the level of evaluative threat determined when test anxiety was negatively associated with test performance. However, there is some research to suggest that the moderating effect of evaluative threat on the test anxiety – test performance relationship may only occur in college students (Hembree, 1988).

The qualities of a test, such as perceived test difficulty, may also moderate the relationship between test anxiety and test performance. For example, Hembree's (1988) meta-analysis of 25 studies provided preliminary evidence by demonstrating a significant effect for tests that were perceived to be difficult ($r = -.45$), whereas no effect was found when tests were perceived to be easy ($r = -.07$). In essence, Hembree found that there were no differences between high and low test-anxious students when they believed a test was easy. When they

believed a test was difficult, however, highly test-anxious students performed poorly than their low test-anxious counterparts. Therefore, the meta-analytic findings indicated that the perception of test difficulty may have moderated the test performance of highly test-anxious students. It is possible that this occurred because difficult tests are perceived to be more threatening, thereby increasing those anxious responses that result in test avoidance or cognitive interference.

A number of variables specific to the test-taker may also moderate the association between test anxiety and test performance. For example, some research shows that the age of the test-taker moderates the effects of test anxiety (Hembree, 1988; Hill & Wigfield, 1984). As mentioned previously, Hembree's meta-analysis provided preliminary evidence of the moderating effects of age. Across multiple performance measures (i.e., intellectual ability, reading and math achievement), correlations between test anxiety and performance were smaller in 1st and 2nd grades ($r = -.05$ to $-.15$) and larger in 3rd grade and above ($r = -.22$ to $-.29$). Additionally, Hill and Wigfield (1984) indicated that the academic performance of middle and high school students appears to be more strongly affected by test anxiety than that of elementary students. Unfortunately, test anxiety studies with elementary samples are uncommon; therefore these findings can only be considered preliminary. However, the consistency between these two sources does suggest that age may indeed impact how test anxiety influences test performance.

In sum, there are a number of variables that can affect how test anxiety influences test performance. The qualities of the testing environment (e.g., evaluative threat), the test (e.g., perception of difficulty), and the characteristics of the test-taker (e.g., age) can each interact to influence the severity of test anxiety symptoms and their consequences. Though not an exhaustive list of potential moderators, the previous review emphasizes how test anxiety has

been conceptualized throughout the past several decades and may clarify why it is such a complex construct to comprehend, assess, and treat.

History of Test Anxiety Conceptualization

Although there is some related research dating back to the early 20th century, it is widely accepted that systematic test anxiety research did not truly begin until the 1950s with the work of George Mandler and Seymour Sarason (Zeidner, 1998). It was their studies with Yale undergraduates that established test anxiety as a reputable line of research. Mandler and Sarason hypothesized that, for test-anxious individuals, tests evoked a learned anxiety drive (i.e., motivation). They posited that the learned anxiety drive was “a function of anxiety reactions previously learned as responses to stimuli present in the testing situation” (1952, p. 166). Individuals attempt to decrease this drive through either task-irrelevant responses, such as feelings of helplessness and physiological reactions, or task-centered responses, such as increased focus on tasks specific to the test (Mandler & Sarason, 1952).

In one of the first systematic studies of test anxiety, Mandler and Sarason (1952) allocated participants into high and low anxiety groups. Additionally, experimenters randomly provided either neutral feedback, feedback indicating successful performance of the task, or feedback indicating failure to perform the task. Feedback conditions were randomized across high- and low-anxious groups. Mandler and Sarason hypothesized that the high anxiety group would require more time to complete trials from a Kohs Block Design Test because those individuals would produce more task-irrelevant responses. Results showed that any performance feedback to high anxiety participants, no matter whether conveying success or failure, resulted in longer time to task completion. In contrast, feedback about either success or failure resulted in shorter time to task completion for the low anxiety group. The high anxiety group only bested

the low anxiety group's scores when no information about task performance was provided. In sum, any reference about task performance to the high anxiety group, whether positive or negative, resulted in increased time to completion on the next trial. Theoretically, this occurred because reference to task performance resulted in symptoms that produced more task-irrelevant responses for those with high anxiety.

In a similar study conducted by Sarason, Mandler, and Craighill (1952), performance on the Wechsler-Bellevue Digit Symbol test was compared between high and low anxiety groups. Participants in each group were told that they were either expected to complete or not complete the test within the given time. Sarason and colleagues found that participants in the low anxiety group performed better overall. Though there was little differentiation between completion conditions for participants in the high anxiety group, those in the low anxiety group who were told they were expected to complete the test outperformed those who were told they were not expected to complete the test. In a second experiment, high test-anxious participants who were given evaluative instructions (i.e., told that test results would be compared to their aptitude scores) performed significantly worse than low test-anxious students provided with the same instructions. Similar conclusions were made: anxiety-provoking instructions resulted in increased performance for individuals with low anxiety and diminished performance for individuals with high anxiety. Similar results have been found across conceptual replications of these studies (Sarason & Mandler, 1952; Mandler & Sarason, 1953).

While the Yale studies contributed to a growing interest in test anxiety, the work of Liebert and Morris resulted in the distinction between the facets of worry and emotionality that remain important distinctions in test anxiety research today (Liebert & Morris, 1967; as cited in Morris & Liebert, 1970). Liebert and Morris theorized that worry was a cognitive facet of test

anxiety and included such symptoms as fear of failure and doubts about one's aptitude. In contrast, emotionality was thought to be a physiological facet of test anxiety that included such symptoms as increased heart rate and blood pressure. In two experiments with college undergraduates, Morris and Liebert (1970) assessed the relationship between worry and emotionality with self-reports of test anxiety, test performance expectancy, heart rate, and pulse rate. Heart rate, a physiological variable that theoretically should be related to emotionality, was in fact more strongly correlated with emotionality than worry. The expected relationship between emotionality and pulse rate was not supported; however, the authors noted that this may have been the result of poor self-report reliability. Additionally, test performance expectancy, a cognitive variable hypothesized to be related to worry, was more strongly correlated with worry than emotionality. These findings provided initial support for the distinction between worry and emotionality.

Notably, Morris and Liebert (1970) demonstrated significant partial correlations between worry and test grade ($r = -.232$ to $-.242$), whereas this relationship failed to occur for emotionality ($r = -.082$ to $-.080$). Upon analyzing the correlation between overall anxiety and test grade, the removal of the effects of emotionality did not reduce the correlation to nonsignificance. In contrast, the removal of the effects of worry resulted in a nonsignificant correlation. These findings suggested that worry and related maladaptive cognitions associated with test anxiety have substantial impact on test performance, whereas physiological responses do not.

Liebert and Morris' findings were conducive to the strengthening of the cognitive zeitgeist taking hold in test anxiety research. Of note was the work of Wine, who built on Liebert and Morris' findings by hypothesizing that the relationship between test anxiety and test

performance could be explained by a cognitive-attentional model (Zeidner, 1998). Wine (1971) believed that test anxiety could be interpreted as an attentional difference. Specifically, students with high test anxiety were focused internally on negative self-talk while students with low test anxiety were focused on external, task-relevant information. Similar to Liebert and Morris' dual theory model, Wine proposed that attentional differences were the result of attention being diverted to worries and task-irrelevant cognitions rather than the test itself. This also aligned with Mandler and Sarason's theory that students who do not experience these interfering cognitions might experience facilitative anxiety that increases task-relevant responding (Wine, 1971).

A later study by Wine (1979) evaluated the observable behavior of high, moderate, and low test-anxious elementary students in an art class either prior to an expected test or when no test was scheduled. Observed behaviors included attending, task-related behavior, activity, communication and interaction. When a test was expected, all students spent more time working on their art tasks, attending to the teacher, and engaging in less activity. Compared to students with high test anxiety, those with moderate or low test anxiety attended more to teacher communication when a test was expected and spent less time sitting idle. Additionally, students with high test anxiety decreased the frequency of communication with peers when a test was expected, whereas those with lower anxiety initiated and received more communication. These findings suggest that when a test is expected, students with less test anxiety spend more time orienting to tasks, while those with high test anxiety spend less time orienting to tasks and become more socially isolated (Wine, 1979).

Until the 1980s, most test anxiety research focused on debilitating symptoms occurring within the context of a testing situation. While Wine's cognitive-attentional model theorized that test anxiety impedes the ability to attend to the test, Tobias' (1985) review of the literature

suggested that test anxiety is more likely the result of cognitive interference or deficits during the acquisition, maintenance, and retrieval of information. The interference model is based on the common assumption that test anxiety impairs an individual's ability to recall prior learning during testing situations, or the retrieval process is compromised. It is hypothesized that this occurs because attention is divided between the task and negative cognitions, a hypothesis nearly indistinguishable from Wine's attentional model (Zeidner, 1998). In contrast to the interference model, the deficit model posits that low test scores are the result of poor study skills or test-taking skills (Tobias, 1985). The encoding of necessary information never occurred, so it cannot be retrieved. Thus, Tobias' theory postulates that anxiety occurs due to self-awareness that one is ill-prepared for a test.

Within the skills deficit model, test anxiety appears to serve a mediating role (Zeidner, 1998). The relationship between test anxiety and academic performance may be conceptualized as a feedback loop in which poor test performance increases test anxiety, and test anxiety decreases future test performance (Benjamin, McKeachie, Lin, & Holinger, 1981). Based on the theory of the deficit model, improving study or test-taking skills would be the most optimal way to change both test anxiety and test performance. Benjamin and colleagues (1981) conducted two studies of undergraduate students in which questionnaire data was collected following the completion of a test. The results showed that participants with higher test anxiety reported more difficulties learning the material, reviewing the material prior to the test, and recalling the material during the test. The outcomes of this study demonstrate that students with high test anxiety tend to struggle not only with the retrieval of test material, but exhibit deficits encoding the material while studying as well.

Recently, Lowe and colleagues (2008) presented a new conceptualization of test anxiety as the interplay between psychological, social, and biological factors. In this model, a number of intra-individual variables influence the severity of test anxiety. Such variables might include intelligence, academic ability, academic self-efficacy, social-emotional functioning, trait anxiety, and study skills and habits. In addition, the degree to which the test is perceived as threatening is believed to influence the severity of symptoms. Lowe and colleagues hypothesized that, in addition to cognitive, physiological, and behavioral effects, test-anxious students experience cognitions more specifically related to social humiliation. Lowe's model expands upon previous theory by including social factors in addition to individual factors. Thus, this work emphasized the consequences of social evaluation more than previous research.

Correlates of Test Anxiety

Test anxiety has both proximal and distal effects that can be deleterious to student functioning. In a meta-analysis of 562 published and unpublished studies, Hembree (1988) analyzed the mean correlations between test anxiety and a number of student and teacher variables. The outcomes of this study had implications for understanding test anxiety and its effects on students of all ages. Results demonstrated that test anxiety was significantly correlated with a number of performance-related variables, including the fear of negative evaluation and poorer study skills. Therefore, students with test anxiety are susceptible to debilitating fear of tests, which may lead to the avoidance studying or ineffective study skills. Test anxiety was also significantly correlated with psychological and environmental variables such as lower self-esteem, sense of well-being, and higher teacher anxiety. These findings suggest test anxiety may decrease one's perceptions of personal ability and quality of life. In addition, a student's test anxiety may influence the thoughts, emotions, and behaviors of his or her teacher. Teachers with

high anxiety might behave in ways that maintain or increase that student's test anxiety. It is important to note that because Hembree's research was correlational in nature, these findings cannot be considered causal. Rather, it is possible that these variables precede test anxiety rather than develop from test anxiety.

While an understanding of the consequences of test anxiety can contribute to interventions designed to target its topography, a more time- and cost-efficient approach may be to identify contributing factors and implement preventative measures. Continued efforts have been taken to identify predictive factors. The results of Hembree's (1988) meta-analysis suggest that tests perceived to be difficult or stress-inducing may be predictive of higher test anxiety. Assuredly, test difficulty and stress are based on individual perception. However, very little research has been conducted that evaluates differential perceptions of test anxiety across students. In one qualitative study, student perceptions about the causes of their test anxiety were assessed in relation to test format, testing environment, and personal ability to meet the demands of the testing situation (Bonaccio & Reeve, 2010). The outcomes showed that students rated variables that are out of their control as the most anxiety-provoking factors, such as test difficulty and test format. However, there may be times when it is possible for educators to address these variables to ease test anxiety. For example, helping students prepare for tests by teaching study and time management skills may serve to alter distorted cognitions and increase perceived self-efficacy (Bonaccio & Reeve, 2010).

Individual ability and academic performance may also influence the onset and course of test anxiety. For example, studies have found that lower aptitude and risk of academic failure are significantly correlated with test anxiety (Segool et al., 2014). An analysis of ten studies of students in 7th grade through college found a medium to large effect for the relationship between

aptitude and test anxiety ($r = -.49$ to $-.52$), suggesting that students with lower aptitude may be susceptible to higher test anxiety (Hembree, 1988). Hembree also found a large effect size when comparing test anxiety among passing students to those who are academically at-risk ($r = .51$). This finding was supported by Segool and colleagues (2014), who found that academic ability was a significant predictor of test anxiety in their cognitive-behavioral model of test anxiety. Because academically at-risk students likely have a history of test failure, those previous experiences could contribute to negative evaluations of themselves or by others. If social evaluation is perceived as threatening, similar future situations are likely to result in test anxiety and task avoidance (Segool et al., 2014). As a result, academically low-performing students may experience anxiety because of fear of failure and social evaluation. Teaching relaxation strategies and techniques to challenge cognitive distortions may help those students learn to manage their fears during testing situations.

Demographic variables such as gender or minority status may increase the risk of test anxiety (Hembree, 1988; Segool et al., 2014). Hembree's meta-analysis found that females consistently reported higher test anxiety, beginning in early elementary school and continuing through college. These results have been replicated in a number of multicultural studies (Chapell et al., 2005; Pajares & Kranzler, 1995; Richardson, Abraham, & Bond, 2012; Segool et al., 2013, 2014; Singh & Broota, 1992; Yildirim, Genctanirim, Yalcin, & Baydan, 2008). Although Onyeizugbo (2010) reported no gender differences in the test anxiety of Nigerian college students, it is possible that this is the result of a specific cultural difference. However, it is clear that there is generally a wealth of research to support the existence of differences in prevalence by gender. Given that the prevalence of clinical anxiety disorders is higher in females (McLean,

Asnaani, Litz, & Hofmann, 2011), it is comprehensible that a similar relationship would exist for test anxiety.

Though not common practice, the association between test anxiety and minority status has also been examined. Hembree's (1988) meta-analysis found small to large effects for the relationship between test anxiety and minority status, with African American and Hispanic students reporting higher test anxiety than their Caucasian counterparts. The effect was strongest for elementary students in 2nd, 3rd, and 4th grades, with these differences decreasing to nonsignificance by high school. Additional studies have also found nonsignificant differences in high school (Pajares & Kranzler, 1995) and college (Segool et al., 2014). In fact, a structural equation model conducted by Segool and colleagues (2014) found that the only effect of minority status was its direct influence on academic achievement, which in turn predicted test anxiety. However, other studies have contradicted these findings. Turner, Beidel, Hughes, and Turner (1993) found that, although test anxiety had a 41% prevalence rate among their sample of elementary African American students, this did not differ significantly from their previous samples of other ethnic groups. Additionally, Putwain (2007) found significant differences in high schoolers' test anxiety among based on ethnicity, with Caucasian students reporting lower test anxiety than African American, Asian, and other minorities. Given the variation in findings and small number of studies, no conclusive assumptions can be made about if or how minority status impacts test anxiety.

Existing research has identified potential factors that may influence the likelihood of test anxiety and its trajectory throughout the formal education years. Nonetheless, current findings are ambiguous at best. While the current review cannot provide a critique of every factor that has been studied, it can examine those with the strongest support and advocate for the investigation

of additional factors. Test anxiety is assuredly a complex variable, as demonstrated by its cognitive, physiological, and behavioral manifestations. Given this, it is likely that the same is true of its precursors. The current study attempted to conceptualize test anxiety as a variable that is influenced by both psychological and environmental factors which interact to produce the triad of symptoms discussed previously. While a more comprehensive model may exist, individual differences cannot be dismissed as these may inform the identification of individual treatment modalities.

Trait Anxiety

The lifetime prevalence of DSM-IV disorders among American adults demonstrates that anxiety disorders are the most common psychiatric diagnoses, affecting roughly 27.7% of the adult population (McLean et al., 2011). Similar results have been found for adolescents between the ages of 13 and 18, with a prevalence rate of 31.9% (Merikangas et al., 2010). Across all DSM-IV anxiety disorders (i.e., agoraphobia, generalized anxiety disorder, social phobia, specific phobia, panic disorder, post-traumatic stress disorder, and separation anxiety disorder), lifetime prevalence rates were consistently higher for females than males (McLean et al., 2011; Merikangas et al., 2010). This is consistent with the demographic correlates of test anxiety.

Various anxiety disorders vary in terms of symptomatology and the contexts in which the anxiety occurs. Anxiety may be context-specific in that it occurs only in the presence of certain stimuli, or it may be an enduring characteristic that is present across contexts. Trait anxiety is defined as the “relatively stable individual differences in anxiety-proneness, that is, to differences between people in the tendency to perceive stressful situations as dangerous or threatening and to respond to such situations with elevations in the intensity of their state anxiety reactions” (Spielberger, 1983; p. 5). Spielberger believed that, while test-anxious individuals are

typically higher in trait anxiety, test anxiety can be thought of as “a situation-specific form of trait anxiety” (Spielberger et al., 1976; as cited in Zeidner, 1998, p. 9). In sum, test-anxious individuals generally may be more anxious overall, but their anxiety is significantly exacerbated during testing situations.

It is comprehensible that a relationship exists between trait anxiety and test anxiety, and this relationship has been evaluated in a number of studies. In fact, meta-analytic research shows that test anxiety and “general” anxiety are significantly correlated across 1st through 12th grades, as well as in college (Hembree, 1988). In the same meta-analysis, trait anxiety specifically showed a significant positive correlation with test anxiety ($r = .53$). These results have been replicated in more recent research. Bonaccio and Reeve (2010) conducted a study assessing undergraduate test anxiety and student perceptions of the sources of test anxiety, including general anxiety proneness. Indeed, student perception of general anxiety proneness was a significant predictor of both the worry ($\beta = .45, p < .01$) and tension ($\beta = .52, p < .01$) subscales of the Reactions to Tests Questionnaire (Bonaccio & Reeve, 2010). Onyeizugbo (2010) found similar results in a sample of Nigerian undergraduates, with a significant correlation of $r = .51$ and trait anxiety contributing to 49% of the variance in test anxiety. The outcomes of these studies suggest that the perception of higher anxiety in general has a significant influence on both cognitive and physiological manifestations of test anxiety, supporting the assumption that trait anxiety is likely a strong predictor of test anxiety.

Academic Achievement

The relationship between achievement and test anxiety is undoubtedly one of the most researched topics in the test anxiety literature, and rightfully so. As mentioned previously, test anxiety is negatively correlated with test performance and academic achievement from 3rd grade

on (Hembree, 1988). One literature review reported that correlations between test anxiety and academic performance range as high as $-.60$ (Hill & Wigfield, 1984). Several additional studies have demonstrated negative correlations between test anxiety and GPA, with reported correlations ranging from $-.15$ to $-.24$ (Benjamin et al., 1981; Chapell et al., 2005; Greenberger, Lessard, Chen, & Farrugia, 2008; Richardson et al., 2012). Similar findings have been found for subject-specific performance tasks (Pajares & Kranzler, 1995) and general achievement (Yildirim et al., 2008).

Interestingly, a study of high-stakes test performance among high school students found that the test anxiety – test performance relationship differed across subject areas (von der Embse & Hasson, 2012). Although significant negative correlations emerged between test anxiety and math, social studies, and science test scores, correlations with reading and writing were nonsignificant. These results differ from previous research showing significant effects across all subjects (Hembree, 1988). Although von der Embse and Hasson do not provide any hypotheses as to why test anxiety was more strongly associated with some subjects, other research has found evidence that high test-anxious students perform more poorly to certain question formats. For example, students seem to have more difficulty responding correctly to short-answer questions than multiple choice or essay questions (Benjamin et al., 1981). Short-answer questions typically require students to retrieve information, whereas multiple choice questions only require students to recognize information; therefore, impairments in short-answer responses may be due to deficits retrieving stored information (Benjamin et al., 1981). Because high-stakes tests often include a combination of question formats, it is possible the results of the von der Embse and Hasson (2012) study may reflect these differences in format.

Liebert and Morris conducted preliminary investigations demonstrating that worry, not emotionality, is more strongly associated with diminished aptitude and academic performance. This finding has been replicated in a number of studies (Chapell et al., 2005; Hembree, 1988; Seipp, 1991). As a result, it has been suggested that assessing the worry component of test anxiety alone may be sufficient for predicting academic performance (Seipp, 1991). Given these findings, it seems fair to assume that cognitive interventions would produce greater effects on achievement than behavioral interventions. Unfortunately, the vast majority of these studies have been conducted with high school and college-aged students. As a result, recommendations concerning interventions that are likely to result in performance improvements in elementary or middle school students should be given cautiously. Additionally, it is necessary to note that the causal direction of the test anxiety – test performance relationship has not been reliably determined. In fact, it is possible that the nature of this relationship is bidirectional (Zeidner, 1998), such that worries and avoidant behaviors diminish test performance and poor test performance produces fear of future evaluation and negative perceptions of one's academic abilities.

Given the relationship between trait and test anxiety, it is likely that trait anxiety produces similar effects on achievement. A high level of trait anxiety indicates that an individual generally has more intense worries and physiological responses than non-anxious individuals. Therefore, it is possible that these responses would interfere with an individual's ability to focus solely on test-related tasks, albeit less so than test anxiety. In a meta-analysis of 126 international studies from 1975 to 1988, Seipp (1991) found an average correlation of $-.21$ between anxiety (including trait and test anxiety) and test performance, meaning higher anxiety was associated with lower test performance. The effects were larger for test anxiety ($r = -.233$) than general

anxiety ($r = -.163$), which is theoretically plausible given that test anxiety is a situation-specific manifestation of anxiety. Interestingly, the anxiety-performance relationship was stronger when anxiety was measured after the test rather than prior to the test. Given this finding, Seipp hypothesized that the impending outcome of the test influences the strength of anxious symptoms following tests.

Academic Self-Efficacy

A large body of work has been devoted to examining the effects of self-referent thought on behavior. Of particular importance is the work on social cognitive theory conducted by Alfred Bandura. Bandura believed that an individual's capacity to self-regulate impacts one's behavior, including the ability to regulate perceptions of the self. Self-efficacy is one such construct. Bandura (1977) defined self-efficacy as a person's subjective belief in his or her ability to successfully perform the tasks required to achieve a desired outcome. An individual's self-efficacy is due in part to previous experiences of performance successes and failures, observational learning, verbal persuasion, and physiological reactions (Bandura, 1977), and the combination of these factors can produce high self-efficacy. It was Bandura's contention that higher self-efficacy makes an individual more likely to choose, put forth effort, and persist in challenging tasks. Therefore, an individual's knowledge, skills, and prior achievements aren't necessarily the only predictors of future achievement. Rather, personal beliefs about one's capability to carry out certain tasks can influence subsequent behavior. Specifically, one is likely to avoid demanding tasks that he or she feels incapable of performing (Bandura, 1977). For example, individuals with low self-efficacy for taking tests are likely to avoid test-related tasks by procrastinating, worrying, or perseverating on potential outcomes.

Given that self-efficacy is a cognitive appraisal of one's ability in certain situations, it seems evident that academic self-efficacy and test anxiety would be related constructs. The consensus amongst existing research that lower self-efficacy is associated with higher test anxiety, with correlations ranging from $-.24$ to $-.64$ (Bong, Cho, Ahn, & Kim, 2012; Onyeizugbo, 2010; Pajares & Kranzler, 1995; Pintrich & De Groot, 1990; Richardson et al., 2012). Self-efficacy, and academic self-efficacy in particular, appears to be one of the strongest correlates and potential predictors of test anxiety.

Pajares and Kranzler (1995) evaluated a path model that included gender, general mental ability, math self-efficacy, math anxiety, and high school math level as predictors of math performance. Ultimately, the path coefficient from math self-efficacy was the most powerful predictor of math achievement ($\beta = .349$) and math anxiety ($\beta = -.394$). Notably, math self-efficacy mediated the effects of general mental ability on math anxiety, meaning the impact of intelligence on a student's test anxiety differed based on whether the student perceived themselves as having high or low self-efficacy.

In contrast, a structural equation model analyzed by Bandalos, Yates, and Thorndike-Christ (1995) found that general self-efficacy was not significantly correlated with worry or emotionality, one of the primary dimensions of test anxiety. A significant relationship with worry only occurred when test anxiety was measured in regard to statistics; however, the relationship with emotionality remained nonsignificant. The authors noted that this may have occurred as a result of collinearity between math self-efficacy and self-concept. An alternative model in which the path was reversed such that self-efficacy predicted self-concept demonstrated a significant negative relationship between self-efficacy and all other test anxiety variables (Bandalos et al., 1995).

In another evaluation of self-efficacy, Bong and colleagues (2012) analyzed two structural equation models examining the associations between two different measures of academic self-efficacy and task value (i.e., the importance, usefulness, and interest in a task), test anxiety, and academic achievement. The first study, which included academic self-efficacy as a predictor of task value, found that both academic self-efficacy measures were significant predictors of test anxiety in elementary ($\beta = -.59$ to $-.62$) and middle school students ($\beta = -.45$). The path coefficients from academic self-efficacy to test anxiety were stronger for elementary students, which suggests that academic self-efficacy may influence test anxiety symptomatology more profoundly at earlier ages. The second study, in which academic self-efficacy and task value were merely correlated, found comparable results. Although test anxiety did not fully mediate the relationship between academic self-efficacy and achievement, the inclusion of test anxiety resulted in significant path coefficients from academic self-efficacy to test anxiety and a large decrease in the path coefficient from test anxiety to achievement. Therefore, some of the relationship between academic self-efficacy and achievement may have been accounted for by the level of a student's test anxiety. In sum, the studies reviewed here corroborate the hypothesis that academic self-efficacy may greatly influence the expression of test anxiety in young students.

Given that trait anxiety often results in increases in worry and cognitive distortions, it is likely that trait anxiety and self-efficacy are also correlated. Trait anxiety may influence an individual's perceptions of his or her ability to cope with threatening situations, which influences the way an individual thinks, feels, and acts. International studies of both high school and undergraduate students have found self-efficacy and anxiety to be significantly negatively correlated, ranging from $-.23$ to $-.46$ (Onyeizugbo, 2010; Tahmassian & Moghadam, 2011). In

Onyeizugbo's (2010) study, this correlation was nearly equivalent to that of self-efficacy and test anxiety ($r = -.24$). These results indicate that trait anxiety and self-efficacy are conceptually related, despite the context in which the relationship is evaluated. One limitation of both the Onyeizugbo study is that it employed a general measure of self-efficacy. Had academic self-efficacy been measured, which may be more relevant in a school context, it is possible that the relationship between academic self-efficacy and test anxiety would be stronger as the two are relevant constructs to academic contexts.

In another study by Tahmassian and Moghadam (2011), academic self-efficacy exhibited a lower correlation with anxiety ($r = -.395$) than did general self-efficacy ($r = -.459$). However, a limitation of this study is that both state and trait anxieties were measured simultaneously and were not reported in isolation, so the relationship between academic self-efficacy and trait anxiety could not be determined. Due to the variability of employed self-efficacy measures used in existing research, the relationship between academic self-efficacy and trait anxiety has not reliably been determined. Further studies evaluating the strength of the association between academic self-efficacy and both trait and test anxiety would lead to a greater understanding of the relationship between these constructs.

An extension of Bandura's work has been carried out by Pajares, who posited that test performance and self-efficacy share a reciprocal relationship. Specifically, performance outcomes alter self-referent thoughts, and those thoughts impact future performance (Pajares, 1996). Self-efficacy may be considered situation-specific in that the individual sees specific situations, such as taking tests, as more difficult than they actually are. In this regard, persons with a history of task failure and negative thoughts about their abilities may have low self-efficacy. This distorted thinking can increase stress and inhibit a person's ability to problem

solve effectively (Pajares, 1996). In contrast, high self-efficacy may reduce apprehension about certain situations and increase one's approach to and persistence on a task (Pajares & Kranzler, 1995). When one is acquainted with the skills required to successfully complete an academic task, self-efficacy is established through constructive evaluation of one's skills and prior performance on such tasks (Pajares, 1996).

Studies of self-efficacy and academic achievement have been abundant in the research literature and generally support a positive association. However, the strength of results depends again depends upon the selected measure of self-efficacy. Because self-efficacy is conceptualized as situation- or task-specific, Bandura contended that measures assessing self-efficacy of skills required to complete a specific task would provide a more valid indicator of self-efficacy (e.g., emotional self-efficacy, academic self-efficacy). In one study of American undergraduate students, Hackett and Betz (1989) examined the relationship between math performance, math self-efficacy, attitudes towards math, and choice of math-related majors. They found that math self-efficacy and math performance shared a significant positive correlation ($r = .44$), suggesting that higher self-efficacy is related to better academic performance. Similar results have been found in studies of high school students (Pajares & Kranzler, 1995).

More comprehensive research across various academic tasks indicates that the relationship between self-efficacy and performance is fairly stable (Multon, Brown, & Lent, 1991; Richardson et al., 2012). In a meta-analysis of 39 studies conducted between 1977 and 1988, Multon et al. (1991) found a moderate association between self-efficacy and performance, with a mean correlation of .38. Similar results were demonstrated in studies conducted between 1997 and 2010 (Richardson et al., 2012). Notably, Multon and colleagues found that effect sizes

were variable across age ranges, with the weakest effects among elementary students ($r = .21$), stronger effects among college students ($r = .35$), and the largest effects among high school students ($r = .41$).

In addition to variable effect sizes by age, research shows that variations in achievement may also produce differential effects. When Multon and colleagues (1991) compared the self-efficacy of low-achieving and typically-achieving students, they found a larger effect for low-achieving students ($r = .56$) than average achievers ($r = .33$). It is possible that low-achieving students are more susceptible to low self-efficacy because they have a history of poor academic performance. Thus, targeting academic self-efficacy during intervention could potentially impact the academic performance of low-performing students and significantly influence the course of their academic success. Interestingly, Multon and colleagues found a similar effect for measures of task persistence, supporting Bandura's contention that self-efficacy promotes persistence in the face of challenging tasks.

A meta-analysis by Robbins and colleagues (2004) analyzed the effects of studies published between 1984 and 2003 to determine the psychosocial predictors of academic performance and retention (i.e., duration of time a student was enrolled at a university) among American college students. An analysis of 18 correlation coefficients showed that academic self-efficacy was the strongest predictor of GPA ($\rho = .496$), surpassing even high school GPA and ACT/SAT scores. In addition, academic self-efficacy was the second strongest predictor of retention ($\rho = .359$) behind academic-related skills, which included such variables as time-management and study skills. These results suggest that not only does the belief in one's academic abilities influence academic outcomes, but it also influences one's persistence in

challenging academic settings, such as college. These findings are consistent with Bandura's hypothesis that higher self-efficacy influences task persistence.

Though the relationship between academic self-efficacy and achievement has been extensively researched, it is necessary to note that this relationship may be bidirectional in nature. Specifically, it is likely that prior academic success increases academic self-efficacy, while higher academic self-efficacy contributes to academic task engagement, persistence and, thereby, academic success. Because of the subjective nature of assessing academic self-efficacy, causation from one variable to the other may never be reliably determined. Consequently, the covariance of these variables may alter the expression of test anxiety.

Parental Pressure

It is evident that anxiety is associated with a number of psychological factors. However, individuals do not exist in a vacuum; they exist within and interact with their various environments. Therefore, it is imperative that the relationship between anxiety and environmental factors be evaluated. One such factor is the family environment, or the interactions between an individual and the members of his or her family. In particular, parent beliefs, attitudes, and interactions can have a significant influence on a student's academic, behavioral, and social-emotional development. One such factor is parental pressure, or the idea "parents...[are] perceived as sources of pressure when they communicate messages perceived by the student as emphasizing conditions of acceptance based on achievement.... rather than the effort made" (Putwain, 2009; p. 402). Messages might include expectations about their child's academic accomplishments. Putwain (2009) interviewed a number of British students and found that they felt pressured by their parents to perform well on tests, potentially because they feared disappointing their parents if they did not live up to those expectations. It is possible that parental

pressure may impact test anxiety by decreasing feelings of self-efficacy and confidence while increasing avoidance of test-related stimuli (Putwain, Woods, & Symes, 2010).

Although there is a dearth of research on this topic, some studies suggest that parental pressure is associated with increases in test anxiety (Chen, 2012; Greenberger et al., 2008; Putwain et al., 2010; Singh & Broota, 1992). One study of Indian students ages 15 to 18 found a correlation of .27 between self-reported test anxiety and parental pressure. Although Singh and Broota concluded that students who perceived themselves as experiencing more parental pressure had higher test anxiety, there were some limitations to the study. For example, data collection methods and procedures were not adequately described and, therefore, should be interpreted with caution.

In the second of a two-part study, Greenberger and colleagues (2008) analyzed college student self-reports about parent characteristics, test anxiety, and GPA, among other variables. Similar to the results of Singh and Broota (1992), analyses resulted in a significant correlation between test anxiety and parental academic expectations ($r = .34$). Additionally, student perceptions of the extent to which parents compared their achievement to that of other students resulted in a nearly equivalent correlation ($r = .37$), providing further support for the negative impact of perceived social evaluation. Alternately, test anxiety and parental warmth were significantly negatively correlated ($r = -.33$). Overall, the results of this study suggest that some students feel pressured by their parents when they are unsure that they can live up to their parent's expectations. This pressure is associated with negative outcomes such as high test anxiety, including worries about being evaluated negatively by one's parents (Putwain et al., 2010). On the other hand, perceiving one's parents as warm and caring may be related to lower

test anxiety. Parental warmth may serve as a protective factor because individual has less fear of being evaluated by or disappointing his or her parents.

The results of Putwain et al. (2010) were consistent with those of the previous studies. Putwain and colleagues found small to moderate correlations between parental pressure and test anxiety among post-compulsory British students. Specifically, they found that parental pressure was significantly positively correlated with three of the four subscales of the *Revised Test Anxiety* scale, including worry ($r = .29$), test-irrelevant thinking ($r = .21$), and bodily symptoms ($r = .17$). The larger correlations observed for worry and test-irrelevant thinking indicate that parental pressure was more strongly correlated more with cognitive, rather than physiological, dimensions of test anxiety. Hierarchical regression provided further support for this finding, as parental pressure was a direct predictor of both worry and test-irrelevant thinking, whereas it was only an indirect predictor of bodily symptoms. In contrast to Greenberger et al. (2008), the results of this study did not support a notable relationship between test anxiety and parental support. These findings could be attributed to some difference in the operational definitions of parental support and parental warmth. Another limitation of Putwain's study was the internal consistency reliability of the selected parental support scale, which exhibited a Cronbach's alpha of only .68. Thus, due to differences in psychometric reliability, the findings of the Greenberger and Putwain studies may not be comparable.

In a study of parental pressure among 997 Chinese high school students, the relationships between parental warmth, parental academic pressure, anxiety, and depression were examined (Quach, Epstein, Riley, Falconier, & Fang, 2015). Results indicated that academic pressure from both mothers and fathers was significantly correlated with anxiety for males and females ($\rho = .28$ to $.39$). These findings suggest that higher academic pressure from either parent is associated

with higher levels of trait anxiety. A follow-up path analysis corroborated these findings by demonstrating significant path coefficients between anxiety and academic pressure from both parents, with the exception of mother's academic pressure to male anxiety. In contrast, parental warmth from both mothers and fathers was significantly negatively correlated with anxiety ($\rho = -.22$ to $-.28$), suggesting that greater perceptions of comfort and acceptance from parents are associated with lower anxiety. Although Quach and colleagues concluded that anxiety is associated with parental factors, the generalizability of these findings is unclear. This study was conducted with a sample of students from a collectivist culture in which family values and well-being are emphasized above that of the individual.

A similar evaluation by Chen (2012) was also conducted with high school students in China by collecting self-reports of test anxiety, parental pressure, and parent's socioeconomic status. The path coefficient between test anxiety and perceived parental pressure was significant ($\beta = .861$), indicating that higher perceptions of parental pressure predicted higher test anxiety. Surprisingly, Chen's results are much stronger than those reported in previous research. As in Quach et al. (2015), Chen's findings suggest that the effects of parental pressure on test anxiety in Asian culture may be qualitatively and quantitatively different than what would be expected of American students. Many Chinese families emphasize collectivist values, such as filial piety and family glory (Chen, 2012). As a result, Chinese students may experience more profound test anxiety than Western students because they attempt to honor their family through their academic achievements (Chen, 2012). Therefore, students from collectivist cultures may be more likely to experience parental pressure because of the emphasis on family honor and achievement over individual achievements.

Agliata and Renk (2009) conducted one of the few evaluating parental pressure among American students. They assessed 174 culturally diverse undergraduates from the southeastern United States on their perceptions of parental pressure as measured by the Living Up to Parental Expectations Inventory (LPEI). The LPEI assesses student perceptions of parental expectations and self-performance, and the discrepancy between these two subscales is used to determine an individual's perception of living up to his or her parents' expectations. The outcomes resulted in a significant negative correlation between anxiety and student perceptions of living up to parental expectations ($r = -.33$). The more strongly a student believed he or she was not living up to parents' expectations, the higher his or her general anxiety. This may occur due to fear of social evaluation by a student's parents when he or she does not perform well academically.

The relationship between family environment and academic achievement may be more difficult to discern. Family often plays a large role in supporting academic success during the early school years, so it seems evident that interactions between family members would influence academic outcomes. However, parent behaviors and expectations may play a facilitative or detrimental role. For example, some studies have found that family warmth and support is associated with higher academic achievement (Richardson et al., 2012; Robbins et al., 2004; Rogers, Theule, Ryan, Adams, & Keating, 2009; Yildirim et al., 2008), whereas others have demonstrated a positive but negligible relationship (Greenberger et al., 2008). Social support provided by family members might serve as a coping mechanism for students with test anxiety (Zeidner, 1998), providing students with an outlet in which to verbalize their fears and be reassured that they are capable of success.

When children perceive their parents' expectations as unattainable or feel their parents are overly critical of their academic performance, their academic achievement may be impacted.

Some research indicates that the perception of more parental pressure is associated with a decline in academic outcomes. In a study of 5th and 6th grade students from Canada, Rogers and colleagues (2009) found significant correlations between perceived academic pressure from mothers and overall achievement ($r = - .22$), as well as achievement in science and language arts specifically. Significant correlations were also observed between perceived academic pressure from fathers and overall achievement ($r = - .29$), as well as achievement in math, science, and language arts. However, separate path analyses for mothers and fathers demonstrated that academic pressure did not have a direct relationship with academic achievement. Rather, parental pressure indirectly influenced academic achievement by decreasing the child's academic competence (i.e., motivation, academic skills, and study skills). Academic pressure from fathers exhibit a greater impacts on academic competence and, ultimately, achievement.

Lastly, Greenberger and colleagues (2008) collected self-report data regarding self-entitlement and parent factors among culturally diverse American college students. The results showed significant correlations between parental academic expectations ($r = - .12$), as well as parent use of social comparison and GPA ($r = - .15$). The social comparison measure evaluated the extent to which students felt that their parents compared their achievement to others. Hierarchical regression of GPA on both parent variables showed that test anxiety was the only significant predictor of GPA and parental pressure did not predict GPA. Thus, these studies only exhibited support for the achievement and parental pressure relationship when correlational data was examined. It should be noted, however, that this may be due to the other variables chosen for inclusion in these studies.

The movement towards increased educational accountability and the accompanying increases in high-stakes testing has occasioned researchers to examine how test anxiety is related

to academic achievement and well-being. Furthermore, a number of effective interventions have been developed to address the cognitive, physiological, and behavioral features of test anxiety, as well as improve academic functioning. Given the multidimensionality of test anxiety, it is likely that its predictors and the relationships between them are complex. Evaluation of the predictors of test anxiety may provide more evidence for specific avenues of prevention and intervention research and application. While many of the variables previously described have been evaluated in the existing literature, there has been no study to date examining the current hypothesized path model of psychological and environmental predictors of test anxiety.

Hypotheses

Hypothesis 1: Trait anxiety will be a significant predictor of test anxiety, such that higher ratings of trait anxiety predict higher ratings of test anxiety. It is hypothesized that trait anxiety will be the strongest predictor of test anxiety.

Hypothesis 2: Parental pressure will be a significant predictor of test anxiety, such that higher ratings of parental pressure predict higher ratings of test anxiety.

Hypothesis 3: Academic self-efficacy will be a significant predictor of test anxiety, such that lower ratings of academic self-efficacy predict higher ratings of test anxiety.

Hypothesis 4: Academic achievement will be a significant predictor of test anxiety, such that lower ratings of academic achievement predict higher ratings of test anxiety.

METHOD

Participants and Setting

Participants in this study were college undergraduates enrolled in entry-level psychology classes at a large public university in south Louisiana. All participants provided informed consent prior to accessing the questionnaire. Demographic information regarding gender, ethnicity, presence or absence of a psychiatric or educational diagnosis, and number of semesters completed was ascertained. All participants who reported the current semester as their first semester of college, or who had not previously completed one full semester, were excluded from the study in order to generate comparable college GPAs. Participants were recruited via the SONA online research participation system and completed questionnaires on a remote computer. As such, participants had no face-to-face contact with the researcher.

Although structural equation modeling (SEM) does not employ strict guidelines for *a priori* sample size estimation, a sample of 200 participants is generally considered large, though complex structural models may require a larger sample size (Kline, 2005). Of the 498 students recruited for participation, 28 had not completed one full semester of college and one did not specify a GPA. All other questionnaire responses were completed. As a result, 469 participants were included in the data screening process.

Research Design

Proposed hypotheses were evaluated using the latent variable path analysis approach to SEM. Latent variable path analysis was the chosen multivariate statistical approach in order to estimate and analyze both measurement and structural models of the relationships between test anxiety and potential predictors identified by existing research (Mueller & Hancock, 2010). A measurement model depicts indicators (measured variables) and latent factors (hypothetical constructs) without specification of hypothesized relationships between the factors (Kline, 2005).

Following the final specification of the measurement model, a structural model is specified depicting the hypothesized direct and indirect relationships between latent factors (Kline, 2005).

The measurement phase is evaluated using confirmatory factor analysis (CFA). First, a CFA model is identified; that is, the number of observations must equal or exceed the number of parameters to be estimated (Kline, 2005). Kline also recommends each latent factor have a minimum of three indicators in order to increase the probability of identification. Next, the model parameters are estimated. Standardized estimates include the correlations between each factor, as well as the factor loadings of each indicator on its factor (Kline, 2005). Next, model fit is evaluated by examining predetermined model fit indices (see below). If the estimated fit indices meet the predetermined criteria, the initial model has attained adequate model fit and no further modifications are necessary. If fit indices demonstrate inadequate model fit, the model may be respecified based on statistical modification indices and theoretical reasoning (Mueller & Hancock, 2010). The Lagrange Multiplier (LM) test is a statistical analysis that provides modification indices that may be considered to improve model fit. Specifically, the LM test determines the extent to which the model chi-square improves when a fixed parameter is freed to be estimated (Kline, 2005; Mueller & Hancock, 2010; Tabachnick & Fidell, 2013). In this study, both LM and theory were used to justify modifications.

The structural phase imposes the hypothesized model on the final measurement model, increasing confidence that appropriateness of model fit is due to the hypothesized relationships between latent factors rather than measurement error (Mueller & Hancock, 2010). During the structural phase, the researcher specifies the hypothesized directionality between latent factors, then follows the steps used during the measurement phase (identification, estimation, model fit evaluation, and respecification when necessary; Kline, 2005).

Instruments

Revised Test Anxiety Scale. In the current study, the primary variable of interest was test anxiety. The Revised Test Anxiety Scale (RTA; Benson & El-Zahhar, 1994) is a self-report measure of test anxiety normed on a multinational sample of undergraduate and graduate students. It was developed based on a combination of items from the Test Anxiety Inventory (Spielberger, Gonzalez, Taylor, Algaze, & Anton, 1978; as cited in Benson & El-Zahhar, 1994) and Reactions To Tests (I. Sarason, 1984; as cited in Benson & El-Zahhar, 1994). The RTA contains 20 items measuring total test anxiety and is made up of four subscales: Worry, Test-Irrelevant Thinking, Tension, and Bodily Symptoms. Worry includes six items that reflect cognitions about the testing situation (e.g., “During tests I find myself thinking about the consequences of failing). Test-Irrelevant Thinking includes four items assessing cognitions that are unrelated to the test (e.g., “While taking tests, I sometimes think about being somewhere else). Tension includes five items reflecting uneasiness about tests (e.g., “During tests I feel very tense). Bodily Symptoms includes five items reflecting somatic symptoms during tests (e.g., “I get a headache during an important test”). Participants rated each item using a 4-point Likert scale ranging from 1 (Almost Never) to 4 (Almost Always), with higher ratings indicating greater test anxiety symptomology. In the original scale development study, confirmatory factor analysis demonstrated good internal consistency reliability for the overall scale ($\alpha=.89$) with subscale reliabilities ranging from .71 to .84. A replication with Irish undergraduate students supported the original factor structure, and the cognitive subscales (Worry and Test-Irrelevant Thoughts) were predictive of performance on exams when controlling for previous performance (McIlroy, Bunting, & Adamson, 2000).

State-Trait Anxiety Inventory Form Y – Trait Anxiety Subscale. The Trait Anxiety subscale of the State-Trait Anxiety Inventory (STAI; Spielberger, 1983) is a self-report measure of anxiety that is generally stable over time. This subscale contains 20 items, including 11 anxiety-present items. Participants rated each item using a 4-point Likert scale ranging from 1 (Almost Never) to 4 (Almost Always), and anxiety-absent items were reverse scored. The STAI – Form Y was developed with large samples of adults, military recruits, high school students, and college students, with separate norms available for each sample. The original development studies reported an internal consistency reliability of .90 for males and .91 for females. Test-retest coefficients were .71 for males and .75 for females at 30 days, and .68 for males and .65 for females at 60 days. When compared with existing trait anxiety scales, concurrent validity of the previous STAI (Form X) was supported by Pearson correlation coefficients of .73 to .80.

Motivated Strategies for Learning Questionnaire – Self-Efficacy for Learning and Performance Subscale. The Self-Efficacy for Learning and Performance subscale of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1993) is a self-report measure of academic performance self-efficacy normed on a sample of Midwestern university students. The Self-Efficacy subscale contains eight items measuring a student's perception of his or her ability to master and perform academic skills (e.g., "I'm confident I can do an excellent job on the assignments and tests in this course"). Participants rated each item using a 7-point Likert scale ranging from 1 (Not At All True of Me) to 7 (Very True of Me), with higher ratings indicating higher perceived academic self-efficacy. In the original scale development study, confirmatory factor analysis indicated that the eight items demonstrated reliability coefficients ranging from .63 to .89 and excellent overall reliability ($\alpha =$

.93). Additionally, the final course grade demonstrated a Pearson correlation coefficient of .41 and supported the scale's predictive validity.

Frost Multidimensional Perfectionism Scale – Parental Expectations and Parental Criticism Subscales. The Parental Expectations and Parental Criticism subscales of the Frost Multidimensional Perfectionism Scale (FMPS; Frost, Marten, Lahart, & Rosenblate, 1990) are self-report measures of student perceptions of the intensity of their parents' general expectations and use of criticism. The Parental Expectations subscale contains five items (e.g., “Only outstanding performance is good enough in my family”), and the Parental Criticism subscale contains four items (e.g., “My parents never tried to understand my mistakes”). Participants rated each item using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with higher ratings indicating a stronger perception of unattainable parent expectations and criticism. Frost and colleagues developed the measure using samples of North American female college students. The original study reported an internal consistency reliability of .84 for both subscales. Similar reliabilities ($\alpha = .81-.88$) have been found using multinational samples of both males and females (Greenberger et al., 2008; Harvey, Pallant, & Harvey, 2004; Stober, 1998). In the original scale, the Parental Expectations and Parental Criticism subscales were measures of separate constructs. Since that time, several studies have determined that the factor structure is more appropriate when these scales are used in combination (Harvey et al., 2004; Purdon, Antony, & Swinson, 1999; Stober, 1998).

Academic Achievement. Self-report of each participant's overall college GPA was used as an indicator of academic achievement. Because participants who had not completed one full semester of college did not have a comparable GPA, they were excluded from data analysis.

Big Five Inventory – Extraversion Subscale. The Extraversion subscale of the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991; as cited in John, Naumann, & Soto, 2008) is a self-report measure of extraversion normed on a sample of undergraduates from the western United States. The Extraversion subscale contains eight items measuring an individual's tendency to approach social situations (e.g., "I am someone who is talkative"). Participants rated each item using a 5-point Likert scale ranging from 1 (Disagree Strongly) to 5 (Agree Strongly). The higher the total score, the greater the level of extraversion. Confirmatory factor analysis demonstrated good internal consistency reliability ($\alpha = .86$). Convergent validity has also been supported by strong correlations with two alternate measures of extraversion.

This rating scale was included in order to evaluate discriminant validity with the RTA. Test anxiety is typically characterized by negative emotionality and fear of social evaluation similar to the neuroticism dimension of the Big Five. In contrast, extraversion is typically characterized by positive emotionality and sociability (John et al., 2008). A low correlation between test anxiety and extraversion would suggest that the measures assess different constructs, providing support for discriminant validity.

Data Analysis Procedures

Screening and Assumptions. Questionnaires were programmed to require a response for each item in order for the questionnaire to be electronically submitted, therefore no missing data was anticipated. However, the data was inspected to ensure no missing responses. If a missing response was identified, listwise deletion was used to remove that participant from the data set.

SEM programs require a number of statistical assumptions to be met in order to produce the most valid and reliable estimations. Specifically, most SEM programs assume multivariate normality, linearity, and a lack of multicollinearity and singularity (Kline, 2005; Tabachnick &

Fidell, 2013). Univariate outliers were addressed by examining boxplots of test anxiety, trait anxiety, academic achievement (i.e., GPA), academic self-efficacy, parental pressure, and age. Univariate outliers were defined as data points greater than or equal to three standard deviations above or below the mean (Mueller & Hancock, 2010), and only those outliers hypothesized to differ from the targeted population were removed. Additionally, multivariate outliers were assessed using Mahalanobis D, a statistical indicator used to identify data points exhibiting an extreme score on two or more variables (Kline, 2005; Tabachnick & Fidell, 2013). A statistical significance level of $p < .001$ was employed as the criterion (Kline, 2005), and all cases reaching statistical significance were removed from the data set.

Normality was assessed by analyzing the skewness and kurtosis of each continuous variable. Significance tests are commonly used to evaluate skew and kurtosis in small to moderate samples sizes, but Tabachnick and Fidell (2013) state that large sample sizes commonly produce statistical significance with only slight deviations from normality. As a result, visual analysis of histograms was conducted to determine the extent of skew and kurtosis. Additionally, conservative skewness and kurtosis values less than the absolute value of two were also considered (Mueller & Hancock, 2010).

Linearity was assessed for all pairs of variables using both bivariate scatterplots and curve estimation. Visual inspection of bivariate scatterplots was used as the primary analysis (Tabachnick & Fidell, 2013) and curve estimation as a secondary procedure when scatterplot patterns were undiscernible. A bivariate scatterplot exhibits linearity when the data points resemble a straight line with no curve. In the current study, it was frequently difficult to detect a shape from the bivariate scatterplots. As a result, the researcher often relied upon statistical estimations to determine the best explanation for the relationship between pairs of variables. In

addition, homoscedasticity was assessed by plotting the standardized residuals against the standardized predicted values of each combination of variables (Field, 2009). Each scatterplot was visually inspected to determine whether the variance of one variable was equally distributed across the values of the second variable (Tabachnick & Fidell, 2013).

Multicollinearity was assessed to ensure that no two variables were highly correlated, suggesting that they measure the same construct thereby making certain statistical analyses unstable or not possible (Kline, 2005; Tabachnick & Fidell, 2013). Multicollinearity was assessed by computing the tolerance value and variance inflation factor (VIF) between each variable and all other variables (Kline, 2005). Tolerance values below .10 and VIF values above 10 were used as criteria to identify multicollinearity (Field, 2009; Kline, 2005).

Measurement Model. The measurement model was analyzed by conducting a CFA using IBM® SPSS® Amos 23. All items of each rating scale were indicators of their respective latent factors, and each factor was free to covary. Results were analyzed to determine the appropriateness of standardized factor loadings and covariances between factors. If indicators with factor loadings below .50 were identified, the model was altered to improve convergent validity of the rating scales. Validity was also assessed by calculating the average variance extracted (AVE) for each rating scale, with a recommended AVE value of .50 or above (Mueller & Hancock, 2010). In addition, pairs of factors were examined for covariances greater than .85, which might suggest a lack of discriminant validity (Kline, 2005). Finally, Coefficient *H* was calculated for each factor to evaluate internal consistency reliability of the rating scales, with coefficients of .70 or above indicating acceptable reliability (Mueller & Hancock, 2010).

Because there is no gold standard for model-fit indices, multiple indices were used to determine model fit. For the purposes of this study, comparative fit index (CFI) values at or

above .95 (Mueller & Hancock, 2010; Tabachnick & Fidell, 2013), root mean square error of approximation (RMSEA) values below .08 (Kline, 2005; Vandenberg & Lance, 2000), and standardized root mean square residual (SRMR) values below .10 (Kline, 2005; Vandenberg & Lance, 2000) were considered representative of good model fit. If model fit was not adequate, the LM test was used to determine how best to modify the model. The model was reestimated, within the bounds of theory, until a satisfactory model was reached.

Measurement Invariance. In order to determine whether the model was equivalent across males and females, the intention of this study was to conduct a multi-group CFA by gender (Kline, 2005). If justifiable, tests of configural invariance (equivalent factor structure), metric invariance (equivalent factor loadings), and scalar invariance (equivalent item intercepts) were compared in a hierarchical fashion (Vandenberg & Lance, 2000). Measurement invariance was examined using the same model fit indices described above (CFI, RMSEA, and SRMR) in addition to the change in CFI between models (Δ CFI; Vandenberg & Lance, 2000). Those with Δ CFI values of $\leq .002$ were to be considered invariant, and all models (configural, metric, and scalar) were to meet this criteria in order to consider the model fully invariant (Meade, Johnson, & Braddy, 2008). If fully invariant, latent means were to be analyzed by examining the statistical significance ($p < .05$) and effect sizes (Cohen's d) of the estimated standardized mean differences between males and females (Kline, 2005). In this study, configural invariance was not supported (see Results). No further tests could be conducted as the model was theoretically measuring different constructs between males and females (Vandenberg & Lance, 2000).

Structural Model. Once the final measurement model was achieved, a chi-square difference test was to be conducted to determine differences between the final measurement model and hypothesized structural model (Mueller & Hancock, 2010). However, the model was

just-identified; therefore, the chi-square statistic for the hypothesized structural model could not be calculated (see Results). Model fit of the structural model was evaluated by examining CFI, RMSEA, and SRMR indices based on the criteria reported in the previous section. If model fit was not adequate, theory and LM tests were used to modify and reestimate the model until a satisfactory model fit was reached. All exploratory modifications to the structural model are reported in the following sections, as are the standardized parameter estimates, statistical significance, and the proportion of the variance explained by the model.

RESULTS

Data Screening

Missing Data. The researcher developed the survey within SONA such that all items were required to be completed in order for the survey to be submitted. However, one GPA value was missing; as a result, listwise deletion was used to remove that participant. No other missing data was identified. The researcher also restricted possible item responses to predetermined numerical values, with the exception of the number of college semesters completed and GPA. If a participant responded to a question with a written rather than numeric response (e.g., “three” semesters instead of “3”), the response was changed to a numeric value.

Univariate Outliers. All assumptions and basic statistical analyses were conducted using IBM® SPSS® 23. Boxplots were used to screen for univariate outliers on all continuous variables, including age. The average participant age was 20.48 years ($SD = 1.80$), and nine outliers were identified ranging from 26 to 37 years of age. All nine outliers were removed as it was hypothesized that older participants represented a different population than the typical college undergraduate (e.g., late college entry, spouses and dependents). The average participant GPA was 3.28 ($SD = .48$), and two outliers were identified ranging from 1.70 to 1.80. While these responses were significantly different, they neared the cutoff of 1.83 and did not appear to be practically different from other responses. As a result, this data was retained. The average participant academic self-efficacy was 39.99 ($SD = 9.28$), and one outlier was identified with a value of 8. Visual inspection of this participant’s data showed that, while the responses on each item of the MSLQ were the same, responses across all other rating scales showed variation. Based on the variation in overall responding, it was assumed that this participant’s responding on the MSLQ was honest; therefore, this data was retained. No outliers were identified for any of the remaining continuous variables.

Normality. Skewness and kurtosis values were calculated and assessed for all variables to be included in SEM. Visual inspection indicated that test anxiety scores were normally distributed with a skewness of .26 ($SE = .11$) and kurtosis of $-.52$ ($SE = .23$). Trait anxiety scores were also normally distributed with a skewness of .07 ($SE = .11$) and kurtosis of $-.61$ ($SE = .23$). Academic achievement appeared to exhibit negative skew, but numerical criteria suggested it was normally distributed with a skewness of $-.54$ ($SE = .11$) and kurtosis of $-.24$ ($SE = .23$). Academic self-efficacy exhibited similar characteristics with a skewness of $-.43$ ($SE = .11$) and kurtosis of $-.16$ ($SE = .23$). Lastly, both visual inspection and numerical criterion confirmed that parental pressure scores were normally distributed with a skewness of .21 ($SE = .11$) and kurtosis of $-.26$ ($SE = .23$).

Linearity. Either visual inspection of bivariate scatterplots or curve estimation procedures demonstrated linearity among the following pairs of variables: test anxiety and trait anxiety, test anxiety and academic achievement, test anxiety and academic self-efficacy, trait anxiety and academic self-efficacy, trait anxiety and parental pressure, and academic achievement and academic self-efficacy. Several pairs of variables demonstrated nonlinear relationships that should be addressed. Among these variable pairs, scatterplot patterns were ambiguous and curve estimation confirmed that the relationships were better explained by a nonlinear model. This occurred for several relationships with parental pressure. Test anxiety and parental pressure exhibited a significant linear relationship; however, the relationship was best explained by a quadratic model. Academic achievement and parental pressure also exhibited a significant linear relationship, but was better described as a compound, growth, exponential, or logistic model. Academic self-efficacy and parental pressure did not exhibit a linear relationship, and the relationship was best explained by a quadratic model. Lastly, trait anxiety and academic

achievement exhibited a significant linear relationship, but was better explained as an inverse model.

Homoscedasticity. Homoscedasticity was assessed by plotting the standardized residuals against the standardized predicted values of each combination of variables (Field, 2009). Each scatterplot was visually inspected to determine whether the variance of one variable was roughly equally distributed across the values of the second variable (Tabachnick & Fidell, 2013). It was concluded that nearly all pairs of variables exhibited homoscedasticity, with the exception of two scatterplots. Trait anxiety and academic self-efficacy as well as academic achievement and academic self-efficacy exhibited a slight funnel shape, suggesting some heteroscedasticity. Tabachnick and Fidell (2013) stated that analyses of ungrouped data are fairly robust to violations of homoscedasticity. However, if a multi-group CFA by gender was conducted, violations of homoscedasticity (i.e., homogeneity of variance) would weaken the analysis and limit interpretation.

Discriminant Validity. Discriminant validity was assessed by calculating the Pearson correlation coefficient between test anxiety, as measured by the RTA, and extraversion, as measured by the corresponding subscale of the BFI. There was a significant correlation between test anxiety and extraversion, $r = -.09, p < .05$. Given the negligible effect size, however, significance was likely a byproduct of large sample size. The negligible correlation supported the theory that these two measures assess different constructs, providing support for discriminant validity.

Exploratory Factor Analysis

Originally, SEM was intended to be used to evaluate the measurement model without a preliminary exploratory factor analysis (EFA). However, data screening demonstrated several

violations of statistical assumptions. Additionally, the preliminary measurement model exhibited very poor model fit across all indices, and modification indices suggested that many modifications to items and residuals would have been necessary to achieve acceptable model fit. In response, an EFA was conducted for each rating scale representing a latent factor in the hypothesized model. The purpose of EFA was to address items that were adversely impacting validity and reliability and, thus, fit of the measurement model.

EFA is a statistical tool for summarizing the correlations between variables, as well as identifying and minimizing redundant items that do not significantly improve the factor structure (Tabachnick & Fidell, 2013). The goal of EFA is simple structure, or the most parsimonious explanation of the data while maximizing variation that is accounted for (Thurstone, 1947; as cited in Tabachnick & Fidell, 2013). When simple structure is obtained, each item exhibits a high correlation with one factor and little to no correlation with all other extracted factors within the same measure. While it was of interest to note differences in factor structure based on the current data set in comparison to the original development studies, the primary goal of this study was to remove problematic items so as to generate the strongest possible baseline measurement model in SEM.

Following data extraction, rotation may be used to create a more interpretable pattern of correlations (Tabachnick & Fidell, 2013). The method of rotation may be orthogonal, in which it is hypothesized that factors are uncorrelated, or oblique, in which it is hypothesized that factors are correlated. While orthogonal rotation is widely used, many prefer the use of oblique rotation in psychological research as it is realistic to hypothesize that many psychological constructs are associated with one another (Fabrigar, Wegener, MacCallum, & Strahan, 1999). The current study utilized maximum likelihood factor extraction and oblique rotation to evaluate the factor

structure of each rating scale. Factor loadings with an absolute value of .32 or greater were considered significant (Tabachnick & Fidell, 2013), and any item that cross-loaded or did not meet this criterion was excluded from future analyses.

An EFA was conducted on the 20 items of the RTA using oblique rotation (promax). The Kaiser-Meyer-Olkin (KMO) measure was .94, a superb value according to Field (2009). Bartlett's test of sphericity $\chi^2 (190) = 4860.77, p < .001$, indicated that correlations between items were sufficiently large for EFA. An initial analysis was run by extracting only four factors, consistent with the validation study by Benson and El-Zahhar (1994). The four extracted factors demonstrated eigenvalues of .817 and above. However, visual inspection of the scree plot indicated that only three factors warranted being retained (Field, 2009), each of which were above Kaiser's criterion of 1 and in combination explained 53.42% of the variance. The three-factor solution combined items of the Worry and Tension subscales, with the exception of item eight which loaded on the Test-Irrelevant Thinking subscale. The wording of item eight ("While taking tests, I find myself thinking about how much brighter the other people are") could be construed as a test-irrelevant thought. Visual analysis of the pattern matrix revealed that item 19 cross-loaded with two factors; as a result, item 19 was removed from all future analyses. Following the removal of item 19, the three-factor solution continued to meet the interpretability criterion. The final three-factor solution explained 53.92% of the variance and exhibited simple structure, with factor loadings ranging from .37 to .91. The revised RTA exhibited excellent reliability, Cronbach's $\alpha = .93$. The factor loadings of the retained RTA items are presented in Table 1.

Table 1. Pattern Matrix of the RTA.

| RTA Indicator | Factor 1 | Factor 2 | Factor 3 |
|---------------|-------------|-------------|-------------|
| Item 6 | .909 | -.168 | -.071 |
| Item 12 | .896 | -.174 | .034 |
| Item 20 | .767 | -.003 | -.104 |
| Item 4 | .719 | -.110 | .029 |
| Item 5 | .678 | -.009 | .179 |
| Item 11 | .637 | .200 | -.076 |
| Item 3 | .560 | .238 | .026 |
| Item 2 | .513 | .242 | .113 |
| Item 1 | .466 | .250 | .043 |
| Item 14 | -.118 | .862 | -.007 |
| Item 7 | .024 | .845 | -.072 |
| Item 13 | .013 | .760 | -.009 |
| Item 9 | -.133 | .739 | .043 |
| Item 8 | .252 | .409 | .109 |
| Item 18 | -.177 | .048 | .823 |
| Item 16 | .096 | -.111 | .758 |
| Item 17 | .106 | -.022 | .706 |
| Item 15 | .005 | .005 | .605 |
| Item 10 | .100 | .179 | .367 |

An EFA was conducted on the 20 items of the Trait Anxiety subscale of the STAI using oblique rotation (promax). The KMO measure was superb at .95 (Field, 2009), and Bartlett's test of sphericity $\chi^2(190) = 4382.43, p < .001$, indicated that correlations between items were sufficiently large for EFA. An initial analysis was run to obtain eigenvalues for each factor in the data. Three factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 49.33% of the variance. Consistent with the original scale, visual inspection of the scree plot justified retaining only one factor, explaining 39.97% of the variance. The factor correlation matrix showed that 20% of the correlations between item 11 and the remaining variables were below .20, and the communality was a mere .17. This suggested that this variable shared little common variance with other variables (Field, 2009; Tabachnick & Fidell, 2013). As a result,

item 11 was removed from all future analyses. Following its removal, the factor solution continued to meet the interpretability criterion and explained 40.75% of the variance, with factor loadings ranging from .49 to .79. The revised STAI exhibited excellent reliability, Cronbach's $\alpha = .93$. Table 2 presents the factor loadings of the retained STAI items.

Table 2. Factor Matrix of the Trait Anxiety Subscale of the STAI.

| STAI Indicator | |
|----------------|------|
| Item 3 | .785 |
| Item 1 | .734 |
| Item 13 | .731 |
| Item 16 | .728 |
| Item 10 | .697 |
| Item 15 | .687 |
| Item 2 | .682 |
| Item 4 | .668 |
| Item 12 | .651 |
| Item 5 | .645 |
| Item 19 | .625 |
| Item 8 | .624 |
| Item 7 | .608 |
| Item 20 | .603 |
| Item 18 | .559 |
| Item 6 | .508 |
| Item 17 | .497 |
| Item 14 | .492 |
| Item 9 | .488 |

An EFA was conducted on the eight items of the Self-Efficacy for Learning and Performance subscale of the MSLQ using oblique rotation (promax). The KMO measure was superb at .92 (Field, 2009), and Bartlett's test of sphericity $\chi^2(28) = 3041.51, p < .001$, indicated that correlations between items were sufficiently large for EFA. An initial analysis was run to obtain eigenvalues for each factor in the data. One factor had an eigenvalue over Kaiser's

criterion of 1 and explained 66.40% of the variance. Visual inspection of the scree plot justified retaining only one factor, with factor loadings ranging from .68 to .88. The MSLQ exhibited excellent reliability, Cronbach's $\alpha = .94$. Table 3 presents the factor loadings of the MSLQ.

Table 3. Factor Matrix of the Self-Efficacy for Learning and Performance Subscale of the MSLQ.

| MSLQ Indicator | |
|----------------|------|
| Item 5 | .880 |
| Item 8 | .861 |
| Item 7 | .851 |
| Item 1 | .832 |
| Item 2 | .815 |
| Item 4 | .797 |
| Item 6 | .784 |
| Item 3 | .682 |

An EFA was conducted on the nine items of the combined Parental Expectations and Parental Criticism subscales of the FMPS using oblique rotation (promax). The KMO measure was great at .83 (Field, 2009), and Bartlett's test of sphericity $\chi^2(36) = 1672.02, p < .001$, indicated that correlations between items were sufficiently large for EFA. An initial analysis was run by extracting only two factors, one representing each of the subscales. The two extracted factors demonstrated eigenvalues above Kaiser's criterion of 1 and explained 52.02% of the variance. Visual inspection of the scree plot justified retaining two factors. The pattern matrix showed that item two cross-loaded with both factors; as a result, it was removed from all future analyses. Following item two's removal, item five then cross-loaded with both factors. Following the removal of item five, the two-factor solution continued to meet the interpretability criterion. The final two-factor solution explained 52.24% of the variance and exhibited simple structure, with factor loadings ranging from .53 to .90. The factor solution found in this study

was nearly equivalent to that of Stober (1998), with the exception of item eight (“My parents have always had higher expectations for my future than I have”) which loaded with the items of the Parental Criticism subscale. The revised FMPS exhibited acceptable reliability, Cronbach’s $\alpha = .77$. Table 4 presents the factor loadings of the retained FMPS items.

Table 4. Pattern Matrix of the Combined Parental Expectations and Parental Criticism Subscales of the FMPS.

| FMPS Indicator | Factor 1 | Factor 2 |
|----------------|-------------|-------------|
| Item 9 | .899 | -.051 |
| Item 7 | .860 | .001 |
| Item 3 | .594 | -.039 |
| Item 8 | .532 | .142 |
| Item 6 | .022 | .765 |
| Item 1 | -.055 | .678 |
| Item 4 | .047 | .623 |

Variable Transformation

Following the removal of items based on the EFA, several pairs of variables continued to exhibit nonlinear relationships. As a result, variable transformation was conducted after the completion of EFA. Because test anxiety and parental pressure did not exhibit a linear relationship, each value of parental pressure was squared. Assumptions were re-examined to evaluate any changes that occurred following item removal and variable transformation. These changes did not produce any differences in univariate outliers. Following transformation, parental pressure was normally distributed with skewness of .76 ($SE = .11$) and kurtosis of .16 ($SE = .23$). Trait anxiety and academic self-efficacy continued to exhibit slight heteroscedasticity, but remained minimal.

Linearity was again examined to determine whether variable transformation improved linearity between test anxiety and parental pressure. The bivariate scatterplot was ambiguous;

however, curve estimation showed that the relationship was best explained by a linear model. Parental pressure maintained a linear relationship with trait anxiety, but continued to exhibit a nonlinear relationship with academic achievement and academic self-efficacy.

A range of commonly employed plausible transformations of parental pressure were attempted to determine whether linearity with the other variables could be improved, but the current transformation was the most appropriate. The squared transformation was considered successful since test anxiety is hypothesized to be the sole criterion variable in the structural model. The violation of linearity with both academic achievement and academic self-efficacy will be a limitation if certain modifications are made to the model in which one of these variables predicts the other. However, it is common for variables to violate assumptions even after transformation (Tabachnick & Fidell, 2013).

Multivariate Outliers. The Mahalanobis D statistic was used to identify multivariate outliers and was estimated using the following variables: test anxiety, trait anxiety, academic achievement, academic self-efficacy, and parental pressure. One case was statistically significant at $p < .001$ and was removed from all future analyses.

Multicollinearity. Both tolerance and variance inflation factors (VIF) were analyzed to determine whether the assumption of the absence of multicollinearity was violated. The data showed that all tolerance and VIF values fell within the acceptable range, suggesting no multicollinearity between any of the variables.

Demographic Data

Following screening, a total of 459 participants were included in data analysis. The majority of participants were women ($n = 381$) and 17% were male ($n = 78$). Participants were a mean age of 20.31 ($SD = 1.24$). Most participants identified their ethnicity as Caucasian ($n =$

354), but the sample also included participants who identified as African American ($n = 61$), Asian/Pacific Islander ($n = 22$), Hispanic/Latino ($n = 11$), American Indian/Alaska Native ($n = 1$), and Other ($n = 10$). The sample included 101 participants who endorsed a current or previous psychiatric or educational diagnosis (e.g., Attention-Deficit/Hyperactivity Disorder, Specific Learning Disability). Participant demographics are presented in Table 5.

Table 5. Participant Demographics.

| Item | $N = 459$ |
|-----------------------------------|--------------|
| Gender | |
| Female | 381 (83.01%) |
| Male | 78 (16.99%) |
| Ethnicity | |
| Caucasian | 354 (77.12%) |
| African American | 61 (13.29%) |
| Asian/Pacific Islander | 22 (4.79%) |
| Hispanic/Latino | 11 (2.40%) |
| American Indian/Alaska Native | 1 (0.22%) |
| Other | 10 (2.18%) |
| Psychiatric/Educational Diagnosis | |
| No | 358 (78.00%) |
| Yes | 101 (22.00%) |

Group Means

Gender. In order to examine mean differences between males and females on each of the variables, independent samples t -tests were conducted. T -tests were conducted for each variable based on the sum of scores attained using the original rating scale structures (i.e., prior to the EFA). Levene's test for each variable was nonsignificant, supporting the assumption of homogeneity of variance between groups. On average, test anxiety was rated higher by females ($M = 47.97$, $SD = 12.18$) than males ($M = 40.46$, $SD = 11.29$). This difference was significant $t(457) = -5.02$, $p < .001$ and it represented a small to medium effect $d = .47$. Similarly, trait

anxiety was rated higher by females ($M = 46.55$, $SD = 11.23$) than males ($M = 42.62$, $SD = 10.33$), and represented a significant difference $t(457) = -2.86$, $p = .004$, but a small effect $d = .27$. Academic achievement of females ($M = 3.26$, $SD = .49$) and males ($M = 3.37$, $SD = .41$) did not significantly differ $t(457) = 1.89$, $p = .059$ and a demonstrated a negligible effect $d = .18$. Academic self-efficacy was rated lower by females ($M = 39.26$, $SD = 9.21$) than males ($M = 43.77$, $SD = 9.02$). This difference was significant $t(457) = 3.95$, $p < .001$ and demonstrated a small effect $d = .37$. Lastly, parental pressure was rated slightly lower by females ($M = 26.48$, $SD = 7.16$) than males ($M = 27.96$, $SD = 6.70$), but the difference was not significant $t(457) = 1.69$, $p = .092$ and the effect was negligible $d = .16$. Results are presented in Table 6.

Table 6. Independent Samples *T*-test by Gender.

| Variable | <u>Males</u> | | <u>Females</u> | | <i>t</i> | df | Sig. (2-tailed) | Cohen's <i>d</i> |
|------------------------|--------------|-----------|----------------|-----------|----------|-----|-----------------|------------------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | | | |
| Test Anxiety | 40.46 | 11.29 | 47.97 | 12.18 | -5.02 | 457 | .000 | .47 |
| Trait Anxiety | 42.62 | 10.33 | 46.55 | 11.23 | -2.86 | 457 | .004 | .27 |
| Academic Achievement | 3.37 | 0.41 | 3.26 | 0.49 | 1.89 | 457 | .059 | .18 |
| Academic Self-Efficacy | 43.77 | 9.02 | 39.26 | 9.21 | 3.95 | 457 | .000 | .37 |
| Parental Pressure | 27.96 | 6.7 | 26.48 | 7.16 | 1.69 | 457 | .092 | .16 |

Diagnosis. Independent samples *t*-tests were also conducted to examine mean differences between participants with and without psychiatric or educational diagnoses. Levene's test for each variable was nonsignificant, supporting the assumption of homogeneity of variance between groups. On average, test anxiety was rated higher by those with diagnoses ($M = 51.31$, $SD = 13.24$) than those without diagnoses ($M = 45.41$, $SD = 11.80$). This difference was significant $t(457) = -4.31$, $p < .001$ and represented a small effect $d = .40$. Similarly, trait anxiety was rated higher by those with diagnoses ($M = 50.31$, $SD = 10.91$) than those without ($M = 44.65$, $SD = 10.94$), and represented a significant difference $t(457) = -4.58$, $p < .001$ and small effect $d = .43$.

Academic achievement was lower for those with diagnoses ($M = 3.17$, $SD = .45$) than those without ($M = 3.31$, $SD = .48$). While this difference was statistically significant $t(457) = 2.72$, $p = .007$, it represented only a small effect $d = .25$. Academically self-efficacy was rated lower by those with diagnoses ($M = 36.71$, $SD = 9.73$) than those without ($M = 40.95$, $SD = 9.00$), and this difference was statistically significant $t(457) = 4.09$, $p < .001$ with a small effect $d = .38$. Lastly, parental pressure was rated roughly equivalent by those with diagnoses ($M = 27.12$, $SD = 7.91$) and those without ($M = 26.62$, $SD = 6.86$), demonstrating a nonsignificant difference $t(457) = -0.63$, $p = .532$ and a negligible effect $d = .06$. Results are presented in Table 7.

Table 7. Independent Samples *T*-test by Presence of Diagnoses.

| Variable | <u>No</u> | | <u>Yes</u> | | <i>t</i> | df | Sig. (2-tailed) | Cohen's <i>d</i> |
|------------------------|-----------|-----------|------------|-----------|----------|-----|-----------------|------------------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | | | |
| Test Anxiety | 45.41 | 11.80 | 51.31 | 13.24 | -4.31 | 457 | .000 | .40 |
| Trait Anxiety | 44.65 | 10.94 | 50.31 | 10.91 | -4.58 | 457 | .000 | .43 |
| Academic Achievement | 3.31 | 0.48 | 3.17 | 0.45 | 2.72 | 457 | .007 | .25 |
| Academic Self-Efficacy | 40.95 | 9.00 | 36.71 | 9.73 | 4.09 | 457 | .000 | .38 |
| Parental Pressure | 26.62 | 6.86 | 27.12 | 7.91 | -0.63 | 457 | .532 | .06 |

Measurement Model

A CFA was conducted using IBM® SPSS® Amos 23. The hypothesized model was a five-factor model including four latent factors (test anxiety, trait anxiety, academic self-efficacy, and parental pressure) and one observed factor (academic achievement). Indicators for each latent variable included all rating scale items retained following the EFA. Test anxiety included 19 indicators from the RTA, trait anxiety included 19 indicators from the STAI, academic self-efficacy included eight indicators from the MSLQ, and parental pressure included seven indicators from the FMPS. All five factors were hypothesized to covary with one another and were specified to be unconstrained.

Maximum likelihood estimation was used to estimate each model. The hypothesized model was estimated first and exhibited poor model fit, $\chi^2(1368) = 4444.73, p < .001, CFI = .78, SRMR = .08, RMSEA = .07, 90\% CI [.068, .072]$. Several post hoc model modifications were performed in an attempt to develop a better fitting model of the current data. Although all standardized factor loadings were significant, visual inspection of the estimates showed several factor loadings below the .50 criterion, including the following: items one, four, and six of the FMPS; item 14 of the STAI; and items nine and 15 of the RTA. First, the three items of the FMPS were removed in stepwise fashion, but the CFI continued to exhibit poor fit. In addition, a handful of factor loadings continued to fall below the .50 range. On the basis of that criterion, the remaining low factor loadings were removed in stepwise fashion, including items nine, 14, 15, and 18 of the RTA, as well as item nine of the STAI. Additionally, several residual error terms were specified to covary. However, only residuals of indicators measuring the same factor were allowed to covary. Following the final re-estimation, the model exhibited acceptable fit, $\chi^2(967) = 2184.45, p < .001, CFI = .90, SRMR = .06, RMSEA = .05, 90\% CI [.049, .055]$. Although the recommended CFI criterion was .95 (Mueller & Hancock, 2010; Tabachnick & Fidell, 2013), Kline states that a CFI as low as .90 may be considered acceptable (2005). Results of measurement model fit indices are presented in Table 8. The final measurement model with corresponding standardized parameter estimates is presented in Figure 1.

Table 8. Model Fit Indices of Hypothesized and Final Measurement Models.

| Measurement Models | χ^2 | df | <i>p</i> | CFI | RMSEA | SRMR |
|--------------------|----------|------|----------|-----|------------------|------|
| Hypothesized Model | 4432.155 | 1368 | .000 | .78 | .07 [.068, .072] | .08 |
| Final Model | 2176.68 | 967 | .000 | .90 | .05 [.049, .055] | .06 |

In comparison to the hypothesized CFA model, the respecified models permitted more parameters to be freely estimated, thus improving model fit. A chi-square difference test demonstrated a significant improvement in model fit between the hypothesized model and the final model, $\Delta\chi^2(401) = 2260.28, p < .001$. The final measurement model demonstrated that all factor loadings were above the .50 criterion, ranging from .51 to .88. Factor loadings for each

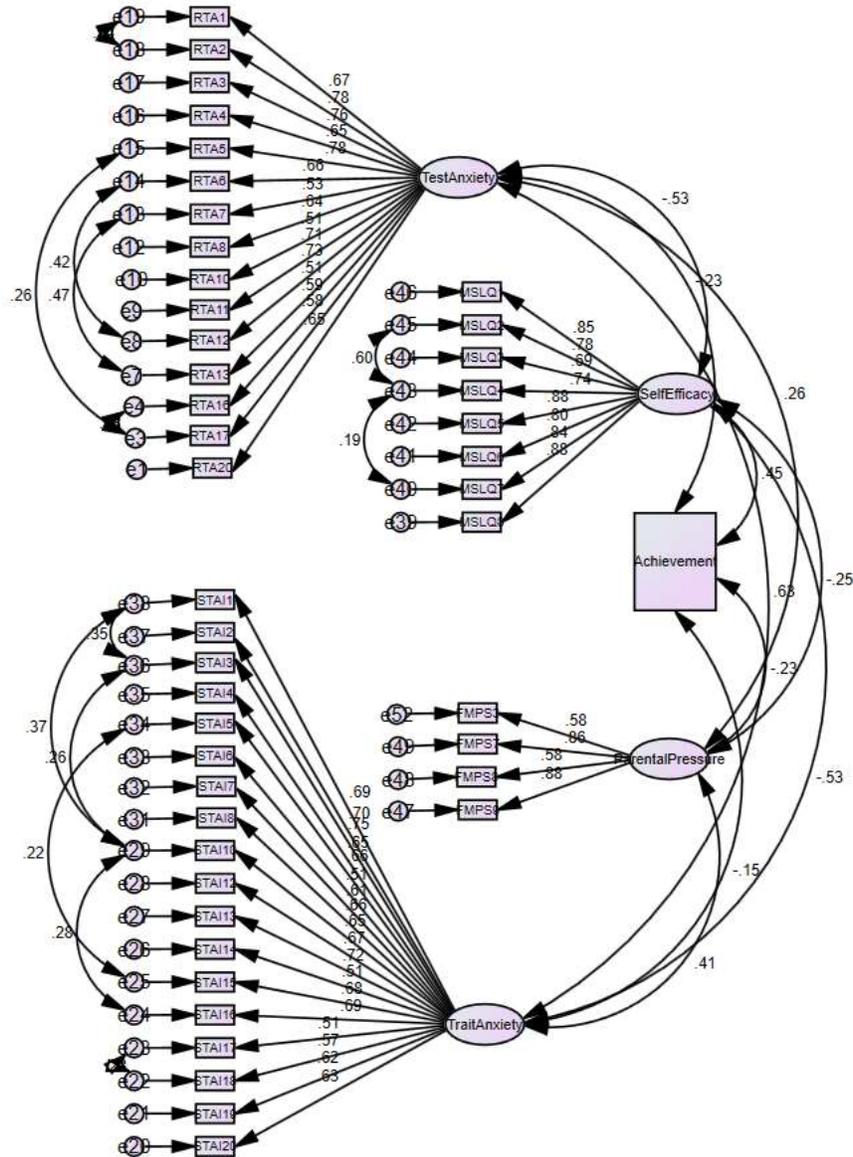


Figure 1. Final Measurement Model with Standardized Parameter Estimates.

factor were relatively high, suggesting support for convergent validity (Kline, 2005).

Additionally, correlations between factors fell below the .85 criterion, ranging from $-.15$ to $.63$.

Correlations between factors were low enough to support discriminant validity (Kline, 2005).

Validity was also examined by calculating the average variance extracted (AVE) for each latent factor. According to Mueller and Hancock (2010), an AVE value of $.50$ is desired. In the final measurement model, the MSLQ exhibited acceptable variance extracted (AVE = $.66$), as did the retained items of the FMPS (AVE = $.53$). The retained items of the RTA did not meet the criterion (AVE = $.43$), nor did those of the STAI (AVE = $.41$). Given the extent to which the indicators of both the RTA and STAI had been altered during EFA and CFA, as well as exhibiting standardized factor loadings above $.50$ for all indicators, the researcher opted not to improve AVE by removing additional indicators. Because several indicators exhibited similar or equivalent factor loadings, the removal of indicators would have been highly arbitrary and contributed to additional reductions to the integrity of the original scales.

Reliability was examined by calculating Coefficient H for each factor. Coefficient H is a measure of maximal reliability, or the extent to which a factor correlates with itself following several administrations (Mueller & Hancock, 2010). The RTA ($H = .93$), STAI ($H = .93$), MSLQ ($H = .95$), and FMPS ($H = .88$) all exhibited very good reliability and fell well above the $.70$ criterion recommended by Mueller and Hancock.

Measurement Invariance

In order to determine whether the measurement model measured the same constructs in comparable ways for males and females, tests of measurement invariance were conducted across gender. Vandenberg and Lance (2000) recommend examining configural invariance prior to any further invariance tests as it determines the extent to which the measurement model measures the

same constructs across groups. Thus, configural invariance is a prerequisite for more narrow tests such as metric and scalar invariance. Configural invariance was evaluated by conducting an unconstrained multi-group CFA and examining model fit. The resulting fit indices demonstrated configural noninvariance across males and females, $\chi^2(1934) = 3578.35, p < .001, CFI = .87, SRMR = .11, RMSEA = .04, 90\% CI [.041, .045]$. In this case, configural noninvariance suggested that there was a difference in the factor structure of the model based on gender. As a result, no further group comparisons could be conducted.

To determine the source of the differences between the measurement model among males and females, a separate CFA was conducted for each group. Model fit indices for the female group exhibited acceptable model fit, $\chi^2(967) = 1937.65, p < .001, CFI = .90, SRMR = .06, RMSEA = .05, 90\% CI [.048, .055]$. However, fit indices for the male group exhibited very poor fit, $\chi^2(967) = 1630.10, p < .001, CFI = .72, SRMR = .11, RMSEA = .09, 90\% CI [.086, .102]$. Thus, the data showed that the obtained measurement model demonstrated adequate factor structure for females, but not males.

Structural Model

The structural model was estimated based on the final measurement model obtained for the combined gender sample. The hypothesized model was a five-factor model including four exogenous variables (trait anxiety, academic achievement, academic self-efficacy, and parental pressure) and one endogenous variable (test anxiety). Each exogenous variable was specified to covary with all other exogenous variables. Maximum likelihood estimation was used to estimate the model. The hypothesized model had an equivalent number of observations and parameters to be estimated, therefore it was just-identified (Kline, 2005). As a result, chi-square, CFI, and SRMR could not be estimated and interpreted. The hypothesized model exhibited poor model fit,

$\chi^2(0) = .00, p < N/A, CFI = 1.00, SRMR = .00, RMSEA = .40, 90\% CI [.379, .428]$. The hypothesized model is presented in Figure 2. Solid lines denote significant paths, and dashed lines denote nonsignificant paths.

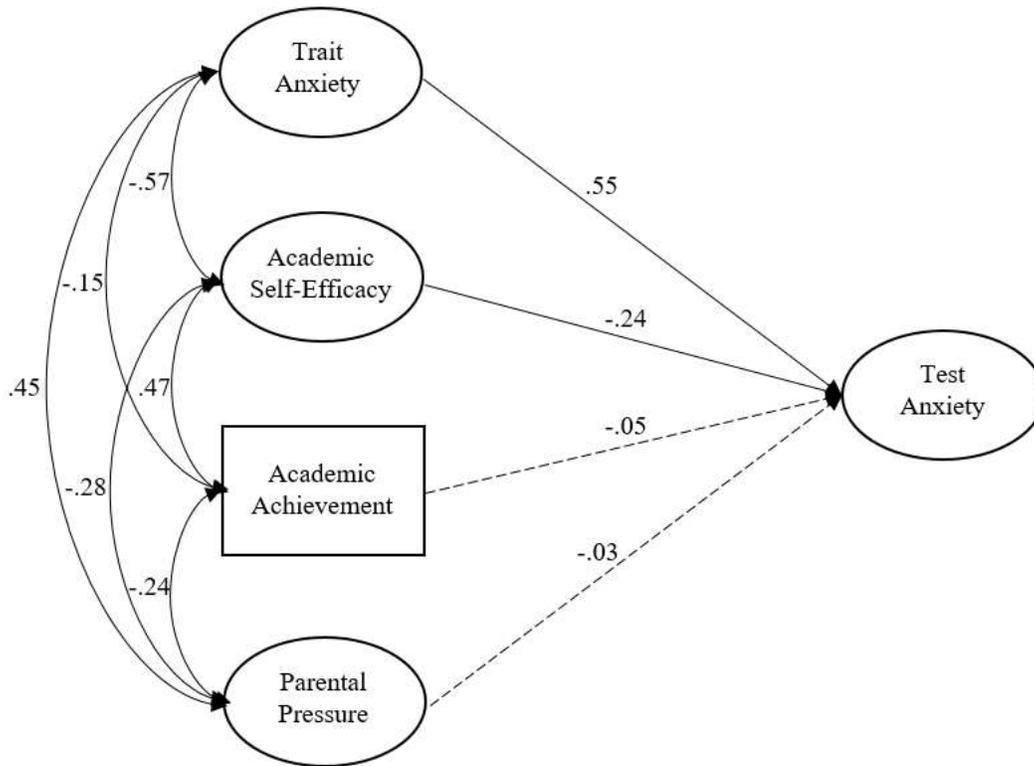


Figure 2. Hypothesized Structural Model of Test Anxiety.

Because the model was just-identified, the LM test could not be conducted to determine possible model modifications. As a result, the initial modification to the poor-fitting hypothesized model was based solely on theory. According to Bandura (1977), self-efficacy is influenced by previous experiences of success or failure. If one considers academic achievement to be indicative of past academic success or failure, it is possible that academic achievement predicts academic self-efficacy. Thus, the revised model (Model 2) included a path predicting

academic self-efficacy from academic achievement. Model 2 continued to exhibit poor fit, $\chi^2 (2) = 181.95, p < .001, CFI = .76, SRMR = .15, RMSEA = .44, 90\% CI [.390, .499]$.

Based on the results of Model 2, post hoc modifications were made within the bounds of theory to specify Model 3. On the basis of the LM test, a path with trait anxiety predicting academic self-efficacy was added. Model 3 exhibited much improvement in fit, $\chi^2 (1) = 2.14, p = .143, CFI = .99, SRMR = .01, RMSEA = .05, 90\% CI [.000, .145]$. However, the paths predicting test anxiety from academic achievement and parental pressure were nonsignificant. As a result, these paths were dropped in stepwise fashion to make the model more parsimonious. In Model 4, the path from academic achievement to test anxiety was dropped, $\chi^2 (2) = 3.69, p = .158, CFI = .99, SRMR = .01, RMSEA = .04, 90\% CI [.000, .111]$. Because the path from parental pressure to test anxiety remained nonsignificant, parental pressure was removed from the final model altogether. The final model exhibited acceptable model fit, $\chi^2 (1) = 1.20, p = .274, CFI = 1.00, SRMR = .01, RMSEA = .02, 90\% CI [.000, .128]$. Model fit indices for each estimated model and final parameter estimates are presented in Tables 9 and 10, respectively.

Table 9. Model Fit Indices of Computed Structural Models.

| Structural Models | χ^2 | df | <i>p</i> | CFI | RMSEA | SRMR |
|--------------------|----------|----|----------|------|------------------|------|
| Hypothesized Model | N/A | 0 | N/A | 1.00 | .40 [.379, .428] | .00 |
| Model 2 | 181.95 | 2 | .000 | .76 | .44 [.390, .499] | .15 |
| Model 3 | 2.14 | 1 | .143 | .99 | .05 [.000, .145] | .01 |
| Model 4 | 3.69 | 2 | .158 | .99 | .04 [.000, .111] | .01 |
| Final Model | 1.20 | 1 | .274 | 1.00 | .02 [.000, .128] | .01 |

Table 10. Parameter Estimates of Final Structural Model.

| Parameter Estimate | Unstandardized | S.E. | Standardized |
|--|----------------|------|--------------|
| Academic Self-Efficacy <--- Trait Anxiety | -1.08*** | .07 | -.51 |
| Academic Self-Efficacy <--- Academic Achievement | 0.93*** | .08 | .39 |
| Test Anxiety <--- Trait Anxiety | 0.57*** | .04 | .53 |
| Test Anxiety <--- Academic Self-Efficacy | -0.14*** | .02 | -.27 |

*** = $p < .001$

The large RMSEA confidence interval demonstrates a possibility that this fit index indicates poor model fit. However, the LM test suggested no further modifications were warranted, and the researcher chose not to make any theoretically unfounded alterations. Final model parameter estimates demonstrated that trait anxiety ($\beta = -.51$) and academic achievement ($\beta = .39$) were both significant predictors of academic self-efficacy. Additionally, trait anxiety ($\beta = .53$) and academic self-efficacy ($\beta = -.27$) were significant predictors of test anxiety. The model explained 51% of the variance in test anxiety and 47% of the variance in academic self-efficacy. Parameter estimates are presented in Table 10. The final structural model is presented in Figure 3.

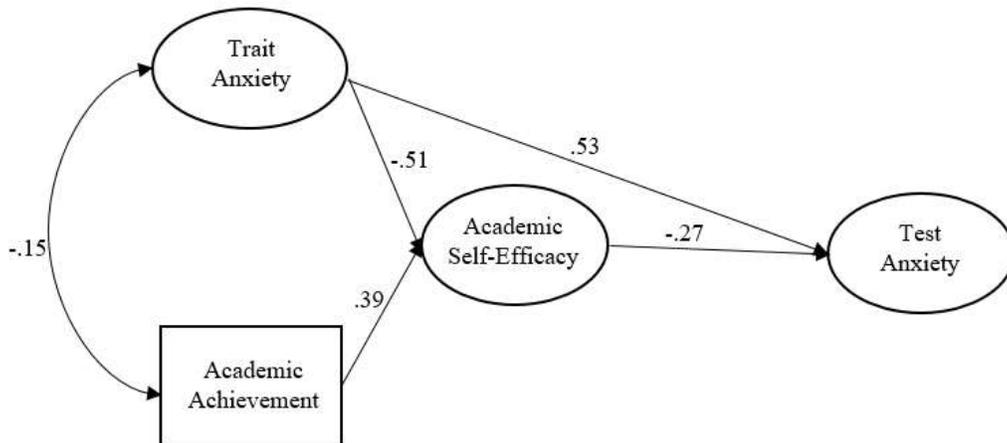


Figure 3. Final Structural Model of Test Anxiety.

Mediation

Once the best-fitting model was obtained, a mediation analysis was conducted. According to Baron and Kenny (1986), a mediator is a variable that explains the relationship between a set of variables. Baron and Kenny recommend using regression to test for mediation and outline several conditions for determining whether a variable functions as a mediator. First, a significant effect must be apparent when the mediator is regressed on the independent variable (IV). Second, a significant effect must be apparent when the dependent variable (DV) is regressed on the IV. Lastly, the potential mediator must significantly impact the DV when it is regressed on both the IV and mediator, with the effect of the IV decreasing when the mediator is included in the model. Support for mediation is strengthened via Sobel's significance test, or when the indirect effect of the IV on the DV is significant (Baron & Kenny, 1986).

In this study, it was necessary to determine whether academic self-efficacy mediated the relationship between trait anxiety (IV) and test anxiety (DV). The standardized regression weight from trait anxiety to academic self-efficacy was significant, $\beta = -.51, p < .001$. The direct effect of trait anxiety on test anxiety with academic self-efficacy removed from the model was also significant, $\beta = .68, p < .001$. Lastly, the direct effect of trait anxiety on test anxiety with academic self-efficacy in the model was smaller but still significant, $\beta = .53, p < .001$. The effect of trait anxiety on test anxiety was significant with or without academic self-efficacy in the model, but the decrease when the mediator was included provided preliminary evidence for partial mediation. The indirect effect confirmed that academic self-efficacy partially mediated the effect of trait anxiety on test anxiety ($p < .001$).

DISCUSSION

The purpose of the current study was to evaluate a model of test anxiety in college undergraduates by evaluating the influence of psychological and environmental variables hypothesized to have some effect on the severity of test anxiety. The hypothesized structural model included trait anxiety, academic achievement, academic self-efficacy, and parental pressure as direct predictors of test anxiety, with no mediation specified in the model. However, this model demonstrated poor fit and was revised to include trait anxiety and academic achievement as predictors of academic self-efficacy, while parental pressure was dropped due to its negligible contribution to the model. Thus, the final structural model included trait anxiety and academic achievement as predictors of academic self-efficacy, and trait anxiety and academic self-efficacy as predictors of test anxiety. Additionally, academic self-efficacy partially mediated the effects of trait anxiety on test anxiety, though trait anxiety continued to explain some unique variance in test anxiety that was not also explained through academic self-efficacy.

In the final structural model, nearly all fit indices provided support for the conclusion of good model fit. Although the RMSEA point estimate fell within the acceptable range, the 90% confidence interval indicated that one cannot have complete confidence that RMSEA was indicative of good model fit. Given that several modifications had to be made to the hypothesized model and the final LM test did not provide any statistical criteria for altering the model, the researcher opted to forego any further modifications.

It was hypothesized that trait anxiety would be a significant predictor of test anxiety, as well as the most robust predictor. The final model supported this hypothesis ($\beta = .53, p < .001$), demonstrating that students who reported higher trait anxiety also reported higher test anxiety, and vice versa. This is supported by previous studies showing that higher anxiety across situations is associated with higher test anxiety (Bonaccio & Reeve, 2010; Hembree, 1988;

Onyeizugbo, 2010). Specifically, individuals whose personalities make them prone to seeing stressful situations as overly threatening are more likely to perceive tests in this manner.

Though not part of the original structural model, trait anxiety was also a significant predictor of academic self-efficacy ($\beta = -.51, p < .001$). Therefore, greater anxiety-proneness predicted lower self-perceptions of one's ability to learn and perform well on academic assignments and tests. According to Kendall (1993), anxious individuals are more likely to underestimate their ability to cope with a threatening situation. Consequently, this perceived inability to cope may translate to the belief that one cannot carry out the tasks required to perform well on a test. Additionally, Bandura (1977) posited that emotional arousal can influence an individual's perceived self-efficacy. If anxiety-prone individuals are more likely to experience aversive physiological arousal in threatening situations, this arousal can produce more cognitive distortions and contribute to avoidance of the threatening situation.

It was hypothesized that academic self-efficacy would also be a significant predictor of test anxiety. The final model supported this hypothesis ($\beta = -.27, p < .001$), demonstrating that students who perceived themselves as having low academic self-efficacy reported higher test anxiety. This is consistent with existing research (e.g., Pajares & Kranzler, 1995; Pintrich & De Groot, 1990; Segool et al., 2014), indicating that students who feel incapable of completing the tasks required to be successful on a test experience heightened anxiety in response to testing situations. Interestingly, the final structural model demonstrated that the effect of trait anxiety on test anxiety was partially mediated by perceived academic self-efficacy. Hence, some of the influence of trait anxiety on test anxiety occurred because students made subjective judgments about their ability to successfully learn and perform academic tasks.

It was hypothesized that academic achievement would be a significant predictor of test anxiety; however, this hypothesis was not supported. Following estimation of the hypothesized structural model, academic achievement exhibited a negligible relationship with test anxiety ($\beta = -.05, p = .213$). This relationship remained nonsignificant after each modification to the model; as a result, the path from academic achievement to test anxiety was removed. This outcome was surprising given the vast literature regarding the relationship between test anxiety and GPA (e.g., Benjamin et al., 1981; Chapell et al., 2005; Greenberger et al., 2008; Richardson et al., 2012; Segool et al., 2014). However, several of these studies reported only small effects. For example, Segool and colleagues (2014) produced a model indicating that academic ability, a combination of total GPA and current GPA, was a significant negative predictor of test anxiety ($\beta = -.07, p < .01$). However, Segool's study included a sample nearly three times as large as the current study, which likely impacted the significance despite a standardized regression weight comparable to the outcomes presented here. In the current study, total GPA was the only indicator of academic achievement. Had academic achievement been measured using multiple indicators, it is likely that measurement error would have been reduced, thereby strengthening the parameter estimates and potentially producing a stronger relationship with test anxiety.

During modifications to the poor-fitting hypothesized model, a path from academic achievement to academic self-efficacy was added based on Bandura's (1977) theory that academic self-efficacy is affected by prior experiences of success or failure. In the final structural model, academic achievement was a significant predictor of academic self-efficacy ($\beta = .39, p < .001$). This suggested that lower GPA predicted lower perceptions of academic self-efficacy. Pajares (1996) stated that the direction of causality in self-efficacy studies will likely never be settled, and some existing literature has evaluated self-efficacy as a predictor of

achievement (e.g., Bandalos et al., 1995; Bong et al., 2012; Pajares & Kranzler, 1995). While some studies found self-efficacy to be a significant predictor of achievement (Bong et al., 2012; Pajares & Kranzler, 1995), others demonstrated a nonsignificant relationship (Bandalos et al., 1995). Because Bandura posited that self-efficacy is impacted by previous experiences of success and failure, the current study contended that it was theoretically plausible for academic achievement to predict academic self-efficacy. If a student has experienced repeated academic failure (e.g., inaccurate assignments, failed tests), particularly during earlier school years, he or she may have lowered expectations of their ability to perform (Bandura, 1977). Assuming academic failures are reflected in a student's overall GPA, it is conceivable that GPA could predict academic self-efficacy.

It was hypothesized that parental pressure would be a significant predictor of test anxiety, but this hypothesis also was not supported. After estimating the hypothesized structural model, parental pressure demonstrated a negligible relationship with test anxiety ($\beta = -.03, p = .396$). The effects remained negligible following modifications to the model; therefore, this parental pressure was removed from the final structural model. Currently, few studies have examined the relationship between parent factors and test anxiety, of which most have been correlational (Greenberger et al., 2008; Putwain et al., 2010; Quach et al., 2015; Singh & Broota, 1992). The number of studies conducted with American students is even scarcer, limiting the extent to which one can make conclusions about the influence of parent factors in the United States specifically. It is possible that parental pressure has little impact on test anxiety among college students because they no longer reside with their parents and/or have less direct contact. Because college students are adults, their parents do not have access to grades or test scores without the student's consent. Furthermore, parents are limited in the extent to which they can implement sanctions for

poor academic performance. Social evaluation may be less salient when a student does not interact face-to-face with a disappointed parent. On the other hand, it may be that parental pressure shapes psychological well-being during childhood and adolescence, becoming internalized as the student matures. Persistent academic evaluation by parents may cause the student to be more critical of his or her academic performance and, by adulthood, parental pressure may manifest as anxiety. Thus, it is possible that these results reflect a genuine difference from previous research due in part to the age and characteristics of the sample.

Limitations

This study posed several challenges with respect to both the measurement and structural components. First, the rating scale employed to measure parental pressure exhibited several psychometric issues. The original data based on the FMPS was transformed due to nonlinear relationships with multiple variables. Additionally, a total of five items were removed from the original rating scale following EFA and CFA. Although item removal statistically improved convergent validity and linearity, modifications to the indicators may have resulted in the measurement of a different construct. Given that the FMPS in its full form is intended to measure perfectionism, the selected subscales may not have provided the best measure of parental pressure as defined in this study.

Second, the measurement model required several respecifications in order to achieve reasonable fit. Model respecification resulted in the removal of several indicators with factor loadings below .50, particularly those of FMPS (see above) and RTA. Additionally, LM tests showed that several residual error terms were correlated. As a result, some residuals of indicators measuring the same factor were freed to covary. Although standard CFA assumes residuals are independent of each other (Kline, 2005), it was theoretically plausible that indicators within the

same rating scale were correlated (e.g., “During tests I feel very tense” and “While taking a test my muscles are very tight”). Despite modifications to the RTA during CFA, the retained indicators only extracted an average of 43% of the variance. As a result, the RTA may not have been the most valid or robust measure of test anxiety for this sample. Given the psychometric concerns of the measurement model, these findings should be interpreted with caution and the outcomes considered exploratory.

Third, configural noninvariance precluded the researcher from analyzing cross-group differences by gender. Specifically, the measurement model showed that the pattern of fixed versus free factor loadings was not equivalent across males and females. As a result, cross-group comparisons of factor loadings could not be conducted as meaningful comparisons could not be made (Vandenberg & Lance, 2000). It is possible that noninvariance was impacted by the predominance of female respondents, which made up 83% of the sample. The small number of male respondents may have resulted in decreased power when estimating parameters based on the male sample alone. Indeed, an anecdotal examination of model fit indices by gender showed that all indices were stronger for females than males. These outcomes limit one’s ability to make inferences about the implications of the structural model based on gender.

Lastly, it is likely that other factors influencing test anxiety were not included in the model. The final structural model explained 51% of the variance in test anxiety, and additional factors may have contributed to a more holistic understanding of what predicts test anxiety. For example, previous models have found school climate (Segool et al., 2014), mental ability (Pajares & Kranzler, 1995), and gender (Segool et al., 2014) to be significant predictors. In this study, the inclusion of additional predictors might have improved the current model or altered the relationships between predictor variables. Although a good-fitting structural model was

obtained, this occurred following exploratory modifications and does not imply that the model is “confirmed” (Mueller & Hancock, 2010). Therefore, one must consider that other models with additional or alternative factors may provide improvements over the final model obtained in the current study.

Future Directions

The current study contributes to the ongoing investigation of the myriad factors impacting to the severity of test anxiety. These outcomes provide provisional support that trait anxiety and academic self-efficacy are predictive of test anxiety in undergraduate students. Test anxiety continues to be an elusive construct requiring further investigation to inform evaluation and intervention efforts that improve student well-being. Further research is warranted to clarify the outcomes of this study and further improve theoretical and practical understandings of test anxiety.

This study should be replicated using more appropriate assessments and a sample with a more equivalent representation of males and females. While the rating scales used in this study exhibited internal consistency reliability, the scales measuring test anxiety and parental pressure appeared to have weak validity. The RTA exhibited insufficient average variance extracted (Mueller and Hancock, 2010), and a number of indicators were removed due to low factor loadings. Some items of the RTA appear similar in nature (e.g., “I think about current events during a test” and “During tests, I find I am distracted by thoughts of upcoming events”). Therefore, future research may benefit from updating the phrasing of items and dropping those items that are redundant. Additionally, five of the nine items of the FMPS subscales were dropped from analysis. The FMPS was developed with a female undergraduate sample (Frost et al., 1990), and validation studies have primarily been conducted with international samples of

adult participants (Harvey et al., 2004; Purdon et al., 1999; Stober, 1998). It would be of benefit to conduct further validation studies with samples of American students and refine existing items to improve construct validity. With improvements in validity, more substantive inferences regarding the fit and theoretical appropriateness of the models might be made. Additionally, a sample with roughly equivalent numbers of males and females may allow for the analysis of group differences, contributing to a better understanding of both the measurement and structural components of the model.

Additionally, improvements in the operational definition of parental pressure may improve the ability to study this construct. In the current study, parental pressure was defined as the extent to which an individual perceives that his or her parents emphasize acceptance based on achievement rather than effort (Putwain, 2009). A more sound operational definition may contribute to the selection or development of a more valid and reliable rating scale. With improvements in measurement, future studies may better determine whether the parental pressure does or does not impact test anxiety in undergraduate students.

Finally, studies addressing practical implications in schools should be conducted to inform treatment. Given that previous literature also supports the notion that self-efficacy impacts test anxiety, its use in test anxiety treatment should be evaluated. For example, an examination of prevention or intervention programs broadly targeting anxiety and academic self-efficacy may contribute to a greater understanding of effective test anxiety treatments in schools. Additionally, the extent to which general anxiety and academic self-efficacy are targeted in existing test anxiety treatments may be examined and compared to programs that do not address these factors.

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APPENDIX: IRB EXEMPTION APPROVAL



ACTION ON EXEMPTION APPROVAL REQUEST

TO: Meredith Harris
Psychology
FROM: Dennis Landin
Chair, Institutional Review Board
DATE: August 6, 2015
RE: IRB# E9432
TITLE: Personal and Environmental Predictors of Test Anxiety: A Structural Equation Model

Institutional Review Board
Dr. Dennis Landin, Chair
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New Protocol/Modification/Continuation: New Protocol

Review Date: 7/31/2015

Approved X Disapproved

Approval Date: 8/6/2015 Approval Expiration Date: 8/5/2018

Exemption Category/Paragraph: 2a

Signed Consent Waived?: No

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

Protocol Matches Scope of Work in Grant proposal: (if applicable)

By: Dennis Landin, Chairman [Signature]

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING - Continuing approval is CONDITIONAL on:

- 1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE: If emailing more than one recipient make sure to use bcc.

*All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb

VITA

Meredith Harris is originally from Sulphur, Louisiana. She earned a Bachelor of Arts with a major in Psychology and a minor in English from Louisiana Tech University in 2012. She enrolled at Louisiana State University the same year, where she earned her Master of Arts in School Psychology in 2014. She is a candidate for a Doctor of Philosophy in School Psychology and expects to graduate in August of 2017. She is completing her predoctoral internship at Boys Town, a clinical training site within the Nebraska Internship Consortium in Professional Psychology. Meredith intends to continue her postdoctoral training in Texas providing services to children, adolescents, and families with various behavioral and mental health disorders.