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The Effects of Two Anxiety Reducing Interventions on Algebra I Test Scores for a Sample of Rural High School Students

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The Effects of Two Anxiety Reducing Interventions on Algebra I Test Scores for a
Sample of Rural High School Students

by

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ABSTRACT

The Effects of Two Anxiety Reducing Interventions on Algebra I Test Scores for a Sample of Rural High School Students

Sharon Wisinger
Old Dominion University, 2010
Director: Dr. Nina W. Brown

As the nation strives to reach the goal of 100% proficiency in reading and math in under the No Child Left Behind Act of 2001 (NCLB) requirements, students may experience increased pressure to perform better on examinations. The purpose of this study was to examine the effects of a short term expressive writing intervention and a psychoeducational intervention on general, test, and math anxieties, physical and attendance, and test scores of ninth through eleventh grade adolescents attending two rural public high schools. Participants ($N = 58$) consisted of adolescents in three intact Algebra I classes which were assigned to write about neutral topics during three classroom sessions (first experimental group) ($n = 24$), participate in a psychoeducational presentation during one classroom session (second experimental group) ($n = 18$), or receive regular classroom instruction (control group) ($n = 16$). At baseline and six weeks after writing, physical symptoms, levels of anxiety, attendance, and test scores were assessed. No statistically significant relationship was found between the experimental and control groups over time. However, when all of the participants were viewed as one population, some significant differences occurred which may have reduced levels of math anxiety and improved math exam scores for the Algebra I population as a whole.

Key words: adolescents; expressive writing; anxiety; test anxiety; math anxiety; math achievement, Algebra I

DEDICATION

This dissertation is dedicated to the loving memory of my brother, Patrick.

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CHAPTER I

INTRODUCTION

Background

As the nation strives to reach the goal of 100% proficiency in reading and math in the midst of high stakes testing under the No Child Left Behind Act of 2001 (NCLB) requirements, and funding remains tight, students face growing pressures to produce results (Lee, 2006). By the year 2013, the NCLB Act endeavors to have all children achieving at their grade level. The NCLB legislation has led to an increased emphasis on the accountability of schools and their role to increase student achievement scores. This reliance on mandated testing in schools has shifted teaching practices (e.g. targeted teaching or “teaching to the objective”), intensified the importance of classroom exams, and initiated various educational reforms.

NCLB related competitive grants are linked with funding for school districts (e.g. Title I grants). Public schools are benefiting from The American Recovery and Reinvestment Act of 2009 (ARRA), the economic stimulus package which has doubled the U.S. Department of Education budget which can be used presently. The ARRA provides an economic incentive to improve student achievement resulting in an unprecedented amount of federal funding for education (Jennings, 2009).

Common rigorous, college ready standards developed by states are required to be developed and implemented in order to receive Title I funding (Children & Youth Funding report, 2010) linked with the ARRA.

In concurrence with the dramatic increase in the use of tests to determine accountability following the No Child Left Behind enactment and its penalties for schools

that fail to make adequate yearly progress, test anxiety has been accorded increased interest (Cizek & Burg, 2006). The impact of test anxiety on academic performance is wide ranging. An abundance of evidence suggests that test anxiety is negatively associated with academic performance (Naveh-Benjamin, McKeachie, Lin and Holinger, 1981; Hill and Wigfield, 1984, Ziedner, 1998). As the level of expectations for students rises in response to the means to hold schools accountable for student achievement (Hembree, 1988; Hill and Wigfield, 1984; Watt, Powell, Mediola, & Cossio, 1006; Reyes, 2008), an understanding of the part test anxiety may have on academic performance, particularly the possibility of bias in test scores (Wren & Benson, 2004), has become even more pertinent, along with other mediating factors.

Students, teachers, counselors, administrators, parents, guardians, and others are frequently distressed by the effects of test anxiety (Casbarro, 2004). Anxiety and its biological correlate, physiological symptoms are related to both academic performance and emotional well-being. Students may experience test anxiety related physiological symptoms (e.g., headaches, gastrointestinal discomfort, perspiration or chills, sleeping difficulties, and shortness of breath) which may cause uneasiness, embarrassment or exacerbate related conditions. School related stress and pressure to pass an exam or course, to be promoted to the next grade, to graduate from high school, to pursue secondary education, or to access career opportunities bears weight on the students' emotional well-being (Aysan, Thompson & Hamarat, 2001; Linn, 2001; Spielberger & Vagg, 1995) particularly for African American and Latino students (Kellow & Jones, 2008; Walpole & McDonough, 2005; Hembree, 1988; Catsambis, 1994).

Secondary teachers, especially those teaching high-stakes subjects (e.g., mathematics), are often held accountable for the results used to compare schools within a district, between districts, and across the state and nation (Linn, 2001). Educators and administrators may be evaluated, in part, by test score results. Challenging and continuous preparation for state and standardized testing often takes the form of rigorous course exams. The importance of passing examinations and courses successfully may cause students to worry, to feel nervous, and to become anxious throughout the school year.

To obtain perceptions of standardized testing, Mulvenon, Stegman, & Ritter (2005) surveyed various stakeholders. The teachers revealed robust reservations about standardized testing. In contrast, most students, parents, principals, and counselors found some merit in the practice and did not account for increased levels of anxiety or stress.

The current economic situation has negatively impacted conditions for many families. Along with educational budgetary constraints, these factors may place youth “at risk” for emotional and academic problems (Pina & Eisenberg, 2009; Lee, 2006). At-risk adolescents in the United States are more likely to encounter psychosocial influences including poverty, sexual relationships, drug and alcohol abuse, poverty, emotional stress, and violent media images (Watkins, 2009). Parents and guardians may rely on test score results as an indicator of general well-being. Academic performance may be used, perhaps inaccurately, by these stakeholders as general gauge of their child’s well-being. Parents and guardians may rely heavily on test scores as an indicative measure of their children’s achievement or academic potential based on exam scores.

Several conditions in the school environment can be linked to student anxiety in areas of academics, peer relationships, and social-emotional development (Tomb & Hunter, 2004). Research linking test anxiety to academic achievement has shown that high levels of anxiety are related to lower levels of school performance (Everson, Millsap, & Rodriguez, 1991). Because students with more obvious difficulties may garnish the attention of educators and practitioners, students with internalizing disorders may be overlooked, despite sometimes noticeable indicators such as stress related migraines or frequent headaches (Breuner, Smith, & Womack, 2004; Just, Oelkers, Bender, Parzer, Ebinger, Weisbrod, & Resch, 2003) which may result in school clinic visits. Generally, anxiety does not affect a child or adolescent's life as adversely as problems like substance abuse or other more overt behaviors, but anxiety difficulties can still affect one's life or academic performance significantly (Rapee, Spence, Cobham, Wignall, & Psych, 2000). Anxious children are inclined to have fewer friends and may interrelate with their limited number of friends less frequently than their peers. Many anxious adolescents are able to function well in the classroom because their perfectionism and conscientiousness propels them to strive more. Despite their endeavors, these individuals may not be succeeding to their potential. This may be especially true for those who worry excessively (Rapee, et al., 2000).

Test Anxiety Prevalence

A considerable amount of the test anxiety related research was conducted in the period 1980-1986. Zeidner added to the existing literature (1998), when he noted that examinations have become a commonplace means of assessing and monitoring student academic performance, often inducing anxiety for many students. Test anxiety seems to

be prevalent and pervasive, affecting up to 20-35% of the population (Zeidner, 1998; Naveh-Benjamin, Lavi, McKeachie, and Lin, 1997). The overall prevalence of test anxiety was 41% in a sample of African American children between the ages of 8 and 12 in an urban and primarily lower socioeconomic school district in an earlier (1993) related study by Turner, Beidel, and Hughes. More recent educational policies involving the use of test results as performance indicators have triggered a rejuvenated interest in researching test anxiety (Cizek and Burg, 2006). Paralleling the United States' reinvestment in examining the impact of student anxiety on academic performance including high-stakes testing, other countries have debated the use of testing to promote educational reform (Firestone & Mayrowetz, 2000) and contributed test anxiety related research (Bodas & Ollendick, 2005; Putwain, 2007) suggesting that this construct is internationally pervasive.

Anxiety Disorders

Anxiety can be perceived as resting on a continuum. A low level of anxiety, perhaps in the form of a warning signal or a motivational factor, would be represented at one end of the continuum, a moderate level of anxiety would be placed in the middle, and the other end of the continuum would be associated with a severe level of anxiety that interferes with daily living. Folkman (2008), building on the work of earlier research, found that positive and negative emotions co-occurred during stressful periods. Relevant anxiety classification studies based on a diagnostic or categorical approach do not consider the full dimension of anxiety and therefore have limitations (Brown, Chorpita, & Barlow, 1998). Alternatively, anxiety disorders can be conceptualized as being qualitatively different from symptoms experienced at a lower level.

Generalized anxiety disorder (GAD) classifications have changed substantially since its first inclusion in DSM-III (Hobbs, Borkovec, Beesdo, Craske, Hiemberg, et al., 2010). High rates of comorbidity, among other concerns about the diagnostic criteria have led to further refinement of the disorder and criteria. A reduction in the number of symptoms and the criteria necessitating larger percentage of symptoms reflects current information associated with the DSM-IV. Limited empirical support for changing the symptom criteria along with modifying GAD conceptualizations which address whether or not to include subclinical cases are considerations warranting attention in the DSM-V (McKay, Abramowitz, Taylor, & Asmundson, 2009).

Worry is the hallmark feature of GAD. The worry acts as a cognitive coping strategy that is associated with avoidant behaviors. Likewise, worry is the central characteristic of anxiety associated with testing or mathematics. Anxiety may influence the occurrence of worry; especially among individuals with GAD (see Kelly, 2008 for a review of the literature). Excessive worrying can impede social, personal, and academic functioning. Anxiety is made apparent in several ways: behaviorally, cognitively, and psychologically. In a school setting, youth may manifest these symptoms simultaneously (e.g. increased activity, worry, and an uneasy feeling in the stomach). If general feelings of anxiety, test anxiety, or math anxiety are not complicated by more serious anxiety disorders, or depression, it can be addressed in a school setting by school counselors, school psychologists, registered nurses, and teachers with the help of principals and parents (Huberty, 2010).

Test Anxiety

Anxiety difficulties are among the most commonly experienced conditions affecting youth (Kendall, Safford, Flannery-Schroeder, & Webb, 2004). Whereas generalized anxiety reflects a pattern of worry that lacks a distinct content (Klein, 2009), test anxiety exacerbated general anxiety during evaluations and math anxiety is particular to general anxiety experienced while attempting math tasks or math evaluations.

Because test anxiety is a multifaceted construct, it has been defined and measured in a diverse attempt to conceptualize it within the broader context of anxiety. Putwain (2008) differentiates test anxiety from the construct of general anxiety by indicating the specific context in which the anxiety occurs; test anxiety transpires in a situation involving the evaluation of assessment performance. Test anxiety may be related with anticipating, experiencing, or recovering from a test (Zeidner, 1998). Test anxiety, as defined by Maxfield and Melnyk (2000), involves apprehensive and negative thought ruminations associated with physiological responses and emotional distress. Along with test phase reactions and cognitive, physiological, and emotional factors, test anxiety may be accompanied by fear, worry, and apprehension experienced to an excessive degree (McDonald, 2001).

Test anxiety is most closely aligned with the Diagnostic and Statistical Manual-IV (DSM-IV: American Psychiatric Association (APA, 1994) classification of social phobia (McDonald, 2001). Concerns felt by students regarding negative evaluations incorporating dysfunctional cognitive thought and physiological symptoms may lead an individual to be diagnosed as having 'a marked and persistent fear of social performance situations in which embarrassment may occur' (APA, 1995, p. 422). Given the established high prevalence and incidence rates linked with test anxiety, the presence of

test anxiety among test anxious adolescents may offer an indicator of more pervasive psychological and debilitating physiological distress (King, Mietz, Tinney & Ollendick, 1995).

Test anxiety may appear as being mild, moderate, or severe in form (Rothman, 2004). Similar to conceptualizations of general anxiety, test anxiety exists along a continuum (McDonald, 2001), ranging from facilitative effects which aid or enhance performance (Alpert & Haber, 1960; Zeidner, 1998) to incapacitating test anxiety which inhibits academic performance (Alpert & Haber, 1960; Naveh-Benjamin, McKeachie, Lin and Holinger, 1981; Hill and Wigfield, 1984, Zeidner, 1998). Facilitative effects notwithstanding, the dearth of research has concentrated on how test anxiety negatively influences academic performance (McDonald, 2001; Zeidner, 1998). This emphasis is due, in part, to the consequences related to not passing course exams and standardized exams required to pass a course needed for graduation. Consequentially, there is an increased likelihood that more students experience anxiety when taking these exams. While some students have an optimal level of anxiety, others may fail these exams despite being familiar with the material.

Test Anxiety Conceptual Framework

Test anxiety has been conceptualized in the literature in various ways. Rothman identified several theories of test anxiety after contemplating numerous theories of origins offering etiological explanations (2004). Rothman suggests that test anxiety may be explained by intensifying vulnerability to interference or distraction as described by Keogh and French (2001) due to worry, emotionality, and self-preoccupation based on Sarason's (1984) four factor model (worry, tension, test irrelevant thinking, and bodily

symptoms). Early theorizing conceptualized the test anxiety construct as one-dimensional (Sarason, 1961) before shifting to viewing test anxiety as bidimensional in the late 1960s (e.g., Liebert & Morris, 1967; Spielberger, 1972). Test anxiety came to be conceptualized as a construct of cognitive (e.g., worry, irrelevant thoughts), and emotional (e.g., tension, distress, physiological reactions) components. Test anxiety as a multidimensional construct (cognitive, emotional, behavioral, and physiological) produces the hindrance that disorders or interrupts test preparation and test performance as a negative outcome of the interaction of these factors.

State and Trait Test Anxiety

There are two types of anxiety: trait anxiety, which refers to chronic and persistent anxiety that is not activated by specific events and state anxiety, which presents as anxiety occurring in specific situations and usually has an obvious trigger.

Similar to the distinction made between general state anxiety and general trait anxiety, Liebert and Morris (1967) described testing anxiety as a construct with worry (cognitive distress regarding performance consequences) and emotionality (evaluative stress induced reaction) components. Carter, Williams, and Silverman's (2008) recent findings support this bidimensional perspective of test anxiety and utilization of the construct with African American school children.

Test anxiety is considered to be a situation specific trait according to the state-trait model (e.g., Keogh and French, 2001). Rothman highlighted Zeidner (1998) and Keogh and French's (2001) studies demonstrating individuals responding to test-related stressors, within an array of evaluative situations by exhibiting intensely worrisome and intrusive thoughts, cognitive disorganization, and physiological stimulation.

The social-evaluative component of test anxiety was also noted in Rothman's (2004) study. Test anxiety is a form of social-evaluative anxiety that influences individuals to respond with elevated levels of state anxiety when facing evaluative situations (Zeidner, 1998). Socially anxious individuals have been shown to perform lower than non-anxious individuals on concentration, working memory and attention measures within a social-evaluative threat condition (Wenzel & Holt, 2003). Most researchers examining evaluative performance in anxious individuals look at reactions to threatening stimuli as being a function of trait anxiety.

Building on general theories of anxiety, Sarason (1984) proposes that test anxiety consists of an emotional component in addition to cognitive (e.g., self-depreciating thoughts, behavioral (e.g., study skills), and physiological components (e.g., involuntary nervous system responses). When perceived as an emotional state, test anxiety refers to the degree to which a student in an examination environment experiences anxiety (Zeidner, 1998). In accordance with trait test anxiety theories, personal factors may contribute to the development of state test anxiety in an assessment situation. A student exhibiting low trait anxiety could view a particular exam as threatening and therefore develop a high level of state test anxiety if influenced by other factors at play (e.g., academic related, self-understanding, and emotional state) between the student and the testing situation (Zeidner & Mathews, 2005).

Test anxiety is a common form of anxiety in youth that can impact academic progress considerably (Hembree, 1988). Utilizing theoretical constructs, researchers developed measures of test anxiety (e.g., Liebert & Morris, 1967) to evaluate college student populations. Although studies have supported the cognitive-emotional

bidimensional view of test anxiety, adolescent population samples have been minimally investigated (Carter, et al., 2008).

During test taking situations, students may exhibit tendencies toward state anxiety, but may also exhibit trait anxiety. Because adolescents with high trait anxiety can be considered candidates for extended evaluation for significant emotional difficulties (e.g. depression), identification of such students (e.g. through screening students who fail exams despite indications of achievement otherwise) should alert school personnel to address the students' needs.

Gender Differences

Maccoby and Jacklin's (1974) landmark review of gender differences in intellectual ability and achievement, social behavior, and psychological origins found females to be more anxious than males. Although limitations and the omission of possible environmental factors in some of the studies Maccoby and Jacklin (1974) reviewed were not sufficiently discussed, the results of Feingold's meta-analysis (1994) were also consistent with the findings.

Anxiety is common among both genders. Physiological anxiety predicted the development of depression for both genders in a longitudinal study of early adolescents by Chaplin, Gillham, and Seligman (2009). Chaplin, et al., (2009) offered that early feelings of worry and oversensitivity were associated with later development of depression among girls, with anxiety symptoms being identified as a predictor of depression.

The impact of gender upon test anxiety has been consistently researched (Hembree, 1988; Zeidner & Safir, 1989). Generally, females experience higher test

anxiety levels than males based on the majority of empirical research conducted (Zeidner, 1998, Hembree, 1988). Hembree's (1988) meta-analysis specified the gender differences as being modest but significant. A small gender difference appeared during primary grades, amplified in grades five to ten and declined for the duration of high school and college. Small but consequential gender differences were identified using confirmatory factor analysis with nonzero latent means to examine the factor structure of the Test Anxiety Inventory (TAI) by Everson, Millsap, and Rodriguez (1991). The finding that females demonstrate higher levels of test anxiety has been replicated cross-culturally. Spielberger (1977) studies conducted in 12 countries, using the Test Anxiety Inventory (TAI) to measure levels of test anxiety among elementary, middle, high school, and college students, found that females consistently reported higher levels of test anxiety. The connection between gender and test anxiety seems to be well established, given the available data, indicating a common pattern of gender differences in test anxiety.

Math Anxiety Gender Differences

Much of the research suggests that math anxiety is a significant barrier to math achievement, one that impedes a sizeable segment of the student population and one that warrants research concentrating on assessment and interventions to with the goal of improving outcomes (Ashcraft & Moore, 2009). Ashcraft and Moore (2009) also found that lower math performance can be connected to math anxiety regardless of mathematical competence or achievement level. Furthermore, test and math anxiety is linked with fewer math courses attempted, lower grades and achievement in math courses taken, increased negative attitude towards math, and an avoidance of science, technology, mathematics, and science (STEM) career paths.

Researchers are also inquiring about the underrepresentation of females in STEM careers. Although the number of women receiving degrees in the STEM disciplines has risen, they have not reached levels similar to men, and retention in the field remains a concern (Rosser & Taylor, 2009). Math anxiety can lead to avoidance of these careers (Ashcraft, 2002, Hembree, 1990, Chipman, Krantz, & Silver, 1992).

Despite growing evidence of gender similarities in math achievement, negative stereotypes that females are deficient in mathematical skills endure. It is possible that stereotype threat may be associated with increased levels of anxiety in students, which may negatively impact test performance, but research in the stereotype threat literature in this area is presently inconclusive.

Steele (1992, 1997) found that the pressure of stereotype increased anxiety, decreased performance, and aversion leading him to formulate his stereotype threat hypotheses. Osborne's (2007) study tested this theory using a challenging math task while physiological actions were recorded. Working memory (Bellock, 2008) and performance (Brodish & Devine, 2009) was affected by negative stereotypes thereby increasing the likelihood of stress-induced failure during high stakes mathematical testing. Anxiety reduces the working memory capacity necessary for achievement (Schmader & Johns, 2003). Whereas these findings support Steele's work, no association between stereotype threat, test anxiety, and academic performance was found by other researchers (Schmader, 2002; Delgado & Prieto, 2008).

In previous decades, females took fewer advanced math and science courses and performed lower than males on the high stakes Scholastic Aptitude Test-Mathematics (SAT-M) standardized test by age 17 (Ryan & Ryan, 2005). In 2005, males and females

completed advanced mathematics courses at similar rates, with the exception of precalculus where females had a slight advantage (National Science Foundation, 2008). Furthermore, few gender differences among 10th grade students exist, using average test scores and grades as indicators of mathematics achievement (Catsambis, 1994). This gender differences shift merits a new examination of gender and math performance research.

Gender similarities exist in standardized test examination scores in the United States (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). NCLB legislations require all states to report assessments of cognitive performance annually, but despite the opportunity to investigate current gender differences in math performance; few states report data by gender. Hyde et al., (2008) studied statistical information of all students tested by grade which was provided by 10 geographically diverse states. Effect sizes for gender differences in state assessment performance are consistently <0.10 , representing insignificant differences in the testing of over one million students. Their analysis of gender differences in state assessments of mathematics performance showed that gender differences in math skills were not evident in the general (grades 2 to 11) population. However, gender differences in mathematics performance and anxiety remain a concern as researchers seek to address the impact test anxiety and math anxiety may have on mathematics performance.

Evidence demonstrating gender and math competence is mixed. Hembree (1990) conducted a meta-analysis of 52 studies on math anxiety and found differences between math educational levels and math anxiety. It appears that anxiety levels correspond with mathematical levels of difficulty. Females reported more math anxiety than males but no

differences in math avoidance or performance between genders. In contrast, math anxiety levels were higher for males than females, and higher levels of math anxiety negatively impacted math avoidance and performance. Although Hembree suggests a relationship between the difficulty level of math problems and level of math anxiety, the types of math problems data was not analyzed accordingly. Ma (1999) noted a significant but small gender effect on the relationship between math anxiety and math achievement. In contrast, few studies show reliable gender effects on math performance and achievement according to Campbell (2005).

Multicultural Considerations.

By the twelfth grade, African American students, on average, lag far behind white students academically, though the gap has become smaller over time, according to Paige, former U.S. Secretary of Education and Witty (2010). Possible ramifications include an increased likelihood of dropping out of high school and reduced college readiness (Neild, Stoner-Eby, & Furstenburg, 2008; Fredericks, Blumenfeld, & Paris, 2004). Average college entrance exam scores, important in the college admissions process, are often lower among African American and Latino students, which may hinder admission to selective colleges (see Contreras, 2005 and Deil-Amen & Tevis, 2010, for a review). The average scores of African American students on the SAT are often 100 points or more below whites, Asian Americans and students with Puerto Rican and Mexican backgrounds (Paige & Witty, 2010). More minority students are preparing for further education, with Hispanic students being the largest and fastest growing minority group taking the SAT according to the *College Board College-Bound Seniors* report (2009).

Algebra I is an integral part of the college readiness process, testing, STEM career opportunities, and improving mathematics achievement (Roschelle, et al., 2008).

Furthermore, because testing and mathematical achievement are so closely intertwined with future success and educational endeavors, an implication is that efforts to increase the academic success of minority and other populations would do well to focus on the critical influence of general, test, and math anxiety.

Limited research related to anxiety among ethnic minority children, though a thorough examination of studying anxiety is warranted, has been conducted (Cohen, et al., 2000). Despite the paucity of literature, a greater amount of research involving African American children and African Americans exists, Cohen, et al., (2000) revealed. Test anxiety levels are commonly greater for African American students than for White students in the lower grades ($ES = 0.52$). These differences become less apparent during the middle grades ($ES = 0.21$) and nominal by high school ($ES = 0.02$) (Cizek & Burg, 2006). Empirical findings among ethnic groups with regard to test anxiety vary by ethnicity. Greater levels of test anxiety are experienced by Hispanic students than White students in grades 4 to 12 across all related studies, Cizek and Burg found (2006). Nevertheless, the shortage of literature provides making inferences or drawing conclusions about anxiety (e.g., prevalence rates, levels of test anxiety, physiological responses, impact on academic performance, and possible differences among varying ethnic minority populations) in ethnic minority student populations a challenge, especially for smaller ethnic groups.

Numerous studies investigating how pervasive negative stereotypes about racial minorities and women can affect the performance of those targeted by such stereotypes

exist in the literature (see Smith, 2004 for a review of the literature). According to Steele (1997), stereotype threat produces general feelings of anxiety. The increased anxiety levels negatively affect testing performance. Pre-existing testing beliefs, influenced by stereotype threat, were found to interact with test anxiety and result in lower test scores (Sawyer & Hollis-Sawyer, 2005). These findings are supported by Osborne's results (2007) demonstrating significant physiological reactance as a function of a stereotype treatment involving a demanding math task and the recording of physiological measures of arousal. Walton and Cohen's (2003) meta-analysis of 43 studies related to the racial achievement gap on standardized tests found that individuals seem to link negative stereotypes to evaluative tests routinely. Reframing math tests as a challenge significantly minimized the negative effects of stereotype among Black students in North Carolina and among undergraduates in New Jersey, suggesting a potential intervention (Alter, Aronson, Darley, Rodriguez, & Ruble, 2010).

The importance of understanding minority youth is realized, in part, by the probable differences in anxiety related symptoms, assessment responses, and cultural experiences (Safren, et al., 2000). With increasing globalization and an emphasis on multicultural perspectives, a fuller understanding of the development, treatment, and predictors requires research efforts that include various cultures. Multicultural research may pinpoint similarities and differences across cultures in the prevalence, patterns, and relationships (Achenbach & Rescorla, 2006) among adolescents from diverse backgrounds.

Test anxiety was reported to be higher among African American students than European American students (Rhine & Spaner, 1983). Results from Carter, Williams,

and Silverman (2008) indicate that certain cognitive and emotional components of test anxiety were found in 152 African American students, aged 8 to 13 years. Cohen, Garcia, Apfel, and Master (2006) found that easing psychological threat can increase cognitive achievement in a population of African American and European American young adolescents.

Multicultural-inspired research seemingly indicates that test performance gaps and math achievement disparities may result in part from psychological factors. Previously, these gaps have been explained as the result of race or lower socioeconomic status. Gender differences in math achievement were found to be the greatest among Latinos and the least among African Americans (Catsambis, 1994). In contrast, Horton (2004) found that race and low socioeconomic status were not negative factors impacting elementary and high school standardized test results. Future research investigating ways of controlling physiological and psychological factors may be able to greatly reduce the achievement gap.

There is a small negative correlation between test anxiety level and SES ($r = -0.13$) based on Hembree's (1988) meta-analysis of over 500 test anxiety studies. SES seems to have a stronger impact on mathematics achievement than on test anxiety. The findings show a positive relationship between SES and mathematics achievement (Ortiz-Franco & Flores, 2001, Hopkins, 2005). Hopkins (2005) reported higher levels of mathematics achievement among rural economically disadvantaged middle and high school students than their non-rural counterparts. The SES of the school was found to impact the mathematics achievement levels of rural students in 40% of the states, but not at the national level (Howley & Gunn, 2003). The (2009) results from the National

Assessment of Educational Progress (NAEP) indicate that students in rural and urban high schools score significantly lower in mathematics than students attending suburban schools, although some concerns regarding validity have been reported (Braun, Jinming, & Vezzu, 2010; Noel & Ginsburg, 2009).

The NAEP scales allow for studying relationships between mathematics assessment performance and other variables such as race, gender, and family income. The assessment data was gleaned from grade 4 and grade 8 students from the nation and the Department of Defense Education Activity although not all states had Black (or White) populations that were sizable enough to impart reliable data. Average mathematics scores for both Black and White eighth-grade students were higher in 2007 than in 2005 and 1990. Nevertheless, Black-White mathematics achievement gaps existed at grade 8 in the 41 states providing results and did not change significantly for either males or females over the 17 year time period. Mathematics scores increased between 2005 and 2007 for both male and female eight graders. Black females' scores increased more than those of White females, thus narrowing the gap to some extent. Male scores did not change significantly during this time period, according to the report.

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Attendance

Although academic success is a high priority focus in schools, efforts to enhance students' physical and emotional well-being are also considered to be important. Anxiety-based school refusal may involve 5 to 28% of youth and can lead to waning academic performance and dropping out of school, among other short and long term problems (Kearney, 2001). Anxiety related components may involve a misguided attempt to avoid experiencing anxiety (e.g. an examination or attending a specific class). Attendance concerns may result in negative outcomes (e.g. missed instructional time, possibility of suspension or failing a course due to lack of attendance if the limit was exceeded). Students who experience anxiety in the school setting deal with a range of issues that may affect physical and emotional well-being as well as attendance, achievement, and behavior. Overanxious individuals with absenteeism concerns may benefit from relaxation training, systemic desensitization, and cognitive procedures (Lauchin, 2003). Therefore, although the antecedent reasons and behaviors for non-attendance may vary, school and parental involvement is imperative for an effective multi-systemic approach. In particular, school personnel can strategically monitor student attendance, complete a functional analysis of non-attendance, develop systemic, group, and individual approaches to intervention, and inform parents and guardians.

Considerable evidence has accumulated demonstrating the impact of anxiety on academic performance. As opposed to facilitative anxiety, test and mathematics anxieties can be debilitating because the anxiety is associated with possible negative repercussions, which may be evidenced in the form of class absenteeism, poor preparation, difficulties understanding course content, classroom test results which are not aligned with actual ability, and feelings of uncertainty.

Mathematics Related Anxiety

In the growing empirical literature, there is evidence that mathematics anxiety, a particular form of test anxiety (Sapp, 1999), may have a substantial impact on adolescents. Mathematics anxiety is linked with test anxiety through a common concern for testing situations. Unlike the test anxiety construct, math anxiety does not have a theoretical foundation. Math anxiety, lacking an independent theoretical base, is often conceptualized within the theoretical support of test anxiety (Hembree, 1990). Math anxiety may be viewed as a focused, subject specific form of test anxiety according to many researchers (e.g., Hembree, 1990; Richardson & Woolfolk, 1980; Bandalos, Yates, & Thorndike-Christ, 1995). Furthermore, Bandalos, Yates, and Thorndike-Christ (1995) described math anxiety as an amalgamation of test anxiety, poor self-confidence, a fear of failing, and a perceived negative attitude toward learning math. Theoretical models of the association between math anxiety and math performance have been difficult to establish. Although the theoretical foundations and causes of math anxiety are not firmly established, students with high levels of math anxiety are known to experience negative reactions to mathematical content and testing (Richardson & Woolfolk, 1980). A negative relationship between higher levels of anxiety and lower levels of achievement is apparent to many researchers (Hembree, 1990; Ma, 1999).

Math anxiety, though lacking a single cause (Jain & Dowson, 2009), may have numerous significant effects including math avoidance during high school and college (Betz, 1978; Dew, Galassi & Galassi, 1984) which may interfere with preparation to compete globally given the current emphasis on mathematics (Furner & Duffy, 2002; Rapee, et al., 2000) in college and career preparation. Career paths are shaped by math

curricular choices, background dispositions, and the suitability of math class enrollment that achieved grades communicate (McFarland, 2006). Correlations between math anxiety and other factors (e.g., motivation and self-confidence in math) are robustly negative, ranging between $-.47$ and $-.82$ (Ashcraft, 2002). Highly math anxious students tend to shun math related high stakes testing, higher level courses, career paths, and professions that involve frequent math use (Scarpello, 2007; Beilock, 2008; Ashcraft, 2002; Ashcraft & Faust, 1994). These otherwise intelligent and capable individuals circumvent opportunities, which may have proved rewarding.

Research demonstrates that adolescents, who exhibit high levels of math anxiety, have lower levels of math achievement and may be less likely to take higher level math courses, both in high school and college, or pursue math-related careers. Math anxiety has been shown to predict later career choices (Luzzo, et al, 1990; Furner & Duffy, 2002). Moreover, as early as grade 9, math achievement categorizes students' future career aspirations, even after controlling for overall academic achievement (Ashcraft, 2002; Shapka, Domene, & Keating, 2006). Math-anxious students then to have negative attitudes toward math and may avoid math classes (e.g. absenteeism, selecting lower level courses) which may result in lower achievement.

The importance of algebra is considerable, according to a progression of research positioning algebra as a gateway to college, in line with the goals of the National Council of Teachers of Mathematics (2000), and the academic standards movement to prepare students for college and work. A decade ago, it was possible to graduate from high school without having passed an algebra course. Presently, most states compel students to not only take one or more algebra classes required for graduation, but to pass an

examination that assess whether they are able to meet or surpass state algebra-specific benchmarks (Chazan, 2008). Students who succeed in algebra often succeed in higher level math courses, making math a gateway to higher educational pursuits. Students who excel at algebra have the foundation to succeed in pre-calculus and enter the science, technology, engineering, and mathematics professions. Students who struggle with algebra and other college preparatory math coursework frequently find that math serves as a gatekeeper to future success in college level math courses and are more likely to require as many as four remedial courses before taking college level algebra (Bryk, A., & Treisman, U., 2010), placing them at risk academically.

The cognitive literature enumerates how critically math performance depends on cognitive processing and, in turn, how math anxiety compromises the functioning of working memory to such an extent that even individuals with strong abilities in math will function ineffectively (Beilock & Carr, 2005). Consequences of math anxiety include lower performance on math achievement tests as a result of impaired working memory due to the influence of math anxiety (Ashcraft & Krause, 2007).

With the understanding that anxiety among students, often in the forms of test anxiety and math anxiety, has been negatively linked with test performance, and selection of courses and professions, minimizing levels of anxiety is an important component of test anxiety and math anxiety research. Various ways of approaching its treatment include efforts stemming from a physiological and emotional perspective aimed at reducing physiological symptoms through behavioral methods, behavioral approaches (e.g. progressive muscle relaxation training), cognitive behavioral treatments (e.g. cognitive behavioral modification, self-talk), and skill improvement (e.g. study skills,

test-taking strategies), as well as combined interventions. Overall, these and other anxiety reduction interventions have received support from the literature, and are commonly used in student populations, including high school adolescents, although the generalizability of some of the research has been scrutinized (Ergene, 2003).

Math anxiety and related attitudes toward math can impact attention, motivation, conscientiousness, working memory and cognition. These important research threads, along with others, are important ways to approach the math anxiety and achievement confound.

Expressive Writing

“The pen is the tongue of the mind,” is a quote by Miguel de Cervantes which may suitably capture the essence of expressive writing; writing is good for your physical and mental health as an abundance of literature over the past few decades demonstrates (Esterling, L’Abate, Murray, & Pennebaker, 1999; Smyth, 1998; Graf, Gaudiano, & Geller, 2008). Current research builds on decades of work by James Pennebaker, who espoused the beneficial nature of writing; the process enables a person to process and then disclose thoughts with the ability to do so nonverbally. In their landmark study Pennebaker and Beall (1986) commenced a new line of research by examining health benefits within the context of a writing intervention. The notion that writing helps people to feel better is the basic premise supporting expressive writing. A wide range of individuals have engaged in the process, with the vast majority stating that “the writing experience was valuable and meaningful in their lives” (Pennebaker, 1997, p. 162). The often repeated process began with Pennebaker managing the writing experience of a group of college aged students. The procedure involved the students writing for 20 to 30

minutes daily for several days. The treatment group wrote about a stressful, personal experience whereas the control group committed to writing about neutral events. In numerous studies during the past two decades, this paradigm has produced findings positively associated with increased physical and mental health benefits (Pennebaker, 1997).

The Basic Writing Paradigm (Pennebaker, 1997) involves randomly assigning each participant to one of two or more groups. Each group is tasked with writing for 15 to 30 minutes each consecutive day about an assigned value-laden topic. Typically, participants in a disclosure group write about thoughts and feelings connected to a stressful occurrence (Lepore & Smyth, 2002). Participants assigned to the control group write about trivial or neutral topics. Groups are compared on changes in well-being from baseline to follow-up, which is most commonly within several months of writing.

Consistently, studies using an expressive writing intervention have demonstrated noteworthy contributions encompassing a broad spectrum of psychological and physical health. Albeit that disclosure often indicates an immediate but transitory increase in negative mood, ensuing follow-up shows a marked reduction in stress levels (Manier & Olivares, 2005; O'Connor & Ashley, 2008; Smyth & Helm, 2003), depressive symptoms (Gortner, Rude, & Pennebaker, 2006), interpersonal conflict (Landry, Rachal & Rosenthal, 2005), asthma symptoms (Warner, Lumley, Casey, Pierantoni, Salazar, Zoratti, Enberg, & Simon, 2006), and an improvement in the emotional well being of women living with metastatic breast cancer (Laccetti, 2007), lupas and rheumatoid arthritis (Danoff-Burg, Agee, Romanoff, Kremer, & Strosberg, 2006). Increased working memory function (Klein & Boals, 2001; Yogo & Fujihara, 2008) and immune

functioning improvement (Petrie, Booth, Pennebaker, Davidson, & Thomas, 1995; Esterling, L'Abate, Murray, & Pennebaker, 1999) have also been associated with the utilization of expressive writing interventions. A meta-analytic review of the substantial empirical research indicates that expressive writing interventions have positive effects on indicators of health, both physical and mental (Smyth, 1998; Frattaloli, 2006).

Most expressive writing studies have exemplified positive results with a healthy population of primarily adults. Research involving mostly adults with health problems is altogether less promising, in some studies. No effects from the expressive writing treatment were generated from some studies (Broderick, Stone, Smyth, & Kaell, 2004, Corter & Petrie, 2008; D'Souza, Lumley, Kraft, & Dooley, 2008; Rivkin, Gustafson, Weingarten, & Chin, 2006). Contrary to expectations, depression was not affected by the expressive writing intervention (Danoff-Berg, et al., 2006). Mixed results were reported in Harris' health utilization meta-analysis of randomized control trials (2006) where the results were impacted by whether the population was healthy. Health care utilization was reduced in healthy populations only when participants wrote about stressful events whereas studies involving participants experiencing preexisting medical conditions, stress or other psychological factors did not show significant effects.

The majority of studies employing expressive writing have focused on an adult population (Warner, et al., 2005; Soliday, Garofalo, & Rogers, 2004), although a small number involve healthy adolescent populations in addition to adolescents experiencing illness or emotional difficulties (e.g., Stice, Burton, Bearman, & Rohde, 2006; Soliday, Garofalo, & Rogers, 2004; Stice, Shaw, Burton, & Wade, 2006).

Writing about life events, traumatic experiences, and even writing about neutral topics can provide noteworthy benefits for emotional and physical well-being.

Expressive writing has been effectively used as an intervention in various research settings and conditions. Smyth's meta-analysis (1998) of expressive writing studies validated the generalizability of the intervention effects for various populations' gauges of physical and mental health. Research consistently suggests that expressive writing enhances physical healthiness in diverse populations (Holmes, et al., 2007).

Exploring the use of expressive writing with adolescents in a high school setting, offers promise, based on the effectiveness of expressive writing interventions, the conduciveness to a classroom setting (e.g. low cost, minimal resources, time efficient, replicability), and the possibility of improved well-being and academic achievement.

Expressive writing is an intervention conducive to a school setting. Adolescent use of the internet and text messaging has spurred an incentive for the population to write spontaneously and perhaps more openly. Taken further, a simple intervention like expressive writing is somewhat familiar to students who reflect and respond to prompts consistently. Although Frattaroli's (2006) meta-analysis revealed that the overall effect size of expressive writing is unexceptional (a Cohen's *d* approximately .08), the realization of a brief, short intervention having an impact on a consequential outcome is notable. The majority of available research has found that disclosure is generally beneficial to a wide range of individuals. If expressive writing often leads to improved physical and emotional well-being, such an intervention might be especially beneficial to an adolescent population in a school setting. The use of expressive writing as an

intervention may result in improvements on measures of physical, psychological well-being, and academic performance measured by Algebra I exams.

Importance of the Study

A gap in the research literature exists for investigating expressive writing intervention effectiveness for use with adolescent populations experiencing anxiety and on multicultural responses to test anxiety and, specifically, math test anxiety. The degree to which expressive writing outcomes can be used with students experiencing test anxiety has yet to be investigated. Examinations involving adolescent population samples are meager despite the possible effectiveness of written disclosure. Undergraduate student population samples are predominant (McDonald, 2001). College aged populations may be problematic when studying the constructs of test anxiety and math anxiety. Anxious students, who may have dropped out of high school or altered their college coursework to avoid higher level math requirements, may change the effect size.

From an educational systemic perspective, an expressive writing intervention may be useful and cost effective due, in part, to the applicability of group involvement within a classroom environment. By comparing different treatment approaches to determine how effectively they deliver academic performance improvement and diminish levels of anxiety, the extent to which the interventions yield a beneficial outcome in an educational setting were measured. Increasing the current understanding of the potential impact of anxiety on test performance is essential for developing interventions aimed at improving academic student success.

Purpose

Test anxiety is an important factor associated with student achievement needing to be addressed (Hill and Wigfield, 1984). The purpose of this study is to examine the efficacy of a short-term expressive writing intervention and a psychoeducational presentation for reducing levels of anxiety and physiological symptoms as experienced by adolescent participants anticipating a high school math exam and improving class attendance and math examination performance.

Description of the Study

The study involved three intact groups of ninth through eleventh grade adolescents enrolled in two small, rural, Middle Atlantic public high schools taking Algebra I mathematics courses. One experimental group received an expressive writing intervention. A second experimental group received a psychoeducational test anxiety treatment. A third group, the control group, did not receive any intervention but was assessed. The experimental and control groups completed the Test Anxiety Inventory (TAI), the Mathematics Anxiety Rating Scale – Adolescents (MARS-A), the Multiple Affect Adjective Checklist-Revised (MAACL-R) and an adapted version of the Pennebaker Inventory of Linguistic Languidness (PILL) both pre and post intervention. Demographic information related to the students age, grade, ethnicity, giftedness determination, special educational needs determination, academic performance, and class attendance is based on school records obtained from the data management system and teacher records.

Rationale

An aim of the study is to contribute to the research literature by addressing whether a short term expressive writing intervention or psychoeducational group

presentation is effective in reducing anxiety and to expand the body of research involving an adolescent population within academic settings. A lack of research evidence for the effectiveness of expressive writing as an intervention for students experiencing general, test, or math anxiety provides an impetus to examine the possible impact of a short term expressive writing intervention on emotional well being, academic performance, attendance and investigating the reduction of anxiety and its related physiological symptoms. A psychoeducational presentation was introduced to compare its level of effectiveness with the expressive writing intervention. Test anxiety reduction programs have been found to reduce the test anxiety levels (Ergene, 2003).

Theoretical Foundation

Cognitive behavior theory emphasizes the use of psychoeducation, cognitive restructuring strategies, relaxation techniques, and homework (DiTiomasso & Gosch, 2002). Donald Meichenbaum's theory of cognitive behavioral modification (1972) focuses on assisting individuals to learn alternative ways of thinking and behaving to manage challenging circumstances. Meichenbaum (1985) created stress inoculation training (STI) to aid clients trying to cope with stressful situations by employing a semi structured, graded technique mixing components of cognitive restructuring and behavioral strategies. Meichenbaum's intent to educate clients, so that they possess the skills necessary to make constructive use of stress rather than to attempt to eliminate it altogether, is in alignment with the reality of anxiety provoking situations readily associated with a high school environment. Meichenbaum's (1972) cognitive behavioral modification program for test anxiety was developed to change inappropriate cognitive responses. Meichenbaum described a cognitive modification treatment which aims to

increase the awareness of self-talk associated with anxiety and to monitor self instruction and behavior so that it is more effective with reducing test anxiety. The intervention includes an insight component and an adapted desensitization component. Highlighting the client's pattern of test anxious thinking and showing him or her how to replace negative statements with task-oriented ones leads into monitoring self-statements related to test performance. A modified desensitization technique focuses on relaxation (e.g., slow, deep breathing and progressive muscle relaxation), drawing from mastery and coping imagery.

Research Question

This study endeavors to answer the broad research question: What are the effects of a short term expressive writing intervention and a psychoeducational intervention on general, test, and mathematics anxieties, physical and psychological well-being, attendance, and mathematics test scores in a population of ninth through eleventh grade rural high school students enrolled in Algebra I?

Specific research questions include:

1. What is the relationship between expressive writing and anxiety?
2. What is the relationship between expressive writing and physical well-being?
3. What is the relationship between expressive writing and psychological well-being?
4. What is the relationship between expressive writing and attendance?
5. What is the relationship between expressive writing and mathematics exam performance?
6. What is the relationship between general, test, and math anxieties and mathematics exam performance?

Hypotheses

1. There is no statistically significant difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).
- 2: There is no statistically significant difference on general anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).
- 3: There is no statistically significant difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).
- 4: There is no statistically significant difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).
- 5: There is no statistically significant difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).
- 6: There is no statistically significant difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

Limitations

Anticipated limitations to the study include generalizability of the population sample, confounding variables, comorbidity (e.g., anxiety and depression), and lack of random selection. The demographic makeup of the school may potentially limit the generalizability of the research findings. The limited number (or lack of) students with multi-ethnic backgrounds may narrow the generalizability of the findings to a wider

population. The study was conducted in a rural, Mid-Atlantic secondary setting, thereby possibly limiting the applicability of the results to urban areas throughout the region, the nation, and the world.

The self-reporting of symptoms may be problematic, “However, adolescents are found to be accurate reporters of their own symptoms of depression and anxiety” (Chaplin, Gillham, & Seligman, 2009). Internalizing disorders, which are not as easily observable (Bird, Gould & Staghezza, 1992), may present a confounding affect. Although few students with known anxiety disorders were part of the sample, the tentative reduction of physical and psychological symptoms among all participants is still important. Other confounding factors (e.g., resiliency, social support, impact of depression, and prior math experiences) have the potential to skew the results.

Assumptions of the Study

The aim of the present study was to investigate the possible advantages of the expressive writing intervention, developed by Pennebaker and Beal (1986), adapted as an intervention used with an adolescent population and compared with a psychoeducational intervention. It was predicted that participants in the expressive writing condition would show greater improvements as a result of the writing, and that the intervention would enhance academic performance, improve attendance, and reduce levels of anxiety, thus contributing to greater physical and emotional well being.

It was hypothesized that the participants would experience general, test, and mathematics anxieties to some extent. The empirical body of literature suggests that expressive writing interventions have been an effective means of reducing physiological symptoms; a supposition that a short term expressive writing treatment would reduce

levels of anxiety and physical symptoms and improve general psychological well being follows. It was hypothesized that the psychoeducational intervention would have a less significant impact on the reduction of anxiety and physiological symptoms than the expressive writing intervention.

Overview of the Study

The study examined the effects of expressive writing and a psychoeducational presentation on test and general anxiety, physical and psychological well-being, attendance, and test scores of ninth through eleventh grade adolescents in a rural public high school setting. The first Algebra I class section received the short term writing intervention using three neutral writing prompts; a second Algebra I class received a psychoeducational group treatment, and a third intact Algebra I class participated in a regular classroom instructional experience as members of the control group. At baseline and four weeks following the interventions, physical symptoms, levels of anxiety, attendance, and test scores were assessed. Physical symptoms were assessed using the PILL (Modified). Psychological well being was measured by the MAACL-R. Test anxiety levels were compared by means of the TAI scores. Math anxiety levels were determined by the MARS-A instrument.

In Chapter I, the direction of the study is explained and the research design is explained accordingly. Chapter II expounds the literature associating expressive writing interventions with other variables and provides a context for understanding the theoretical and conceptual frameworks for anxiety with a particular emphasis on test anxiety and math anxiety. Chapter III describes the design in more detail, provides a description of the participants, and delineates the procedure. Chapter IV includes information about

collecting, managing, and analyzing the data used to examine hypotheses. Assumptions are assessed. Chapter V presents the primary and supplemental analyses, summarizes and interprets findings, considers the implications of the findings, points out the study limitations, and highlights possible future directions.

Definition of Terms

Anxiety: Mental and physical nervousness and uneasiness often results in increased tension and is usually associated with pressure to please, fear of failure, or the unknown (Gladding, 2001). Anxiety can be accompanied by cognitive, physical, or emotional responses.

Emotionality: Emotionality refers to physiological reactions such as sweating or feeling nervous.

Exercise: An exercise is a structured activity or action intended to achieve a specific purpose.

Expressive Writing: Expressive writing is a psychosocial intervention incorporating written emotional disclosure in a structured and confidential delivery (Nazarian and Smyth, 2008).

High Stakes: High stakes testing refers to the level of severity of consequences associated with test or assignment performance (Cizek & Burg, 2006).

Math Anxiety: Richardson and Suinn (1972) defined math anxiety as *feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematics problems in a wide variety of ordinary life and academic situations. Mathematics anxiety may prevent a student from passing fundamental mathematics*

courses or prevent his pursuing advanced courses in mathematics or the sciences. (p. 551)

Psychoeducational Group: A psychoeducational group is a group whose main purpose is to educate or train clients in regard to specific subjects or areas relevant to their lives (Gladding, 2001).

School Refusal: Problematic absenteeism or a child-initiated negative response to attending or remaining in school. School refusal behavior may include truancy, school phobia, and anxiety based school refusal (Kearney, 2007).

Stereotype Threat: The event is defined by Steele (1997) as *a negative stereotype about a group to which one belongs becoming self-relevant, usually as a plausible interpretation for something one is doing, for an experience one is having, or for a situation one is in, that has relevance to one's self-definition* (p. 616).

Test Anxiety: Test anxiety is one of many specific forms of anxiety. Test anxiety involves the arousal of physical (e.g. emotionality) and cognitive responses (e.g. worry) during testing or evaluative situations (Cizek & Burg, 2006). "Test anxiety can be interpreted as [being] the tendency to view with alarm the consequences of inadequate performance in an evaluative situation" (I.G. Sarason, 1978, p.214). Spielberger's (1972) time-honored definition describes test anxiety as an "unpleasant state characterized by feelings of tension and apprehension, worrisome thoughts and the activation of the autonomic nervous system when an individual faces evaluative achievement-demanding situations." High test anxiety may be debilitating whereas moderate to low levels may be helpful to a person's performance.

Trait: The predominant feature of a trait is the lasting, enduring characteristic nature of a person.

Trait Anxiety: Trait anxiety is a rather stable characteristic that has pervasive effects or is manifested in varied facets of an individual's life (Cizek & Burg, 2006).

State: A state is a temporary frame of mind or manner of behaving.

State Anxiety: State anxiety is a form of anxiety that exists in particular situations.

Worry: Worry refers to cognitive responses such as concern about the consequences of failing (Ryan & Ryan, 2005).

CHAPTER II LITERATURE REVIEW

Introduction to the Literature

The purpose of this study was to examine the utilization of a short-term expressive writing intervention for the reduction of anxiety level and physiological symptoms linked with test anxiety for an adolescent population in a secondary level math examination environment. Contemporary literature regarding expressive writing and testing anxiety is critically reviewed.

The review of the literature draws on empirical studies and conceptual research with respect to (1) general and test anxiety, (2) the possible association between test anxiety and academic performance, (3) the potential correlation between anxiety and attendance, (4) the utilization of a short-term expressive writing intervention as a means of reducing levels of anxiety and its related symptoms, and (5) the impact of general anxiety, test anxiety, and math anxiety on academic performance

A thread of anxiety research has espoused the differentiation of cognitive and somatic dimensions of anxiety. This body of research follows the topic of specificity between components from diagnostic and symptom viewpoints (e.g., Dugas, Marchand, & Ladouceur, 2004). The cognitive dimension is connected with thought processes (e.g., worry, intrusive thoughts, and poor concentration ability) whereas the somatic distinction indicates self-reported physiological symptoms (e.g., sweating, palpitations, and abdominal discomfort). Furthermore, trait cognitive and somatic anxiety can be reliably and validly measured as separate constructs (e.g., Lee, French, MacLeod, and Lock, 2008).

In Leibert and Morris's (1967) reconceptualization of anxiety, cognitive concerns in the form of worry, in addition to an affective emotionality component emerged. The focal point of self-related cognitions is concern about the consequences of failing and self-awareness of ability in comparison with others as opposed to actual experience of failing an examination.

State and Trait Anxiety

Differentiating between general state anxiety and general trait anxiety deepens the understanding of how and why youth experience anxiety. Anxiety should be considered as being a dimensional construct and state and trait anxiety as multidimensional according to Endler and Kocovski (1999). The authors compared the distinction between trait and state anxiety with the distinction between potential and kinetic energy. As defined by Cizek and Burg (2006), a state is a temporary experience, and a trait is a lasting personal characteristic.

General anxiety, as described by May (1977), is based on a threat to an essential value that a person closely associates with his or her personality. Spielberger conceptualized state anxiety and trait anxiety (1995) and expanded his earlier distinction of the two constructs to consider individual differences in anxiety susceptibility as accounted for by one's personality trait. Trait anxiety is viewed as a comparatively established personality characteristic. Therefore, trait anxiety was defined by Spielberger as an individual's predisposition to react and state anxiety as a changing emotion influenced by physiological distress and an awareness of feelings of apprehension, trepidation, and stress.

The international literature widely accepts that anxiety disorders are prevalent and demonstrate significantly varied patterns as Somers, Goldner, Waraich, and Hsu confirm in their review of the prevalence and incidence studies of anxiety disorders (2006). The majority of studies restricted to the adult population reviewed by Somers, et al., (2006) revealed that anxiety disorders are twice as widespread among women and indicated “a burden of illness” associated with anxiety disorders reported overall. Investigations of anxiety disorders among children and adolescents also consistently demonstrate the prevalence of anxiety disorders and related distress and impairment and advances are helping to close the gap between what is known and what remains to be learned (Ollendick et. al, 1994). The study of longitudinal data is substantiated by a review of the literature concentrating on anxiety disorders, trait anxiety, test anxiety, fears and worries, among ethnic minority children and adolescents in the United States conducted by Saffren, et al. (2000).

Test Anxiety

Early studies in the area called attention to individually differing testing situation reactions experienced by students (Luria, 1932) and supposed that these intense emotional reactions stemmed from traumatic childhood experiences (Neumann, 1933, as cited in Spielberger & Vagg, 1995). Brown (1938a, 1938b) and his colleagues offered the first psychometric instrument for identifying students, who are test anxious, and noted potentially serious consequences of test anxiety (e.g., suicide). In 1951, McKeachie, in a series of studies, reported that when provided with an opportunity to comment on multiple choice test questions, students felt less anxious. McKeachie and his colleagues also reported that poor test performance may be explained by poor study habits and

diversity in ability levels. S.B. Sarason and other investigators found that test anxious students were affected by test instructions and information regarding failure (Doris & Sarason, 1955; Mandler & Sarason, 1952; S.B. Sarason et al., 1960; 1952). Furthermore, I. G. Sarason's earlier work (1958) revealed that students performed less effectively when testing situations were associated with achievement. These early studies generally concluded that test anxious students performed better on exams when anxiety during examinations was reduced. As Spielberger (1972), Liebert and Morris (1967) addressed, however, these early studies considered physiological responses but neglected to take emotional states, personality traits, and the components of worry and emotionality into account. Later studies more clearly specified behaviors interfering with test performance.

McDonald's review of test anxiety literature focusing on prevalence rates and educational effects found that studies involving child populations replicated the vast body of test anxiety knowledge. In contrast to earlier reviews (Hembree, 1988; Seipp, 1991), McDonald's focused solely on students required by compulsory attendance to attend school. Test anxiety was generally defined as trepidation over negative evaluation involving cognitive and emotionality components. The frequency of testing and related feedback increased as children progressed through the grade levels. McDonald also reported, based on the studies he reviewed, that students increasingly compared their performances with peers as they aged. The assessment of test anxiety frequency and severity among student populations were conducted by comparing test-related fears to other potentially stressful events which were categorized or by examining test anxiety level score means. With specific regard to test anxiety and test performance, McDonald noted that most, but not all studies revealed a connection between test anxiety and

performance. Overall, the correlation between the two factors was modest. Test anxiety significantly predicted overall grades and test performance, but not performance based on classwork participation or essay exams. The level of test anxiety was influenced by mediating factors including individual characteristics and testing environmental interactions. Methodologically, attainment measure clarifications and control measures of ability without the influence of test anxiety warrant further consideration.

Over the last several decades, researchers have underscored the adverse effect of test anxiety on student performance, apart from the students' previous academic achievement (McDonald, 2001). Hembree's (1988) meta-analysis of 562 studies examining the relationship between test anxiety and academic performance suggested that test anxiety is a significant factor that may inhibit academic performance. With the marked increase in using tests to measure accountability, test anxiety has received a renewed interest (Cizek & Burg, 2006).

This study reviews literature relevant to the relationship between test anxiety and academic performance among adolescents attending a rural high school. For a wide-ranging review of the test anxiety literature, see McDonald, 2001; Spielberger and Vagg, 1995; Zeidner, 1998; Zeidner and Mathews, 2005; Cizek and Burg, 2006, and Hembree, 1988. The literature reviews conducted by the authors revealed several areas that warranted a more thorough examination. These areas were the causal relationship between test anxiety and academic performance, ethnic minority youth and test anxiety similarities and differences with relation to European American populations, school performance factors (e.g., attendance, behavior, motivation, math-related anxiety, and

teacher characteristics), and gender similarities and differences regarding anxiety experiences.

High test anxious individuals have a tendency to view testing environments as more threatening or dangerous than low anxious persons (Ziedner, 1998). Numerous factors including the situational demands and restrictions, personal history of similar experiences, understanding of possible consequences, individual aptitude, skill, and personality trait variations account for differences in threat interpretations (Zeidner, 1998). High test anxious individuals experience physiological changes (e.g., increased heart rate) and the negative emotional reactions of state anxiety, triggering them to attempt to avoid or minimize the testing threat, depending on the degree to which a test is viewed as being threatening (Spielberger, 1995). Furthermore, Spielberger conceptualized test anxiety as a situation-specific personality trait affecting the emotional and cognitive processes (1995).

Ethnic Minority Youth

The concept of test anxiety has been studied from a cross-cultural perspective, proposing that the construct envelops cultural and geographic boundaries. Nevertheless, the majority of researchers have not investigated the possible relationship between cultural factors and test anxiety. In an attempt to better understand test anxiety within and outside of western cultures, some studies have addressed this void. Among the factors that have been hypothesized for cross-cultural variations in test anxiety are cultural viewpoints and norms, parental values and socialization patterns, and differences in educational systems (Ziedner, 1998). Bodas and Ollendick's (2005) study examined contextual variables related to test anxiety in the Indian setting and found that employing

a western methodological framework would likely produce “western results” which may not necessarily convey to another culture. Furthermore, cross-cultural research carried out in eastern countries persists with a western bias along with other substantial limitations (Bodas, Ollendick, & Sovani, 2008). In another study, Chinese Canadian undergraduate students scored significantly higher in test anxiety than students from other diverse ethnic backgrounds, perhaps due to aims of pleasing parents and cultural pressure (Dion & Toner, 1988). Cultural factors may play an important role in the conceptualizations of anxiety, assessment usage, coping strategies, and other experiences which students may bring to an evaluative situation.

Gender

Despite the collective understanding of the impact of gender on test anxiety, researchers are still investigating possible explanations. The gender differences in test anxiety may be attributed to differing socialization patterns and cultural child rearing practices (Maccoby & Jacklin, 1974). Family interaction patterns in general and parental contributions in particular, influence children’s emotional functioning with child temperament also being a contributing factor (Sanson, Hemphill, & Smart, 2004). This line of research was further enhanced by Suveg, Sood, Hudson, & Kendall (2008) who reported that parents of youth (aged 8-13) with an anxiety disorder, utilized some maladaptive emotional parenting and that these youth had lower participation levels of problem-solving and less adaptive emotion regulation strategies when experiencing negative emotions than youth without an anxiety diagnosis.

Some researchers posit that both genders may actually experience the similar levels of test anxiety with males being less likely to self-report anxiety due to

defensiveness (Hill & Sarason, 1966). It is presumed that as males mature, parental and cultural cues aim to suppress expressions of anxiety in boys while remaining acceptable for females.

McDonald's review of the literature (2001) reported that test anxiety occurred equally between genders, with females experiencing higher levels of test anxiety based on standardized instruments. These findings are consistent with the adult population. The variation in the anxiety and gender relationship reported in the literature indicates a need for further research.

Attendance

Although academic success is a high priority focus in schools, efforts to enhance students' physical and emotional well-being are also considered to be important. Anxiety-based school refusal may involve 5 to 28% of youth and can lead to waning academic performance and dropping out of school, among other short and long term problems (Kearney, 2001). Anxiety related components may involve a misguided attempt to avoid experiencing anxiety (e.g. an examination or attending a specific class). Attendance concerns may result in negative outcomes (e.g. missed instructional time, possibility of suspension or failing a course due to lack of attendance if the limit was exceeded). Students who experience anxiety in the school setting deal with a range of issues that may affect physical and emotional well-being as well as attendance, achievement, and behavior. Overanxious individuals with absenteeism concerns may benefit from relaxation training, systemic desensitization, and cognitive procedures (Lauchin, 2003). Therefore, although the antecedent reasons and behaviors for non-attendance may vary, school and parental involvement is imperative for an effective

multi-systemic approach. In particular, school personnel can strategically monitor student attendance, complete a functional analysis of non-attendance, develop systemic, group, and individual approaches to intervention, and inform parents and guardians.

Considerable evidence has accumulated demonstrating the impact of anxiety on academic performance. As opposed to facilitative anxiety, test and mathematics anxieties can be debilitating because the anxiety is associated with possible negative repercussions, which may be evidenced in the form of class absenteeism, poor preparation, difficulties understanding course content, classroom test results which are not aligned with actual ability, and feelings of uncertainty.

Test Anxiety and Academic Achievement

A variety of school related factors are negatively associated with anxiety including poor sleep (Mayers, Grabau, Campbell, & Baldwin, 2009), school connectiveness (Shochet, Dadds, Ham, & Montague, 2006), and school refusal (McShane, Walter, & Rey, 2001).

Test anxiety is generally understood to be associated with lower academic performance (Zeidner, 1998) and diminished grade point average (GPA), on the basis of an extensive body of literature investigating American primary and secondary level students (Blanding, Takahashi, Silverstein, Newman, Gubi, & McCann, 2005). Meta-analyses have shown a correlation of -0.23 between test anxiety and academic achievement measures (e.g., Hembree, 1988; Seipp, 1991). In his meta-analyses of students from the United States, Hembree (1988) found that test anxiety negatively impacted student performance at every educational level. Overall, the vast amount of empirical research on the test anxiety and cognitive performance shows a relatively

modest inverse relationship between the correlates (Zeidner, 1998). Test anxiety theory generally views test anxiety as being an interfering agent, blocking the focus and retrieval of relevant information (Naveh-Benjamin, Lavi, McKeachie, & Lin 1997; Wine, 1971).

Hong's 1999 study tested two hypothesized test anxiety relationship models; perceived test difficulty, and test performance observed immediately before and after a final examination. Two hundred and eight undergraduate students completed modified versions of the Test Anxiety Inventory (TAI: Spielberger, 1980) to measure their worry and emotionality levels during the time of their final exam. In this structural model, perceptions regarding the test difficulty level had a significant effect on worry arousal and emotionality arousal. According to the temporal model, test difficulty was perceived before and after the exam with the greatest effect on test anxiety occurring during the exam. The perceived test difficulty level did not directly impact test performance, but the construct of worry, aroused by test difficulty perception, impacted exam performance.

Hong's findings suggest students' test difficulty perceptions and the actual exam difficulty level both significantly related to test anxiety. High test-anxious undergraduate students performed worse on end of course exams than high test anxious students who were tested at staggered retention intervals after the course and performed as well as other students (Naveh-Benjamin, et al., 1997). The importance of retaining knowledge gained by students and the influence of individual differences was thoroughly studied. Two hundred and ten undergraduate students with differing levels of test anxiety were evaluated at retention intervals up to seven years in this longitudinal study. Although the results showed that high test anxious students performed worse on course exams than other students but tested similarly to other students at various retention intervals.

Seemingly, high test anxious students have the cognitive organizational structure and the applicability to respond to test questions in a similar fashion to other students, yet test anxiousness impacts their achievement level as evidenced by lower initial course exam scores.

In an earlier study (1981), Naveh-Benjamin, McKeachie, Holinger, and Lin demonstrated the negative relationship between test anxiety with overall course grade and grade point average. Test anxiety was observed to be the result of worry due to poor test taking skills. This important study however, consisted of a small sample ($N = 48$) of college level students.

Physiological Symptoms

Hughes, Lourea-Waddell, and Kendall (2007) hypothesized that children with anxiety disorders would show signs of more somatic symptoms than non-anxious control children and that an increased number of symptoms would predict poorer academic performance. Anxious and non-anxious children and adolescents aged eight to fourteen years ($N = 108$) participated in the randomized clinical trial. The volunteer participants were drawn from the community for either treatment or research purposes. Data was collected in the form of a child measure (the total anxiety and physical symptoms subscales of the Multidimensional Anxiety Scale for Children), parent measure (the internalizing and somatic complaints subscales of the (Child Behavior Checklist), and a teacher measure (The Teacher Report Form).

The participants completed a structured diagnostic interview and the study measures. The Teacher Report Forms were returned by 95% of the students' teachers. Standard multiple regression analyses were engaged using somatic, anxiety, and

internalizing reported symptoms as predictor variables and academic performance and the criterion variable. Univariate analyses of variance (ANOVA) investigated group differences on somatic complaints and academic performance and chi-square analyses examined categorical variables. The results demonstrate that the treatment group experienced more physical symptoms (e.g., dizziness, tiredness, headaches, stomach aches, nausea, and vomiting) than the control group according to the child report measure. The anxious disorder group reported significantly higher levels of anxiety on the children's measure ($p < 0.001$) and had higher internalizing scale scores ($p < 0.0001$) than the control group. The treatment group's academic performance was rated worse than the control group by their teachers ($p < 0.002$). Results from the parent report measure analysis demonstrated that somatic complaints helped predict child academic performance, but anxiety symptoms did not show a relationship. Several limitations in the study are evident. The community sample was comprised primarily by Caucasians, thus the findings may not convey to more ethnically diverse populations. The authors note that the use of a standardized measure of academic achievement may be more telling and favorable than their use of the academic performance subscale of the Teacher Report Form. A comparison group representing other mental health conditions (e.g., depression, attention deficit disorder, obsessive compulsive disorder) may help to clarify whether the findings in the study relate specifically to anxiety. Findings from Hughes, et al.'s (2007) study point to the importance of somatic complaints when examining the anxiety and poorer academic functioning relationship.

Mathematics Anxiety

Mathematical understanding and high school assessments provide adolescents with skills and experiences that pave the way to both college and careers (Brown & Conley, 2007). High stakes circumstances or stressful environments may negatively undermine math performance when monetary and social consequences are linked with poor performance (Beilock, 2008). Given laboratory situation-induced pressures, Beilock (2008) established that individuals most likely to succeed in low stress situations are often the ones most apt to fail in demanding situations. Students affected by math anxiety may hinder their progress in learning mathematical concepts and their academic performance (Frenzel, Pekrun, & Goetz, 2007; Ryan & Ryan, 2005; Hembree, 1990).

As students become less anxious about their math performance, they may make less careless mistakes on the various types of computations (Beilock, 2008), their test scores may improve, and they can be better prepared for the future while experiencing more confidence in their approach to learning.

Math anxiety interrupts cognitive processing by conceding working memory activity (Ashcraft, 2002; Beilock, 2008), offering some understanding about poor performance and individual differences in experiences with math anxiety. Highly anxious students in stressful situations may be more susceptible to unwanted failure in math despite often showing competency in other areas (Beilock, 2008). Math anxiety and overall intelligence is only weakly related given the minor correlation of $-.17$ between math anxiety and intelligence, especially when the quantitative aspect of intelligence testing is considered (Ashcraft, 2002).

Math anxiety is consistently related to math performance (e.g., Hembree, 1990; Liebert & Morris, 1967; Hsiu-Zu, Senturk, Lam, Zimmer, Hong, & Okamoto, 2000).

Researchers have found correlations commonly within the $-.11$ to $-.36$ range, a small negative relationship pointing out that students with higher levels of math anxiety are inclined to have lower levels of math performance (e.g., Hembree, 1990; Ma, 1999). Math anxiety, according to numerous studies (e.g., Hembree, 1990; Liebert & Morris, 1967; Ma, 1999, Betz, 1978), has been found to have a consistent but small negative relationship with math achievement with students experiencing high levels of math anxiety performing at lower mathematics levels academically.

Ma's (1999) landmark meta-analysis considered twenty six studies on the relationship between math anxiety and math achievement among elementary and secondary level students. The purpose of Ma's study was to determine the degree of significance between math anxiety and math achievement. Additionally, Ma aimed to determine the permeability of the relationship in response to the moderating variables gender, grade level, ethnicity and assessments to measure anxiety and achievement.

Ma and Xu (2004) endeavored to ascertain the causal ordering between mathematics anxiety and mathematics achievement using data from the Longitudinal Study of American Youth (LASA). A probability sample of fifty two public middle and high schools from throughout the United States representing various geographic regions and community types offered improved generalizability. Approximately sixty students from grade seven in each of these schools were randomly selected and followed for six years. The total sample of 3,116 students was comprised of 1,626 boys and 1,490 girls. The students were administered achievement tests in mathematics and science and completed a questionnaire with a mathematics anxiety measure.

The study examined math anxiety and math achievement to determine a possible causal direction. Two five-point Likert-type scale self-report questions were used to identify the presence of math anxiety. The math achievement test in the LSAY evaluated basic skills, algebra, geometry, and quantitative literacy. Gender was obtained from the student questionnaires to examine causal effects.

Consistent significant associations, across grade levels, between prior poor math achievement and later math anxiety have been demonstrated by Ma and Xu (2004) using structural equation modeling. Prior math achievement and later math achievement were significantly related across the six grade levels (from 0.91 to 0.98) whereas the stability effects for prior math anxiety on later math anxiety were weaker (0.39 to 0.57). However, the stability effects for math anxiety became more pronounced from grade eight (0.55 to 0.59) and impacted later math anxiety consistently across later grade levels. Prior high levels of math anxiety relating to later poor math achievement were not statistically significant beginning with the ninth grade. In spite of these findings, prior poor math achievement was related to high math anxiety across all junior and senior high school grade levels, most notably for males. However, a similar relationship was noted for girls during junior high and senior high transition periods only. The notable exception was the more reliably stable relationship between females and math anxiety than males and math anxiety.

A critical problem within this study is that the measurement of test anxiety was not a specific anxiety scale that explicitly evaluates test anxiety, which has been shown to be better at measuring test anxiety (Alpert & Haber, 1960) than merely the two items on the questionnaire in the LSAY. Ma and Xu note that this limitation may account for the

relatively low test-retest coefficients observed for math anxiety compared with math achievement measures which contained multiple items embedded in several subscales. The measurements of math achievement may have been impacted by test anxiety themselves, thus revealing some of the complexities involved with studying test anxiety and academic performance. Additionally, the multidimensionality of math anxiety, an important consideration (Balolu & Koçak, 2006) was not taken into account, which may have affected the results.

Hembree's (1990) findings for math anxiety treatments, as part of a meta-analysis of 151 studies, focused on reducing anxiety levels and improving academic performance. An average correlation of $-.34$ was reported for a student population, illustrating that math anxiety significantly affects mathematical performance and that achievement gains are coupled with diminished anxiety. Classroom interventions, behavioral and cognitive psychological treatments, and cognitive-behavioral treatments were analyzed. Classroom interventions (e.g., curricula modifications, instructional strategies, and specialized equipment) and whole class psychological treatments were not found to be associated with a reduction in math anxiety. Systematic desensitization, anxiety management training, and conditioned inhibition are behavioral treatments, which often included relaxation training, which was highly effective in lowering levels of math anxiety. Cognitive faulty belief restructuring treatments were moderately effective approaches. The cognitive restructuring treatment combined with desensitization or relaxation training was comparably as effective as desensitization alone.

Expressive Writing Interventions

Adapting Pennebaker's expressive writing procedure (Pennebaker & Beall, 1986) for use as a homework intervention with outpatient psychotherapy patients, Graf, Gaudiano, & Geller (2008) sought to determine the possible benefits of the treatment on reductions in anxiety and depressive symptoms as well as improved overall progress in psychotherapy in comparison to a control group. The early drafts of Graf et al.'s study received comments from Dr. James Pennebaker.

According to the researchers, previous research on written emotional disclosure centered on healthy undergraduates and the benefits of expressive writing on physical and psychological health. The role of expressive writing in psychologically distressed populations was limited and revealed mixed findings Graf, et al., found (2008).

The researchers, using a randomized controlled study, assigned outpatient psychotherapy patients to an adapted form of Pennebaker's writing intervention or to a control writing condition as part of weekly homework assignments. Participants were drawn from an outpatient psychiatry clinic and a student counseling center, both of which were university based. Forty-four participants agreed to participate and twenty-seven rejected the opportunity. Fourteen males and thirty females, with a mean age of 33.3 years, participated in the study. 40.9% of the participants were prescribed a psychiatric medication, but did they not report a medication change within 6 months prior to the beginning of the study. Clients self-reported their primary issues on their demographic questionnaires: depression ($n = 22$ [50%]); trauma grief ($n = 9$ [20.4%]), anxiety ($n = 7$ [15.9%]), health/medical problems ($n = 3$ [6.8%]), marital difficulties ($n = 1$ [2.3%]), and eating disorders ($n = 2.3\%$). Anxiety, health/medical problems and depression were

reported as being secondary concerns by a significant number of the participants ($n = 17$ [38.6%]).

Therapists provided psychotherapy services to the clients enrolled in the study. The Depression Anxiety Stress Scales was used to assess depression, anxiety, and stress in clinical samples during the preceding week. The Outcome Questionnaire was used to measure the participants' therapeutic progress during the study. After the three treatment sessions, the clients completed a self-report measure of homework completion, the amount of time spent writing, and the client's perceived emotional intensity of the writing topic. The Client Post-Writing Questionnaire, developed from similar items in other expressive writing studies, assessed the role of writing in the therapy sessions. The therapists completed the Therapist Post-Writing Questionnaire to assess the impact of the writing homework intervention on the therapeutic sessions.

Participants were randomly assigned to an emotional disclosure group and a writing control group. Participants wrote about their topic given for 20 minutes each week for two weeks, outside of therapy. Primary analyses, using independent-sample t tests and chi-square tests were performed to determine the differences between conditions and recruitment sites on baseline measures and client-therapist variables. A series of 2X2 repeated measures analyses of covariance were performed on the subscales of both measurements. Results, all of which were significant at $p = .05$, indicated that participants in the expressive writing condition improved more significantly than the control condition. The exploratory findings indicate that the positive effects of the expressive writing condition could not be adequately accounted for by therapist factors.

The authors suggest that written emotional disclosure may support effective problem solving strategies based on dealing with previous stressful life event experiences which may lead to improved understanding and a decline in distress related symptoms. The study supported current research regarding the benefits of expressive writing with regard to psychological health.

This study is limited by the generalizability of the findings to individuals without college educational experience as a little over half of the sample reported some college education. Interpretation of the results, specifically regarding group differences, may be limited by the informational deficit regarding the 27 individuals declining to participate. Although the study validated a significant reduction in depression and anxiety symptoms in the expressive writing group compared with the control group, long term follow-up information was lacking.

The authors noted the need for future research involving the use of emotional disclosure writing in conjunction with psychotherapy with the aim of improving therapeutic process and outcome.

Four classes of eighth-grade students in a suburban middle school health course were randomly assigned to write about either an emotional or neutral topic in an (2004) expressive writing intervention for adolescents' somatic symptoms and mood study conducted by Soliday, Garofolo, and Rogers. Their research revealed advantages of using expressive writing as a cost efficient intervention to attend to the emotional worries of adolescents.

To assess the usefulness of a written expressive intervention on minimizing levels of distress experienced by young adolescents and to measure overall functioning

improvement, the student sample population ($N = 106$) was randomly assigned to an emotional disclosure group (negative events) a control group (neutral events). The Children's Somatization Inventory (CSI), and the Somatization scale of the Youth Self-Report Inventory (YSR) subscale were used to assess somatic symptoms. The Center for Epidemiological Studies Depression Scale (CESD) and the Negative Affect (NA) subscale of the Positive and Negative Affect Schedule for Children (PANAS) were used to measure depressive symptoms. The Positive Affect (PA) subscale of the PANAS measured interest, engagement, and energy. Positive disposition was identified by the Children's Hope Scale and the Life Orientation Test-Revised (LOT-R) assessed the potential of positive outcomes. At baseline and at a six week assessment, a medical visit self-report of the number of medical visits within the previous six weeks was requested. The Linguistic Inquiry and Word Count (LIWC) program was utilized in an effort to determine the extent student writings contained emotional content.

Data were collected during four intervals: baseline questionnaire; postintervention (following three consecutive daily twenty minute writing sessions); two follow ups (20 days postbaseline); six week follow up (50 days postbaseline). Students reported on their functioning, to some extent, at each interval.

Data generated by the measures was examined for normal distribution. Following the log transformation of CSI scores and the coding transformation of medical visits, skewness and kurtosis estimates for all measured data were within normal limits. Data from 14 students (due to insufficient data or absenteeism), was analyzed through the use of a Chi-square analysis which uncovered no significant differences in the proportion of participants with dropped data. Study completers were younger than those with dropped

data $t(115) = 2.5, p < .01$, Cohen's d (effect size) = .22 ($M = 13.5, SD = 1.1$, and $M = 13.9, SD = .5$, respectively). No significant differences between study completers and those with dropped data as determined by t test measures comparing the scores of all measures at baseline were determined. Effect sizes ranged from $d = .02$ to $d = .09$.

A MANOVA tested the effects of the expressive writing intervention on distress, positive disposition, and somatic symptoms indicating nonsignificant interactions with gender. Univariate analyses showed significant effects for the PANAS-NA scale. The Condition X Time interaction was significant $F(3, 102) = 3.85, p = .01, \eta^2 = .05$. Follow-up analyses demonstrated that scores remained constant from baseline to postintervention for both groups ($\eta^2 = .01$). Further follow-up analyses indicated that LOT scores increased significantly in the experimental condition only $F(1, 105) = 5.39, p = .02, \eta^2 = .05$. Somatic symptoms as measured by the PANAS-PA and the number of medical visits were nonsignificant, with effect sizes ranging from .01 to .06.

Post treatment distress scores decreased and positive disposition scores increased for the treatment condition only. Importantly, the lasting effects of the intervention over time were readily apparent.

Relying on self reported somatic symptoms may have been problematic considering the age of the participants. Concerns regarding the small effect sizes are noteworthy. Without verification by parents, guardians, teachers, or registered nurses, it is difficult to determine whether reported stressors or somatic symptoms are representative of the actual indications. However, multiple perspective assessment disagreement of youth emotions is common and not well understood (Weems, Taylor, Marks, & Varela, 2010).

Despite these and other limitations, the study highlights the possibility for using emotional disclosure interventions with an adolescent population experiencing nonclinical distress.

CHAPTER III METHODOLOGY

Purpose

The purpose of the investigation was to determine if two interventions, expressive writing and a psychoeducational group presentation, would have an effect on mathematics test performance, and the psychological and physical symptoms associated with anxiety for adolescents attending two rural high schools located in the mid Atlantic region.

Research Questions and Associated Hypotheses

What is the impact of two interventions — short term expressive writing and psychoeducational group presentation — on the general test anxiety, mathematics anxiety, and related physical symptoms for performance on a mathematics test for a sample of adolescents enrolled in Algebra I and attending rural public high schools?

Research Question and Hypothesis 1

RQ1: Is there a difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

H1_o: There is no difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

H1_a: There is a difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

Research Question and Hypothesis 2

RQ2: Is there a difference on general anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest)?

H2_o: There is no difference on general anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

H2_a: There is a difference on general anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

Research Question and Hypothesis 3

RQ3: Is there a difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

H3_o: There is no difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

H3_a: There is a difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

Research Question and Hypothesis 4

RQ4: Is there a difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

H4_o: There is no difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

H4_a: There is a difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

Research Question and Hypothesis 5

RQ5: Is there a difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

H5_o: There is no difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

H5_a: There is a difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

Research Question and Hypothesis 6

RQ6: Is there a difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

H6_o: There is no difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

H6_a: There is a difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

General, test, and math anxieties, associated with the participants, were measured by composite scores on the MAACL-R, TAI, and MARS-A, respectively. Physiological well-being was measured by reduced scores on a modified version of the PILL.

Research Design

The research design determined to be the most appropriate for this study was a repeated measures experimental design. There were two experimental groups and one control group. One experimental group received the expressive writing intervention and the other experimental group received the psychoeducational group presentation. The control group did not participate in either treatment. All of the groups received pre and post assessments of general anxiety, test anxiety, mathematics anxiety, and physical symptoms associated with anxiety and mathematics test scores. Additional data (i.e. attendance data and exam grades) was acquired via school records managed by the

teacher and demographic information was obtained through the utilization of the student data information system.

Participants

The participants involved in this study were mixed gender ninth, tenth, and eleventh grade students enrolled in Algebra I high school mathematics courses and attending two small, Middle Atlantic public high schools located in a rural community. The participant pool ages ranged between 14 and 18 years. Participants included male and female students of varying ethnic and socioeconomic backgrounds from the Mid-Atlantic region and military dependents from several branches of the armed services representing various geographic locations throughout the county.

To ensure that all high school graduates are prepared for future endeavors, many states have aligned their graduation requirements with the demands of higher education and the workforce. A national advancement to standardize the high school curriculum so that all students graduate prepared for college at a time when sustaining the nation's competitive edge means preparing and encouraging more students to consider math or science related majors and careers. Students can be better prepared for their future college and career plans if they possess a strong foundation in mathematics.

Students living in many different states must pass four mathematics courses beginning with Algebra I. Typically, a minimum curriculum in mathematics consisting of Algebra I, geometry, and Algebra II prepares students for a credit-bearing, entry-level college algebra course. The college readiness policies have been found to reduce inequities in ninth grade curriculum by entering ability, ethnicity, and special education status although few other benefits resulted from mandating college preparatory core

coursework among freshmen in Chicago (Allensworth, Nomi, Montgomery, & Lee, 2009).

The push to require that students of varying abilities take introductory algebra and do so earlier has gained widespread acceptance in U.S. schools since *A Nation at Risk* advanced strengthening graduation requirements in math. In turn, states have increased local high school graduation requirements, which in turn have trickled down to middle schools in terms of increased emphasis on algebra readiness and advanced coursework opportunities. One result of those efforts is that beginning algebra and higher level math courses are increasingly being taught in the eighth grade rather than the 9th grade (Cavanagh, 2008).

Intact class Algebra I groups were used as the sample. Students in the intact groups did not take Algebra I during the eighth grade when more advanced students take the course. Class groups were assigned to one of two treatment groups (expressive writing intervention group, a psychoeducational group presentation intervention group) or the control group. The possibility that a difference in the means between the experimental groups and the control group could be caused by factors outside of the experimental variables is considered. Algebra I chapter test scores were used to measure any possible academic changes. Many of the students may be considered to be academically at risk, as determined by academic performance, to some extent age, and to some extent, federal lunch program status.

The teacher of these courses was consulted to secure support and collaboration. A letter of explanation explaining the purpose and goals of the study and of their right to refuse participation in the study without consequence, a consent form, and an assent form

was given to each potential participant to take home. Follow up forms of communication with parents and guardians included mailing, email, and telephone contact. Written consent was obtained prior to student participation. The study was conducted by a school counselor. A school counselor facilitated the expressive writing intervention. Another school counselor facilitated the psychoeducational group intervention. Pretest and posttest data was collected from 59 participants. One of these participants was administered posttest instruments in an alternative learning program classroom setting after an alternative placement was designated. Exam 1 data was received from 59 participants. 58 of the 59 participants submitted Exam 2 data. The remaining participant was not required to take Exam 2 by his former teacher. A total of 58 participants remained in the study.

Procedure

Vital approval from the university's Human Subjects Institutional Review Board and school administrators was sought before initiating the present study. The Director of Secondary Education supported the idea of providing interventions for the benefit of the students. The cooperation and participation of school administrative officials and a mathematics teacher was granted. To alleviate potential concerns that the interventions might detract from the teacher's implementation of the mathematics curriculum, a meeting with the mathematics teacher was held to provide information about the proposed study. Approval for participation was obtained from the two high school principals who had oversight of the study implementation. The purpose of the study and its relevance to students was explained. Communicating that the goal of the intervention was to provide assistance to students who may not be making adequate progress

academically, and that the interventions would not supersede the curriculum but rather provide the possibility of reducing an anxiety related negative impact on exam performance was the focus of the meeting. Finally, the research proposal was submitted to the university's Human Subjects Institutional Review Board. Evidence of university collaboration was an essential component of the research proposal, and approval was granted.

Parents and legal guardians of the participants were provided with a written explanation of the study procedures and review board approved informed consent and assent forms. The students were verbally notified about the study during a classroom visit and informed about the confidential nature of their responses. The researcher administered the TAI, MARS-A, modified PILL, and MAACL-R to intact class groups in their regular classroom setting. These measures served as a baseline measure of current physical, psychological, and anxiety functioning. All completed measures were sealed in a large envelope and stored in a secure location.

Written Expression Intervention

The short-term expressive writing sample was completed prior to the Algebra I exam 1 for the experimental-writing group. Participants were reminded about their right to withdraw from the study at any time, confidentiality privilege and other pertinent information. The written instructions were also read aloud. The participants wrote for twenty minutes, uninterrupted over a period of three consecutive days. The first prompt for the first experimental group writing was, "What is your favorite hobby?" The adolescents wrote about their spring break activities and their favorite place to vacation for the following prompts, respectively.

Psychoeducational Intervention.

A week prior to the test, during class time, a school counselor conducted an evidence-based, one hour psychoeducational intervention involving didactic and experiential approaches to reducing test anxiety. The most effective interventions for addressing test anxiety seem to be a blend of cognitive and behavioral methods with skill-focused interventions (Hembree, 1988 & Ergene, 2003). By using physical control methods to address the physiological reactions, cognitive challenging to tackle the cognitive responses, and modifying behavior to target behavioral responses, the anxiety pattern can be intercepted and altered to a more conducive pattern.

Although educators, parents and guardians play important roles in the prevention and reduction of anxiety, students play an essential part in the effort. The intervention was designed to expand the student's behavioral options in response to situations with anxiety provoking potential. Student focused techniques (e.g. test preparation and study skills, positive self-talk, relaxation, mental visualizations) were introduced to help prevent and reduce levels of anxiety.

Introducing tips and strategies for reducing levels of anxiety especially test anxiety and math anxiety, was the primary focus of the psychoeducational group presentation. The informational presentation began with an introductory disclosure activity to generate a discussion about prior test taking experiences. A general, five minute discussion about testing and math (situational) anxiety, with the intent of informally assessing the participants' level of awareness, was followed by a dialogue about testing and math situational anxiety to define and clarify the concepts and normalize the presence of anxiety. The notions of alarm generated by thoughts of taking

a test are normalized by helping the students realize that this experience is relatively common. Normalization of test taking anxiety involves placing it within the context of being an example of everyday stress, which is normal but can feel overwhelming as test time approaches. Test anxiety is not the normal nervousness that many students feel before or during a test. It is natural to experience some anxiety under such circumstances. Some anxiety is necessary for motivation and the pursuit of learning. Performance reaches its pinnacle when anxiety signals the body to respond favorably. However, if anxiety escalates above a state of equilibrium, it can impede or thwart performance. In an average class size of 25, the number of students affected by test anxiety is probably in the midrange of four or five students (Cizek & Burg, 2006). The goal of the intervention was to facilitate anxiety reduction to a level which is conducive rather than remaining at a dysfunctional level.

Various physical responses (e.g., illness, increased heart rate, shallow breathing, sweating, or need to use the restroom), behavioral responses (e.g., fidgeting, staring, crying, pencil tapping, and perhaps lower attendance, difficulty sleeping, or cheating), and emotional responses (e.g., feeling inadequate, acting out, mind going blank, withdrawing or worrying about performance) were identified. By noting that higher achievement scores are often earned by students with lower levels of test anxiety and lower achievement tends to be associated with higher levels of test anxiety, the relevance of the topic was portrayed. Because the presence of overwhelming test anxiety can influence one's performance, beneficial strategies to prevent or reduce anxiety were introduced.

Following the introduction of the topic, practical techniques and strategies for reducing test and math anxiety were provided. After highlighting the common occurrences and effects of test and math anxieties, the school counselor leading the psychoeducational group shared ways to prevent and ways to address test anxiety and math anxiety so that the related consequences are minimized. Anxiety is a complex and multifaceted construct; no single technique will prevent anxiety or provide instant results. Therefore, a variety of strategies to help build success at school during test time were identified and explored.

Self Talk

For anxious students, the messages often replayed in their minds are negative ones. The school counselor facilitated an exercise with the objective of turning negative thoughts into positive ones. Students wrote down a feeling or worry they might have had when completing math problems or taking a test. Then, they transformed their concerns into more positive statements. Students shared messages which boosted their confidence. The facilitator aided in helping the students to reorient their self-talk.

Study Skills

For minimizing performance related anxieties, understanding the nature of the test and establishing effective study behaviors are essential (Sapp, 1999, Cottrell, 2007). Reviewing the syllabus and other information provided by the teacher for important details about the test allows students to gain pertinent test-related information. Students reviewed their math course syllabi to determine when their next chapter test would be administered; identified what material would be tested, and how much the test would count toward the course grade. Students can improve their study skills by working out a

weekly schedule allowing for class assignments, possible part-time work, free time and family responsibilities. Students can estimate the average amount of time needed to earn a desirable grade as they schedule their school work. Monitoring their behavior (e.g., start up time, breaks, ability to focus) can help to lead to using study time more effectively. By helping the students to understand how to plan their study time, the school counselor made the connection between test preparation with the possibility and likelihood of experiencing less stress during examinations.

Test Preparation

Expanding knowledge and understanding of the test preparation process was an important component of the presentation. Typically, many adolescents do not realize the importance of preparing for an examination in advance. Preparing for an exam involves exerting effort and allocating time. Reviewing the material in preparation for a test helps one to commit the information to memory. Ideally, the review time is distributed throughout the course in order to avoid having to study the bulk of the material within a short time period (cramming) and for focusing on weak areas. Setting goals for how much time to study and devoting review time is one strategy which can help prevent test anxiety in advance.

Being comfortable with using the calculator, knowing the problem solving steps, and mathematical computations are an important part of being prepared for a math exam. Reviewing the steps that can help students manage their anxiety before and during the test is an imperative goal of the psychoeducational treatment. Reminding the participants to listen to, read, and follow test directions and rules carefully may be helpful. Reviewing the entire test to see what is required enables the test taker to decide how

much time should be spent on each question or section. Computational errors are common when individuals are experiencing high levels of math anxiety. Checking answers for errors is crucial for performing well. However, answers should only be changed if they're wrong. The school counselor suggested that students read all of the answer choices before choosing one and to make sure that each question is answered. The group then explored the benefits of using all of the time provided to complete the test.

Relaxation Techniques

Relaxation techniques can assist participants with their coping during an exam. The school counselor reminded the students that feeling a little nervous before and during a test is to be expected. By recognizing when stress is starting to impede thinking, students can take measures to counteract the anxiety before it becomes a problem. By paying attention to one's feelings and recognizing when signs of anxiety occur (e.g., tight muscles, mind going blank, difficulty focusing, shallow breathing, and pounding heartbeat), taking some deep breaths and using other techniques can help one to regain a sense of control over the anxious feelings.

Deep breathing helps to relax the muscles and can help students to experience more control when they sense that they are not in control (Cizek & Burg, 2006). The school counselor explained the procedure: "Breathe in through your nose, slowly and deeply, as you count to four. You may close your eyes or keep them open. Breathe out slowly through your mouth as you count to four in your mind. Repeat five times, and then breathe regularly." Alternating tensing and relaxing muscles was introduced as an

additional way to reduce stress before or during exam or while working on a challenging math problem.

Taking a mental mini-vacation is another way to minimize anxiety. The school counselor explained, “Spending a minute or so picturing yourself relaxing or doing something that you enjoy is one way to feel less stressed. Think about a place or an activity that you associate with feeling relaxed and content. Use your senses to imagine the sights, smells, sounds, and the sensation of being there. After a minute or so, return to working on completing your test.” Similar to the way athletes imagine what they want to achieve and visualize themselves reaching their goal, students can think through the what they might encounter on a test or when working on a difficult math problem. Then, they can visualize passing the exam, earning a high grade, feeling relaxed and confident or giving their best effort when taking an examination.

The school counselor helped the students manage the challenge of preventing or confronting anxieties by reflecting on the psychoeducational group experience. “How could you apply some of the strategies we discussed in your preparation for your next math exam or while you are taking your next math exam? How can you manage the critical moment when you are experiencing a lot of anxiety related to taking a test or working on challenging math problems?

What else did you learn from today’s session that you could apply to your life?”

The importance of attending school, paying attention, asking for help, completing assignments in a timely manner, and talking with an adult such as a parent or guardian, school counselor or teacher if they were worried about something was reemphasized at the end of the treatment.

Instrumentation

The negative effects of test anxiety (e.g., Hembree, 1988; I. Sarason, 1984; Bembenutty, 2008; McDonald, 2001) and mathematics anxiety (e.g., Hembree, 1990; Ma, 1999) on academic performance are well documented. Because test anxiety and math anxiety are significantly and negatively related to academic performance, researchers aim to further comprehend and assess anxiety and the effectiveness of interventions using valid and precise measures of various forms of anxiety. Measuring test and math anxieties may be useful to researchers, educators, and counselors in development and counseling.

Physical Symptoms

The Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1980) measures the frequency general physical symptoms and sensations experienced. The PILL is a 54 item instrument with a five point scale designed to evaluate the rate of occurrence of physiological correlates of the psychological process components of disclosure. The PILL permits researchers to see which specific symptoms are regularly experienced by the participant as opposed to assessing a participant's general inclination for reporting physical symptoms (Pennebaker, 1982).

The PILL has high construct validity when compared with other self-report measures of physical symptoms (Richards, Beal, Seagal, & Pennebaker, 2000). In terms of reliability, acceptable test-retest reliabilities over a two month period (for 177 participants) were reported to range from .79 to .83 (the reliability of the binary and summed methods, respectively). The scale has no stable factor structure (Pennebaker, 1982). The item reliability averaged across all 54 symptoms was found to be .725, for 60

participants tested two weeks apart (Pennebaker, Burnam, Schaeffer, & Harper (1977). The internal consistency of the PILL is high. The Cronbach alpha internal consistencies range from .88 (when scored using the binary method) to .91 (the summed method alpha).

A number of construct validation studies indicate that high PILL scorers, compared with low PILL scorers, report more symptoms across various settings (Pennebaker, 1982). Cross-validation analyses with additional symptom inventories show that the PILL moderately correlates with the Hopkins Symptom Checklist .48 ($N = 231$), the Autonomic Perception Questionnaire .50 ($N = 75$), the Cornell Medical Index composite score .57 ($N = 100$), and Pennebaker's standard symptom checklists .45 ($N = 1248$). Pennebaker offered the differences in item numbers, item response methods, and severity of symptoms variations as possible explanations for a moderate correlation between the PILL and other symptom inventories (1982).

State Anxiety

The Multiple Affect Adjective Checklist-Revised (MAACL-R), developed by Lubin and Zuckerman (1999), may be used to measure affect states and traits. A frequent use of the State version of the MAACL-R is to measure change as a result of experimental interventions. The easily administered instrument has been used in a wide variety of settings. Designed for use with college students as a measure of test anxiety, the instrument has also been used with high school populations. The MAACL-R consists of 132 adjectives measuring positive and negative affect (Luberman & Zuckerman, 1999). Eleven anxiety positive and ten anxiety negative adjectives and measures of hostility and depression constructs are combined. The MAACL-R consists of five scales:

anxiety, depression, hostility, positive affect, and sensation-seeking. Only the anxiety subscale was used; its internal consistency (Cronbach's Alpha) was 0.77 with adolescent samples (Luberman & Zuckerman, 1999). Respondents indicate those adjectives that signify their mood state (general feeling for now or today). Examples of adjectives include terrified, nervous, inspired, and active.

The State form has been correlated with the State-Trait Personality Inventory (STPI); the Anxiety scale correlates .56 with STPI anxiety ($p < .001$). Correlations with the Positive Affect and Negative Aspect Schedule (PANAS) scales are very high; Dysphoria with Negative affect ($r = .77, p < .001$), showing evidence of good discriminant validity.

Test Anxiety

To measure the worry, emotionality, and test anxiety of the adolescents, the Test Anxiety Inventory (TAI), developed by Spielberger (1980), a 20 item inventory, which describes reactions experienced before, during, and following examinations was used. Using a four point Likert-type frequency scale for rating, respondents designate how they generally feel by stating the frequency each reaction associated with test taking is experienced. The TAI, based upon the suggestion that individuals high in the worry trait may also be affected by emotionality, measures the combination of high worry and emotionality scores that are thought to affect test performance. The construct of worry is associated with cognitive distress regarding the result of failure. Emotionality refers to autonomic nervous system reactions to testing situations.

The instrument, devised for use with an adolescent and young adult population, provides a total test anxiety score (range 20-80) with worry and emotionality factorially

derived subscales, each based on eight items. The TAI total and subscale scores are highly correlated with The Test Anxiety Scale (TAS) and other generally used test anxiety instruments. Robust concurrent and discriminant validity evidence was presented by the relatively high correlations of the TAI Worry (*W*) and Emotionality (*E*) subscales with the Worry – Emotionality Questionnaire (WEQ) Worry and Emotionality scales.

Normative Data

Norms for the TAI are available for large samples of students, including the high school level. Spielberger (1980) reports test-retest reliability and an internally consistent measure of test anxiety obtained by factor analysis. Validity coefficients of .82 for males and .83 for females were reported (Spielberger). Reliability coefficients were reported at .80 for three weeks and .81 for 1 month intervals. Raw scores from the TAI are converted into standardized t-scores with a mean of 50 and standard deviation of 10, using tables of norms. Significant negative correlations among grades and the TAI are evidenced by a lower range of -.18 and an upper range of -.31.

Math Anxiety

The Math Anxiety Rating Scale (MARS), initially a 98 item inventory developed for secondary school students and adults, was developed by Suinn to provide a one-dimensional measure of anxiety related to the number operations and other mathematical concepts (Suinn, Edie, Nicoletti, & Spinelli, 1972). Participants indicate the degree of anxiety produced in response to situational items by indicating a range from one to five. Total scores reflect the sum of item values. High scores reflect high anxiety associated with mathematics. Normative data for the MARS involving two university populations (for a review see Anton & Klisch, 1995) have been reported. The test-retest reliability

coefficient was .78 following 2 weeks, and .85 following seven weeks, significant at $p < .001$. Internal consistency reliability, measured by coefficient alpha was reported to be .97 for 397 participants (Richardson & Suinn, 1972), suggesting that items consistently cluster around a solitary factor. Item-total correlations were more than .50 for more than half of the correlations for the items (Richardson & Suinn, 1972). Construct validity shown in the significant correlation between MARS scores and a performance test under stress ($r = -.64, N = 30$). The two factor-derived subscales of the MARS are Mathematics Test Anxiety (MTA) and Numerical Anxiety (NA).

Plake and Parker (1982) developed the Revised Mathematics Anxiety Scale (R-MARS), a shorter version of the MARS containing 24 items. The MARS was revised for use with elementary (MARS-E) and adolescent (MARS-A) populations. The MARS-A (Suinn & Edwards, 1982) is a revised form of the MARS that involves changes in some of the wording or the substitution of new items suitable for an adolescent population. The normative sample consists of middle and high school students enrolled in mathematics classes in three public schools from a metropolitan city in Arizona and a small city in Colorado. The total sample entailed the involvement of 1,780 participants.

Construct Validity

Construct validity was determined by the 30th and 75th percentile values based on the scores of students ($N = 483$) in one school. The 159 and 230 respective values were used to identify low and high levels of anxiety in students at the other two schools. The math course grade averages for students who scored at or below the 30th percentile and those at or above the 75th percentile on the MARS-A were compared. Results for one school ($N = 28$) demonstrated statistically significant main effects for MARS-A scores

($F = 14.08, p < .001$) but no interaction effects. Students with high MARS-A scores had lower math course grade averages than students with low math anxiety. This relationship was confirmed with results from a second school ($N=1,009$) with statistically significant MARS-A scores ($F = 40.68, p < .001$).

Confirmatory factor analysis was also used to establish whether a primary factor accounted for test item variance. 89 of the 98 items showed factor loadings of $> .30$ on a single factor. The results are consistent with earlier analyses of the MARS.

Reliability

Internal coefficients based on percentile norms for seventh through twelfth grade students ($N = 1,313$) vary according to the statistical formula used. The Guttman Split-half Method revealed a reliability coefficient of .89, and the Spearman-Brown split-half reliability coefficient was .90. A coefficient alpha was used as an index of internal consistency and was found to be .96.

Normative Data

The calculation of means was acquired from a high school and a middle school with the largest sample. The mean MARS-A score for the high school was 197.6 with a standard deviation of 58.12 ($N = 483$). The mean for the middle school was 204.7, with a standard deviation of 59.24 ($N = 1009$). In addition to calculating the norms on the MARS-A using calculations of means and standard deviations, percentile equivalents were obtained to allow for interpretation of individual score relative positions. The 10%, 30%, 50%, 75%, and 95% norm values were, respectively: grade 9 = 132, 161, 188, 229, 291; grade 10 = 137, 163, 189, 238, 305; and grade 11 = 131, 166, 188, 224, 277 (Suinn & Edwards, 1982).

Data Analysis

Data was analyzed using descriptive statistics. Quantitative analysis was used to explore the effects of the interventions, to compare changes in the groups over time, and to investigate the association between variables.

Demographic Data

Demographic information regarding age, gender, ethnicity, mathematics course enrollment, special education status, grade level, attendance, and gender was obtained from the schools' data management system. Class attendance and mathematics exam grades were acquired through the Algebra I teacher's records.

Data Collection Schedule

Prior to participation in the expressive writing or psychoeducational interventions and math exams, data was obtained for the TAI and the MARS-A. The MAACL-R and the PILL (Modified) were administered just before completing math exam 1. Next, the experimental participants completed the interventions, and then completed the TAI, MARS-A, MAACL-R, and the PILL (Modified) posttest, before the math exam 2.

<u>Pre Intervention</u>	<u>Post Intervention</u>
TAI	TAI
MARS-A	MARS-A
MAACL-R	MAACL-R
PILL-M	PILL-M
Math Exam 1	Math Exam 2

Survey Data

The instruments yield interval data whereas the math exam scores are total percentage scores. The TAI, the MARS-A, the MAACL-R and the PILL (Modified) were administered prior to participating in the short term expressive writing or psychoeducational treatment and math exam as well as following the interventions.

Statistical Analysis

Data was entered into SPSS version 18.0 for Windows for analytical purposes. Descriptive statistics were conducted to describe the characteristics of the sample. For nominal or categorical data, frequencies and percentages were conducted.

The difference between interventions, across three groups, in terms of their scores on several adjustment measures (general anxiety, physical symptoms, attendance, test, and math anxiety), pre and post intervention was analyzed using an analysis of variance (ANOVA).

To examine research question 1, a one-between and a one-within ANOVA was conducted to assess if there are differences on attendance by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Attendance was acquired from official school records and was measured both as a pretest and as a posttest. The ANOVA results impart information for the main effects of the variables, including a main effect within time, a group by time interaction, and a difference between the subjects.

To examine research question 2, a one-between and a one-within Analysis of Variance (ANOVA) was carried out to assess if there were differences on general anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducational presentation vs. control). General anxiety levels were obtained from the Multiple Affect Adjective Checklist-Revised (MAACL-R) and were used both as a pretest and as a posttest. The results of the ANOVA presents findings for the main effects of the variables including a main effect within time, a group by time interaction, and a difference between subjects.

To examine research question 3, a one-between and a one-within Analysis of Variance (ANOVA) was conducted to assess if there are differences on test anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Test anxiety levels were obtained from the Test Anxiety Inventory (TAI) and were used both as a pretest and as a posttest. The results of the ANOVA portray findings for the main effects of the variables, including a main effect within time, a group by time interaction, and a difference between subjects.

To examine research question 4, a one-between and a one-within Analysis of Variance (ANOVA) was performed to assess whether there were differences on math anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions

(pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Math anxiety levels were obtained from the Math Anxiety Rating Scale-Adolescents (MARS-A), and was used both as a pretest and as a posttest. The results of the ANOVA provide findings for the main effects of the variables, including a main effect within time, a group by time interaction, and a difference between the subjects.

To examine research question 5, a one-between and a one-within Analysis of Variance (ANOVA) was conducted to assess if there were differences on math exam scores by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducational presentation vs. control). Math exam scores were obtained from a mathematics examination that was administered to participants at pretest and at posttest. The results of the ANOVA presents findings for the main effects of the variables including a main effect within time, a group by time interaction, and a difference between subjects.

To examine research question 6, a one-between and one-within Analysis of Variance (ANOVA) was conducted to assess if there are differences on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Physical symptoms of anxiety were measured using a modified version of the Pennebaker Inventory of Linguistic Languidness (PILL). This score was obtained at pretest and at posttest. The results of the ANOVA provide findings for the main effects

of the variables including a main effect within time, a group by time interaction, and a difference between subjects.

The one-between and one-within form of ANOVA is used when subjects are measured on one continuous variable between two or more groups or independent variables repeated more than once (Tabachnick & Fidell, 2001). In this study, there are three groups (expressive writing vs. psychoeducational presentation vs. control) and the groups are measured at two points in time (pretest and posttest). A 2 X 3 ANOVA is an appropriate design due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducational presentation vs. control). The ANOVA uses the F test, which allows for making an overall comparison on whether group means differ. If the F is larger than the critical F, the null hypothesis is rejected (Pagano, 1990). The results of the one-between and one-within ANOVAs introduce findings for the main effects of the independent variables on the dependent variable. The findings also assess the overall differences by time (within subjects) and also separately, by group (between subjects). The interaction of group by time determines whether differences exist among group and time concurrently.

The assumptions of normality and homogeneity of group variances were assessed to normalize the data. Normal distribution assumes that data will peak at the mean (bell shaped distribution). To compare a sample with a reference probability distribution, a one-sample Kolmogorov-Smirnov test (K-S test) was used. To satisfy the assumptions of ANOVA, Levene's test was used to assess the equality of variance in the different groups. Box's Test of Equality of Covariance Matrices and Pillai's trace

This analysis was followed by post hoc comparisons (Tukey's Test) to determine which means are significantly different from one another and to test each of the individual tests at a particular significance level.

Sample Size, Power, and Significance

It is essential to determine the sample size necessary to for the statistical analysis a priori, while taking the power, population effect size, and level of significance into consideration. Statistical power analyses utilize sample size, significance criterion, population effect size and statistical power Cohen, 1992b).

It is necessary to establish an acceptable significance level for determining when to reject the null hypothesis (i.e., the probability of committing a Type I error). The standard values for significance level represented by α are set at 10%, 5%, and 1% as convention dictates, according to guiding principles as indicated by Aczel and Sounderpandian's (2005). Therefore, an $\alpha = 0.05$ corresponds to $(1 - \alpha) = 0.95$ probability of a correct statistical conclusion when the null hypothesis is true (Lipsey, 1990). Additionally, a 0.95 probability is equivalent to a 95% confidence level to reject H_0 (Aczel & Sounderpandian, 2005). For the purposes of this research, the level ($\alpha = 0.05$), which is a traditional value in social science research for this parameter (Lipsey, 1990), was utilized.

Statistical power of a significant test refers to the long-term probability of rejecting the null hypothesis given the population effect size, alpha level, and the sample size. This should also be considered a priori. Power is the probability of rejecting the null hypothesis if the null hypothesis is really false. An acceptable level of power for this

study is 0.80, making the Type II error 4 times as likely as the Type I error. Since it is typically more serious to make a false positive claim than it is to make a false negative one, this level is acceptable in the determination of the sample size a priori (Cohen 1992a).

The current study involves ANOVA with three groups (expressive writing vs. psychoeducational presentation vs. control). For an ANOVA, effect sizes are small if they are 0.10, medium if they are 0.25 and large if they are 0.40, according to Cohen (1992a). A large or medium effect size was determined as being appropriate for this study. Both were utilized in the determination of the sample size. G*Power 3.1.0 was used to calculate sample size. Taking into account the large effect size of 0.40, a generally accepted power of 0.80, and a 0.05 level of significance, 21 participants per group would yield the greatest levels of statistical power. Intact class group samples were used in the research. One of the class groups had a total of 17 students. Therefore, a medium effect size of 0.25, a generally accepted power of 0.80, and a 0.05 level of significance, showed the necessary sample size to achieve empirical validity for this study is 14 participants per tested group (writing vs. psychoeducation vs. control) for a total sample size of 42 participants needed to achieve empirical validity. A total of 58 students participated in the study, attaining the compulsory sample size needed. The sample is described in more detail in the results section.

Post expressive writing intervention scores, the MAACL-R, the modified PILL, the TAI, and the MARS-A were compared between the experimental groups and the control group using an ANOVA to measure how much of the variance in math exam scores and physical symptoms can be explained by general, test, and math anxieties.

Group	Comparison		
Within Group Comparisons			
Expressive Writing Group	Pretest TAI		Post-test TAI
	Pretest MARS-A		Post-test MARS-A
	Pretest MAACL-R		Post-test MAACL-R
	Pretest PILL		Post-test PILL
	Math Exam 1		Math Exam 2
Psychoeducational Group	Pretest TAI		Post-test TAI
	Pretest MARS-A		Post-test MARS-A
	Pretest MAACL-R		Post-test MAACL-R
	Pretest PILL		Post-test PILL
	Math Exam 1		Math Exam 2
Control Group	Pretest MAACL-R		Post-test MAACL-R
	Pretest PILL		Post-test PILL
	Pretest TAI		Post-test TAI
	Pretest MARS-A		Post-test MARS-A
	Math Exam 1		Math Exam 2
Between Group Comparisons			
Post-test TAI	Expressive Writing	Psychoeducational	Control

Post-test MARS-A	Expressive Writing	Psychoeducational	Control
Post-test MAACL-R	Expressive Writing	Psychoeducational	Control
Post-test PILL	Expressive Writing	Psychoeducational	Control
Math Exam 1	Expressive Writing	Psychoeducational	Control
Math Exam 2	Expressive Writing	Psychoeducational	Control

CHAPTER IV

RESULTS

The purpose of the current study was to evaluate the impact of a short term expressive writing intervention and an anxiety reduction focused psychoeducation intervention on reducing levels of anxiety and physiological symptoms and improving Algebra I class attendance and math examination performance among rural high school students. The effectiveness of the two interventions was examined using several instruments. The *Test Anxiety Inventory* (TAI), a self-report psychometric scale, which measures individual differences in anxiety proneness before, during and after examinations, the *Mathematics Anxiety Rating Scale for Adolescents*, (MARS-A), measures mathematics anxiety by focusing on negative attitudes toward situations and testing involving mathematics, an adapted version of the *Pennebaker Inventory of Limbic Languidness* (PILL), which gauges the frequency of general physical symptoms and sensations experienced, and *The Multiple Affect Adjective Checklist-Revised* (MAACL-R), which measures general anxiety. The research question that provides the conceptual framework for the study was:

1. What are the effects of an expressive writing intervention and a psychoeducational treatment on levels of general anxiety, test anxiety, math anxiety, attendance, and math exam performance?

This chapter outlines the results of the study. Demographic information describing the participants precedes an overview of the results for the instruments and a presentation of the results of the statistical analysis with regard to the research question and hypotheses.

Procedure

Confidentiality and Anonymity

Protecting the confidentiality and anonymity of minors required strict adherence to ethical guidelines, particularly in the case of vulnerable populations such as minors. Following research protocols for confidentiality and anonymity of minors was paramount to protect the rights of the participants. Expressive writing and instruments were pre-coded, using a non-traceable code, by a researcher. Participant-related information was collected immediately following instrument administration and intervention participation. First, the information was placed in a folder with the assigned code as the only identifiable information. Next, the folders were sealed in a large manila envelope and placed in a locked file cabinet secured within a locked inner office and a secure outer office.

Expressive Writing

Expressive writing participants were provided with written and oral instructions: “Please write about (day 1: your favorite hobby or hobbies throughout the next 20 minutes, day 2: your plans for spring break, day 3: your favorite vacation or vacation place). You do not need to worry about grammar, spelling or neatness. Remember, your writing will be kept confidential. Although I will have access to your writing, I will not read it. Faculty and staff, including your math teacher, will not have access to or be able to read your writing. It is important to spend the entire 20 minutes writing. Are there any questions before beginning?”

Psychoeducational Intervention

A week prior to the second math test, during class time, a school counselor (other than the researcher) conducted an evidence-based, one hour workshop involving didactic and experiential approaches to reducing test anxiety. The intervention was designed to expand the student's cognitive-behavioral options in response to situations with anxiety provoking potential. Student focused strategies and techniques were introduced to help prevent and reduce levels of anxiety.

The information session began with a brief introductory disclosure activity (to establish a rapport with the counselor) followed by a discussion about testing and math situational anxiety. Also described were some common physical responses, e.g., illness, racing heart rate, rapid breathing, sweating, or toileting accidents; behavioral responses, e.g., fidgeting, staring, crying, pencil tapping, and perhaps lower attendance, difficulty sleeping or cheating; and emotional responses, e.g., feeling inadequate, acting out, withdrawing or worrying about performance.

Following the introduction of the topic, practical techniques and strategies for reducing test and math anxiety were provided focusing on self-talk, study skills, test preparation, and relaxation techniques.

Instrumentation

The MAACL-R - The Multiple Affect Adjective Checklist-Revised (MAACL-R) was used to measure general state anxiety (anxiety scale). The 1999 edition provides 132 adjectives that respondents can check or not to describe their affect. The instrument incorporates three basic scales (Anxiety, Depression, and Hostility). In the shorter, revised version (MAACL-R; Zuckerman & Lubin, 1985) of the MAACL (Zuckerman & Lubin, 1965), affect is measured using 66 adjectives reflecting the factored domains:

anxiety, depression, hostility, positive affect, and sensation seeking. Higher order affects include Dysphoria (Anxiety plus Depression plus Hostility) and well-being which measures more passive aspects of affect (Positive Affect) plus the more active, energetic aspects of positive affect (sensation seeking). The State Form of the MAACL-R has high internal consistency (.62 for seven nonreferred groups which varied in size from 237 to 1,392) and low test-retest reliability (ranging over studies from -.08 to .53), as reported by Zuckerman (1983). The State Form scales demonstrate convergent and discriminant properties for similar instruments (e.g., the State-Trait Personality Inventory, Spielberger, 1980) as reported by Lubin and Zuckerman (1960).

MAACL-R scores were obtained by summing the number of adjectives checked on each of the five scales. Raw scores were converted to standard scores to compare scores on a common scale. For this study, the anxiety scale was analyzed and the PASS (positive affect and sensation seeking) subscale was analyzed in the ancillary analyses.

The TAI - The 20 item instrument (Test Anxiety Instrument) measures individual differences in test anxiety, as a situation-specific personality trait, among high school and college students. A 4 item Likert Scale, with 1 indicating low test anxiety and 4 suggesting high test anxieties, asks respondents to report how frequently they experience anxiety before, during, and after taking tests. Test-retest reliability coefficients of the TAI Total scale (for two week to six month time periods) indicate reliability coefficients at .80 or higher. The alpha coefficients for the normative samples suggest internal-consistency reliability for the TAI. Alphas for the TAI Total scales were high for both genders (.92 or higher) when computed by Kuder-Richardson Formula 20, modified by

Cronbach's formula. Thus, the TAI has been found to provide reliable and valid measures of test anxiety.

Math Anxiety - The MARS-A, a revised form of the MARS, was devised for use with adolescents (e.g., changes in some words and substitutions appropriate for adolescents). The 98 item scale lists age-appropriate experiential situations involving numbers. Respondents indicate the level of tension or anxieties associated with these situations on a 5 point scale ranging from 1 (not at all) to 5 (very much). Values from one to five are assigned to each response, and then summed. The minimum score available for the MARS-A is 98 (low math anxiety) and the maximum score possible is 490 (extreme anxiety). Therefore, the maximum available range is 392.

Using the Spearman-Brown split-half reliability, the coefficient was found to be .90. Using the Guttman Split-half Method, the reliability coefficient was .89 on a sample of 1,313 students. A coefficient alpha was found to be .96, as an index of internal consistency. For high school, the mean MARS-A score was 197.6 with a standard deviation of 58.12 ($N = 483$) according to Suinn and Edwards (1982).

Scores in the 50th to 75th percentile for ninth grade students for this instrument fall into the range of 188 to 229. The 30th percentile for ninth, tenth and eleventh grades (averaged) is 163.33. The 50th percentile for ninth, tenth and eleventh grades (averaged) is 188.33. The 75th percentile for ninth, tenth, and eleventh grades (averaged) is 230.66.

The PILL - The original version of the PILL is a 54 item measure of common physical symptoms and sensations. The total number of items for which the participant responds C, D, or E (every month or so, or more frequently) on a five point Likert Scale is summed for a total score ranging from 0 to 54 ($M = 17.9$). The exact instrument symptom items

have varied according the nature of the research question. The symptom checklist is considered by Pennebaker (1982) to have a high internal consistency (mean Cronbach alpha coefficient has been .75; when scored using the binary method, .88; the summed method alpha equals .91).

Data Collection and Analyses

Daily Algebra I class attendance rates and mathematics examination grades were acquired from school records kept by the teacher. Levels of test anxiety were measured by composite scores on the TAI. MARS-A scores were used as an indicator of the presence or absence of math anxiety. Physical symptoms relating to anxiety were measured by lower scores on the modified version of the PILL to assess physical well-being. Emotional well being was measured by subscale scores on the MAACL-R for indicators of general anxiety. An experimental design was utilized in an effort to control the dependent variable of the scores obtained, following the interventions, from the TAI, MARS-A, PILL-M, and MAACL-R coupled with the class attendance rate and math examination performance independent variables. Descriptive statistics were utilized in the data analysis of the repeated measures design.

Demographic Information

Sample

Fifty-eight students, enrolled in Algebra I classes at one of two small, rural public high schools, voluntarily participated in the study. The entire Algebra I, semester 2 population was provided with the opportunity to participate. The current research project was reviewed and approved by the Institutional Review Board of Old Dominion University, Norfolk, Virginia. The participant sample and their parents and guardians,

were informed about the research and guidelines regarding the parameters of participation in the study. All of the participants and their parents or guardians provided informed consent and assent prior to participation. Intact class groups were used to maintain a natural, realistic environment and confidentiality was maintained. Class groups were randomly assigned to experimental group 1, experimental group 2, or control group 3 based on the order of the class section schedule.

No specific criteria were used to select participants. Intact classroom samples, drawing from a naturalistic high school environment, were employed and provided with an opportunity to participate in the study. The study was designed for overall healthy participants who may or may not be experiencing any level of anxiety about testing or mathematics. There were 24 (41.4%) participants in the expressive writing group, 18 (31.0%) in the psychoeducation group, and 16 (27.6%) in the control group. Frequency and percentages for gender, race, grade, giftedness and special educational needs are presented by group (expressive writing vs. psychoeducation vs. control) in Table 1.

Expressive Writing Group Profile

The Expressive Writing group has the following description: ages ranged from 14.50 (14 years, 6 months) to 18.17 (18 years, 2 months) ($M = 15.39$; $SD = 0.77$), and were almost equally divided between males and females. There were over twice as many White/Caucasian students than Black/African-American students in the sample. The students' overall GPAs ranged from 1.76 to 4.66 ($M = 3.59$; $SD = 0.82$) at the beginning to 4.38 ($M = 3.53$; $SD = 0.74$) at the end.

Psychoeducation Group Profile

For the psychoeducation group ages ranged from 14.58 (14 years, 6 months) to 17.42 (17 years, 5 months) ($M = 15.67$; $SD = 0.84$); and were equally divided according to gender. There were over twice the number of White/Caucasian students than there were Black/African-American students in this group. The GPAs ranged from 1.13 to 4.57 ($M = 2.98$; $SD = 0.84$); at the beginning of the study and the range at the end was 0.94 to 4.41 ($M = 2.96$; $SD = 0.82$).

Control Group Profile

Members of the control group ages ranged from 14.50 (14 years, 6 months) to 17.92 (17 years, 11 months) ($M = 15.80$; $SD = 1.05$); and there were more males than females. More students were White/Caucasian ($N = 9$) than were Black/African-American. Their GPAs ranged from 0.00 to 3.93 ($M = 2.44$; $SD = 0.95$); at the beginning of the study, and ranged from 0.00 to 4.04 ($M = 2.45$; $SD = 0.95$) at the end.

Group Differences

The control group had the highest percentage of male participants (62.5%), had the highest percentage of students who are classified as gifted (12.5%), the highest percentage of tenth and eleventh grade students (31.3%, 6.3%, respectively), and was the most ethnically diverse (31.3% African American, 56.3% white, 6.3% Hispanic, and 6.3% multiple ethnic backgrounds) group. The expressive writing group had the lowest percentage of students with special educational needs (4.2%) whereas the psychoeducational group (16.7 %) and the control group (18.8) were more similar. All three intact classes reflected a diverse composition of varying ability levels and ages, although some minority populations lacked representation.

Table 1

Characteristics of Participants by Group (Expressive Writing, Psychoeducation, and Control)

Characteristic	Expressive Writing		Psychoeducation		Control	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender						
Male	11	45.8	9	50.0	10	62.5
Female	13	54.2	9	50.0	6	37.5
Race						
Black	7	29.2	5	27.8	5	31.3
White	17	70.8	13	72.2	9	56.3
Hispanic	0	0.0	0	0.0	1	6.3
Multiple	0	0.0	0	0.0	1	6.3
Grade						
9	23	95.8	17	94.4	10	62.5
10	1	4.2	1	5.6	5	31.3
11	0	0.0	0	0.0	1	6.3
Gifted						
No	23	95.8	18	100.0	14	87.5
Yes	1	4.2	0	0.0	2	12.5
Special Needs						
No	23	95.8	15	83.3	13	81.3
Yes	1	4.2	3	16.7	3	18.8

The means and standard deviations for participant age, overall GPA 1 and overall GPA 2 are presented by group in Table 2.

Results of Analyses

The research variables include attendance, general anxiety, test anxiety, math anxiety, physical symptoms of anxiety, and math exam performance. Means and

standard deviations for the research variables are presented by group (expressive writing, psychoeducation, and control) in Table 3.

Table 2

Means and Standard Deviations for Participant Age, GPA 1 and GPA 2

Variable	Expressive Writing		Psychoeducation		Control	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	15.39	0.77	15.67	0.84	15.80	1.05
GPA 1	3.59	0.82	2.98	0.83	2.44	0.95
GPA 2	3.53	0.74	2.96	0.82	2.45	0.95

Attendance

Attendance was the number of days absent from the Algebra I class during a set time frame totaling eight weeks. This was measured at two time periods: four weeks prior to administration of pretest items (measure 1) and four weeks after the administration of posttest items (measure 2). Overall, the average class absentee rate was only .80 classes.

General Anxiety

General anxiety was measured at pretest and at posttest using the Multiple Affect Adjective Checklist-Revised (MAACL-R) anxiety scale. The number of items checked determines the validity of the scores. Checking 93 items or more on the State Form should not be considered valid. If a random checking pattern is suspected, low scores on The Random Response Scale indicate non-valid responding. Intentional response manipulation is evident if the Dysphoria minus PASS scales indicate a score of -15 or

lower negative responses or +17 or higher positive responses. Although the MAACL-R is vulnerable to these types of invalidity, the manipulation motivation is low.

For general anxiety, as measured by the Anxiety Scale at pretest, the psychoeducation group had a mean score of 60.56 ($SD = 21.88$) as compared to the expressive writing group ($M = 49.92$, $SD = 11.91$) and the control group ($M = 54.06$, $SD = 16.79$). Similarly, at posttest, the psychoeducation group had a mean score of 61.83 ($SD = 21.77$) as compared to the expressive writing group ($M = 48.17$, $SD = 11.25$) and the control group ($M = 51.13$, $SD = 12.18$). Mean scores for the Anxiety Scale range from 36-177. The minimum MAACL-R Anxiety Scale Score (very low, if any, anxiety) is 36. The maximum MAACL-R Anxiety Scale score (very high anxiety) is 177. Average scores for this scale fall into the range of approximately 40-60. For adolescents, the mean Anxiety Scale score is 49. Pretest and posttest means fell within the average range for adolescents on the MAACL-R Anxiety Scale, with the exception of the psychoeducation group which fell slightly above the mean both pretest and posttest.

Test Anxiety

The test anxiety variable was measured using total scores calculated at pretest and at posttest, using the Test Anxiety Inventory (TAI; Spielberger, 1972). Scoring weights are reversed on item one only. TAI scores range from 20 to 80. The minimum TAI Total Score (very low, if any anxiety) is 20. The maximum TAI Total Score (very high anxiety) is 80. Average scores for this instrument fall into the range of approximately 40-50. For pretest test anxiety scores among the three groups, the control group received a mean score of 46.13 ($SD = 12.78$) as compared to the expressive writing group ($M = 32.04$, $SD = 8.99$) and the psycho education group ($M = 40.94$, $SD = 12.51$).

Math Anxiety

The math anxiety variable was measured with the Math Anxiety Rating Scale-Adolescents (MARS-A) and obtained at pretest and at posttest.

Typically, a value above the 75% level would indicate a high anxiety level. On the math anxiety pretest, the expressive writing group had a mean of 159.79 ($SD = 47.06$), considered to represent a moderate level of math anxiety as compared to the moderately high levels of math anxiety associated with the psychoeducation group ($M = 199.72$, $SD = 56.34$) and the control group ($M = 195.50$, $SD = 52.84$).

Academic Performance

Academic performance, another variable of interest in this study, was measured by math examination performance. Participants took a math examination at two time periods (math exam 1- at pretest and math exam 2- at posttest). At math exam 1 the control group had a mean score of 70.64 ($SD = 13.36$) as compared to the expressive writing group ($M = 77.67$, $SD = 15.91$), and the psychoeducation group ($M=82.06$, $SD = 15.19$).

Physical Symptoms

The adapted Pennebaker Inventory of Linguistic Languidness (PILL) was used to measure physical symptoms of anxiety at pretest and at posttest. This measure was modified by shortening the length of the instrument to twenty questions; the range of response possibilities was from a low of 0 to a maximum of 20. Items which were most relevant to anxiety symptoms reported in the literature were selected (Hughes & Kendall, 2008; Janssens, et al., 2010; Kingery, Ginsburg, & Alfano, 2007). Given that the mean of

the 54 item PILL was at approximately the 33 percentile, the mean of the adapted version would be 6.66.

At pretest, the control group had a mean score of 6.00 ($SD = 3.33$) as compared to the expressive writing group ($M = 4.83$, $SD = 3.53$) and the psychoeducation group ($M = 4.72$, $SD = 3.75$). The participants' reporting of physical symptoms indicated an average (control group) to low (expressive writing group and psychoeducation group) range.

Table 3

Means and Standard Deviations for Research Variable by Group (Expressive Writing, Psychoeducation, and Control)

Variable	Expressive Writing		Psychoeducation		Control	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Attendance (measure 1)	0.50	0.66	1.06	1.43	0.63	1.02
Attendance (measure 2)	0.42	1.25	0.33	0.59	0.88	1.26
General anxiety pretest	49.92	11.91	60.56	21.88	54.06	16.79
General anxiety posttest	48.17	11.25	61.83	21.77	51.13	12.18
Test anxiety pretest	32.04	8.99	40.94	12.51	46.13	12.78
Test anxiety posttest	30.58	9.72	38.72	9.25	43.63	13.27
Math anxiety pretest	159.79	47.06	199.72	56.34	195.50	52.84
Math anxiety posttest	141.58	42.46	164.56	44.75	183.25	64.32
Physical symptoms pretest	4.83	3.53	4.72	3.75	6.00	3.33
Physical symptoms posttest	3.38	2.99	4.39	5.34	6.00	2.83
Math exam 1	77.67	15.91	82.17	12.60	70.64	13.36
Math exam 2	82.79	13.20	82.06	15.19	80.00	13.76

Means and standard deviations at pretest and posttest for the entire set of scales of the MAACL-R are presented by group in Table 4. The general anxiety variable was

measured using the MAACL-R Anxiety Scale only. The expressive writing group means ranged from 48.17 ($SD = 48.17$), the lowest, at posttest to the psychoeducational group means 61.83 ($SD = 21.77$), the highest, at posttest. Although the difference was not significant, the expressive writing group means at pretest was 49.92 ($SD = 11.91$) resulting in a -1.75 reduction in means. The psychoeducation group ($M = 60.56$, $SD = 21.88$), at pretest, was lower than at posttest ($M = 61.83$, $SD = 21.77$), resulting in a +1.75 increase. The control group ($M = 54.06$, $SD = 16.79$) was -2.93 lower at posttest ($M = 51.13$, $SD = 12.18$).

Summary of Findings

This study was designed based upon six research questions. The results of the comprehensive statistical analyses of those six questions appear in the following section. The analytical procedure for the research questions are presented in this section. The results of the analysis will be presented in the following section organized by research questions.

Table 4
Means and Standard Deviations for MAACL-R by Group (Expressive Writing, Psychoeducation, and Control)

MAACL-R Variable	Expressive Writing		Psychoeducation		Control	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Anxiety pretest	49.92	11.91	60.56	21.88	54.06	16.79
Anxiety posttest	48.17	11.25	61.83	21.77	51.13	12.18
Depression pretest	44.54	3.64	53.00	15.94	47.31	4.90
Depression posttest	45.54	7.05	50.06	11.88	51.44	15.38
Hostility pretest	48.21	7.76	47.28	5.82	51.13	10.50
Hostility posttest	51.96	12.99	49.56	12.58	54.31	13.30
Positive Affect pretest	49.54	12.57	42.72	9.30	43.13	10.22
Positive Affect posttest	51.54	11.14	42.11	11.37	39.00	10.63
Sensation Seeking pretest	63.13	9.38	59.33	11.06	59.63	10.45
Sensation Seeking posttest	64.08	8.25	54.89	7.75	58.19	12.14
Dysphoria pretest	46.50	8.48	52.94	14.28	51.19	11.03
Dysphoria posttest	49.42	12.22	52.11	13.11	52.31	14.11
PASS pretest	59.79	16.02	48.78	13.33	53.13	13.26
PASS posttest	58.63	12.52	47.50	11.27	46.19	12.75

Note. PASS= Positive Affect and Sensation Seeking Composite Score.

Research Question 1:

Is there a difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 1, a one-between and one-within analysis of variance (ANOVA) was conducted to assess whether differences exist on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant suggesting that the attendance values were not normally distributed by group (see Table 4 for the means and standard deviations on attendance by group). However, according to Stevens (2009), data that is not normally distributed has only a slight effect on the rate of Type I errors. The F statistic was robust with regard to normality assumptions, even when the distributions were highly skewed. Box's M Test of equality of covariances was found to be significant, violating the assumption of equality of covariance. The Pillai's Trace statistic was used. The Levene's test for the equality of error variances was examined for the attendance pretest and posttest values and the assumption of equal variances was met for both.

For the between subjects effects, the results were not significant, $F(2, 55) = 0.77$, $p = .468$, $\eta^2 = .027$, suggesting there was not a significant difference on attendance by group. For the within subjects effects, results were not significant, $F(1, 55) = 0.96$, $p = .331$, $\eta^2 = .017$, suggesting there was no significant difference on attendance by time (pretest vs. posttest). The interaction term between attendance and group was not significant, $F(2, 55) = 2.11$, $p = .131$, $\eta^2 = .071$. There were no differences on

attendance by time or by group and time. The means and standard deviations for attendance by group are presented in Table 5. Results of the ANOVA are presented in Table 6.

Table 5

Means and Standard Deviations for Attendance by Group (Expressive Writing vs. Psychoeducation vs. Control)

Outcome variable	Expressive Writing		Psychoeducation		Control		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Attendance Pretest	0.50	0.66	1.06	1.43	0.63	1.02	.71	1.06
Attendance Posttest	0.42	1.25	0.33	0.59	0.88	1.26	.52	1.10

Table 6

Repeated Measures ANOVA with Between Subject's Factors on Attendance by Group (Expressive Writing vs. Psychoeducation vs. Control)

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Between subjects						
Group	1	1.99	.99	0.77	.468	.027
Error	55	71.06	1.29			
Within subjects						
Attendance Time (pre-post)	1	0.97	0.97	0.96	.331	.017
Time x Group	2	4.24	2.12	2.12	.131	.071
Error	55	55.22	1.00			

Research Question 2:

Is there a difference on general anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest)?

To examine research question 2, a one-between and one-within Analysis of Variance (ANOVA) was conducted to assess whether there were differences on general anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant suggesting that the general anxiety scores were not normally distributed by group (see Table 6 for the means and standard deviations on general anxiety by group). However, according to Stevens (2009), data that is not normally distributed has only a slight affect on the rate of Type I errors. The F statistic is robust with regard to normality assumptions, even when distributions are highly skewed. Box's M Test of Equality of Covariance Matrices was found to be significant, violating the assumption of equality of covariance. The Pillai's Trace statistic was used. The Levene's test for the equality of error variances was examined for the anxiety pretest and posttest values; the assumption of equal variances was met for pretest, but not posttest. However, according to Stevens (2009), unless group sizes are sharply unequal (largest/smallest > 1.5); the F statistic is robust for unequal variances.

For the between subjects effects, results were significant, $F(2, 55) = 4.28, p = .019, \eta^2 = .135$, suggesting there was a significant difference on anxiety by group. Tukey post hoc comparison was conducted to investigate the differences between groups. The results show significant differences between the expressive writing group and the

psychoeducation group with a mean difference of -12.15 ($p = 0.015$), suggesting that the expressive writing group had a lower mean score (49.04) than the psychoeducation group ($M = 61.19$) on the anxiety measure. There was no significant finding between the other groups in the analysis.

For the within subjects effects, results were not significant, $F(1, 55) = 0.22$, $p = .638$, $\eta^2 = .004$, suggesting there was no significant difference on anxiety by time (pretest vs. posttest). The interaction term between anxiety and group was not significant, $F(2, 55) = 0.26$, $p = .775$, $\eta^2 = .009$. There were no differences on anxiety by time and group and time. The means and standard deviations on general anxiety by group are presented in Table 7. Results of the ANOVA are presented in Table 8.

Table 7

Means and Standard Deviations for Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Outcome variable	Expressive Writing		Psychoeducation		Control		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Anxiety Pretest	49.92	11.91	60.56	21.88	54.06	16.79	54.36	17.17
Anxiety Posttest	48.17	11.25	61.83	21.77	51.13	12.18	53.22	16.34

Table 8

Repeated Measures ANOVA with Between Subject's Factors on Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Between subjects						
Group	2	3101.76	1550.88	4.28	.019	.135
Error	55	19909.27	361.99			
Within subjects						
Anxiety Time (pre-post)	1	36.40	36.40	0.22	.638	.004
Time x Group	2	82.92	41.46	0.26	.775	.009
Error	55	8919.52	162.17			

Research Question 3:

Is there a difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 3, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if there were differences on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for the expressive writing group at posttest suggesting that those scores were not normally distributed (see Table 8 for the means and standard deviations on test anxiety by group).

The other KS tests were not significant and the assumption of normality was met. Box's M Test of Equality of Covariance Matrices was not significant and the assumption of equality of covariance was met. The Wilks' Lambda statistic was engaged to test for significant differences between the groups. The Levene's test for the equality of error variances was examined for the test anxiety pretest and posttest values; the assumption of equal variances was met for both measures.

For the between subjects effects, results were significant, $F(2, 55) = 9.01, p = .000, \eta^2 = .247$, suggesting there was a significant difference on test anxiety by group. Tukey post hoc comparison was conducted to investigate the differences between groups. The results indicate significant differences between the expressive writing group and the psychoeducation group with a mean difference of $-8.52 (p = 0.026)$, suggesting that the expressive writing group had a lower mean score ($M = 31.31$) than the psychoeducation group ($M = 39.83$) on the test anxiety measure. The results show significant differences between the expressive writing group and the control group with a mean difference of $-13.56 (p = 0.000)$, suggesting that the expressive writing group had a lower mean score ($M = 31.31$) than the control group ($M = 44.88$) on the test anxiety measure. There was not a significant difference between the psychoeducation group and the control group on test anxiety.

For the within subjects effects, results were not significant for time, $F(1, 55) = 3.80, p = .056, \eta^2 = .065$, suggesting there was no significant difference on test anxiety by time (pretest vs. posttest). The interaction term between test anxiety and group was not significant, $F(2, 55) = 0.10, p = .910, \eta^2 = .003$. There were no differences on test

anxiety by group and time. The means and standard deviations on test anxiety by group are presented in Table 9. Results of the ANOVA are presented in Table 10.

Table 9

Means and Standard Deviations for Test Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Outcome variable	Expressive Writing		Psychoeducation		Control		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Test Anxiety Pretest	32.04	8.99	40.94	12.51	46.13	12.78	38.69	12.57
Test Anxiety Posttest	30.58	9.72	38.72	9.25	43.63	13.27	36.71	11.85

Table 10

Repeated Measures ANOVA with Between Subject's Factors on Test Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Between subjects						
Group	2	3769.63	1884.81	9.01	.000	.247
Error	55	11503.31	209.15			
Within subjects						
Test Anxiety Time (pre-post)	1	119.58	119.58	3.80	.056	.065
Time x Group	2	5.96	2.98	0.10	.910	.003
Error	55	1729.54	31.45			

Research Question 4:

Is there a difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 4, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for the expressive writing group and the control group at posttest suggesting that those scores were not normally distributed (see Table 10 for the means and standard deviations on math anxiety by group). The other KS tests were not significant and the assumption of normality was met. Box's M Test of Equality of Covariance Matrices was significant and the assumption of equality of covariance was violated. The Pillai's Trace statistic was used. The Levene's test for the equality of error variances was examined for the math anxiety pretest and posttest values; the assumption of equal variances was met for pretest, but not posttest. Despite the unequal variances in the posttest, the F statistic is considered robust except when group sizes are greatly unequal (Stevens, 2009)

For the between subjects effects, results were significant, $F(2, 55) = 3.74, p = .030, \eta^2 = .120$, suggesting there was a significant difference on math anxiety by group. Tukey post hoc comparison was conducted to investigate the differences between groups. The results show significant differences between the expressive writing group and the control group with a mean difference of -38.69 ($p = 0.043$), between pre and post suggesting that the expressive writing group had a lower mean score (150.69) than the

control group ($M = 189.38$) on the math anxiety measure. There was no significant difference among the other groups on math anxiety.

For the within subjects effects, results were significant for time, $F(1, 55) = 27.83$, $p = .000$, $\eta^2 = .336$, suggesting there was a significant difference on math anxiety by time (pretest vs. posttest). The pretest scores were higher ($M = 185.00$) as compared to the posttest scores ($M = 163.13$). However, the interaction term between math anxiety and group was not significant, $F(2, 55) = 2.57$, $p = .086$, $\eta^2 = .086$. There were no differences on math anxiety by group and time. The means and standard deviations on math anxiety by group are presented in Table 11. Results of the ANOVA are presented in Table 12.

Table 11

Means and Standard Deviations for Math Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Outcome variable	Expressive Writing		Psychoeducation		Control		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Math Anxiety Pretest	159.79	47.06	199.72	56.34	195.50	52.84	182.03	54.16
Math Anxiety	141.58	42.46	164.56	44.75	183.25	64.32	160.21	52.10

Table 12

Repeated Measures ANOVA with Between Subject's Factors on Math Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Between subjects						
Group	2	35074.19	17537.10	3.74	.030	.120
Error	55	257712.12	4685.68			
Within subjects						
Math Anxiety Time (pre-post)	1	13481.66	13481.66	27.83	.000	.336
Time x Group	2	2492.41	1246.20	2.57	.086	.086
Error	55	26644.73	484.45			

Research Question 5:

Is there a difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 5, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest-math exam 1 vs. posttest-math exam 2). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for all three groups at pretest and at posttest, suggesting that the math exam scores were not normally distributed by group (see Table 12 for the means and standard deviations on math exam by group). Despite the abnormal distributions, the

data has only a slight affect on the rate of Type I errors Stevens (2009). The F statistic is robust with regard to normality assumptions, even when distributions are highly skewed. Box's M Test of Equality of Covariance Matrices was not significant and the assumption of equality of covariance was met. The Wilks' Lambda statistic was utilized. The Levene's test for the equality of error variances was examined for the math exam scores pretest and posttest values; the assumption of equal variances was met for both.

For the between subjects effects, results were not significant, $F(2, 53) = 1.34, p = .271, \eta^2 = .048$, suggesting there was no significant difference on math exam scores by group. For the within subjects effects, results were significant for time, $F(1, 53) = 5.08, p = .028, \eta^2 = .087$, suggesting there was a significant difference on math exam scores by time (pretest vs. posttest). When considering all of the participants' scores, math exam 1 had a lower mean value ($M = 76.82$) than math exam 2 ($M = 81.61$). However, the interaction term between math exam scores and group was not significant, $F(2, 53) = 1.50, p = .233, \eta^2 = .053$. There were no differences on math exam scores when group was added to the model. Means and standard deviations for math exam by group are presented in Table 13. Results of the ANOVA are presented in Table 14.

Table 13

Means and Standard Deviations for Math Exam Scores by Group (Expressive Writing vs. Psychoeducation vs. Control)

Outcome variable	Expressive		Psychoeducation		Control		Total	
	M	SD	M	SD	M	SD	M	SD
Math Exam 1	77.67	15.91	82.17	12.60	70.64	13.36	77.36	14.70
Math Exam 2	82.79	13.20	82.06	15.19	80.00	14.28	81.86	13.92

Table 14

Repeated Measures ANOVA with Between Subject's Factors on Math Exam Scores by Group (Expressive Writing vs. Psychoeducation vs. Control)

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Between subjects						
Group	2	758.57	379.29	1.34	.271	.048
Error	53	15029.14	283.57			
Within subjects						
Math Exam Time (pre-post)	1	612.29	612.29	5.08	.028	.087
Time x Group	2	361.19	180.60	1.50	.233	.053
Error	53	6392.81	120.62			

Research Question 6:

Is there a difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 6, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for the psychoeducation group at pretest and at posttest suggesting that those scores were not normally distributed (see Table 14 for the means and standard deviations

on physical symptoms of anxiety by group). The other KS tests were not significant and the assumption of normality was met. Box's M Test of Equality of Covariance Matrices was significant and the assumption of equality of covariance was violated. The Pillai's Trace statistic was employed. The Levene's test for the equality of error variances was examined for the physical symptoms of anxiety pretest and posttest values; the assumption of equal variances was met for both.

For the between subjects effects, results were not significant, $F(2, 55) = 1.96, p = .150, \eta^2 = .07$, suggesting there was no significant difference on physical symptoms of anxiety by group. For the within subjects effects, results were not significant, $F(1, 55) = 1.10, p = .300, \eta^2 = .020$, suggesting there was not a significant difference on physical symptoms of anxiety by time (pretest vs. posttest). The interaction term between physical symptoms of anxiety and group was not significant, $F(2, 55) = 0.66, p = .523, \eta^2 = .023$. There were no differences on physical symptoms of anxiety by group and time. Means and standard deviations for physical symptoms of anxiety are presented in Table 15. Results of the ANOVA are presented in Table 16.

Table 15

Means and Standard Deviations for Physical Symptoms of Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Outcome variable	Expressive		Psychoeducation		Control		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Physical Symptoms Pretest	4.83	3.53	4.72	3.75	6.00	3.33	5.12	3.53
Physical Symptoms Posttest	3.38	2.99	4.39	5.34	6.00	2.83	4.41	3.92

Table 16

Repeated Measures ANOVA with Between Subject's Factors on Physical Symptoms of Anxiety by Group (Expressive Writing vs. Psychoeducation vs. Control)

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Between subjects						
Group	2	71.35	35.68	1.96	.150	.067
Error	55	998.87	18.16			
Within subjects						
Physical Symptoms Time	1	10.05	10.05	1.10	.300	.020
Time x Group	2	12.03	6.02	0.66	.523	.023
Error	55	503.98	9.16			

Summary

The purpose of this study was to evaluate the efficacy of two interventions on general well-being, physical well-being, test anxiety, math anxiety, academic performance, and attendance compared to a control group. The current study aimed to build upon and extend the available literature by evaluating the relation between these variables with an adolescent population. Findings are explained in relation to demographic information, those related to between group differences, and those related to within group differences, organized by research question.

To assess whether or not the three groups of participants (expressive writing vs. psychoeducation vs. control) differed on attendance, general anxiety, test anxiety, math anxiety, math exam scores, and physical symptoms of anxiety between time periods 1

and 2, six a one-between and one-within analysis of variances (ANOVAs) were conducted. Ancillary analyses were also conducted to investigate which of the anxiety and affect measures best predicted math exam 2 scores.

Preliminary examination was conducted on the research variables. Participants were classified by group; 24 (41.4%) were in the expressive writing group, 18 (31.0%) were in the psychoeducation group, and 16 (27.6%) were in the control group. Males and females were fairly equally represented. The majority of the participants in each group was Caucasian, in the 9th grade, was not identified as being academically or intellectually gifted, and does not receive special educational services. Results of a contingency analysis between categorical variables demonstrated there were no significant differences between the three groups demographically. The dependent variables were obtained from several formal assessment instruments, attendance records and exam scores.

To examine research question 1, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). The ANOVA was not significant and there was not a significant difference on attendance by time period or by the group and time interaction. The null hypothesis was accepted.

To examine research question 2, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if there were differences on general anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). The results showed significant differences between the expressive writing group and the psychoeducation group, suggesting that the expressive writing group had a lower mean score (49.04) than the psychoeducation group ($M = 61.19$) on the general

anxiety measure. However, there was no difference on general anxiety by time and by the group and time interaction. The null hypothesis was accepted. The difference found between the two groups was not found when time period 1 scores were compared to time period 2 scores.

To examine research question 3, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if there were differences on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). Significant differences were found between the expressive writing group and the psychoeducation group; suggesting that the expressive writing group had a lower mean score (31.31) than the psychoeducation group ($M = 39.83$) on the test anxiety measure. Significant differences were also found between the expressive writing group and the control group; suggesting that the expressive writing group had a lower mean score (31.31) than the control group ($M = 44.88$) on the test anxiety measure. There was not a significant difference between the psychoeducation group and the control group on test anxiety. The null hypothesis was accepted. The difference found between the groups was not found when time period 1 scores were compared to time period 2 scores.

To examine research question 4, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). Significant differences were found between the expressive writing group and the control group, suggesting that the expressive writing group had a lower mean score (150.69) than the control group ($M = 189.38$) on the math anxiety measure. There was no significant difference among the other groups on math anxiety. Also, when comparing math anxiety

scores over time, the math anxiety pretest scores were higher ($M = 185.00$) as compared to the posttest scores ($M = 163.13$). The null hypothesis was partially rejected. There was a difference found between the groups and between the two time periods, however, the interaction between group and time on math anxiety scores was not significant. Participants, as a whole, had lower math anxiety scores at the second time period.

To examine research question 5, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest-math exam 1 vs. posttest-math exam 2). Significant differences were found; when looking at all the participants' scores, math exam 1 had a lower mean value ($M = 76.82$) than math exam 2 ($M = 81.61$). However, there were no differences on math exam scores when group was added to the model and the null hypothesis was partially rejected. Participants, as a whole, had higher math exam scores at the second time period.

To examine research question 6, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). There were no differences on physical symptoms of anxiety by group and time and the null hypothesis was accepted.

To further investigate the relationship between the posttest anxiety, multiple affect scores (test anxiety, math anxiety and the MAACL-R scales), and second math exam scores, a forward stepwise regression was conducted to assess which, if any, of the variables impacted the second math exam scores. In preliminary analysis, the assumptions of normality and linearity were evaluated through examination of the

residual scatter plot. The data was found to be normally distributed and the assumptions were met. There were no outliers in the data set or composite scores. The absence of multicollinearity was assessed through the examination of the Variance Inflation Factors (VIF). The values were under 10.0 and the assumption was met (Stevens, 2009).

The posttest scores (test anxiety, math anxiety and the seven MAACL subscales) were entered into the regression in a forward stepwise method to determine the best model of predictors for the second math exam scores. The statistical analysis resulted in an optimal one-variable regression model. MAACL- R PASS (scale combination of positive affect and sensation seeking) factors were in the first step of the regression. The Positive Affect and Sensation Seeking subscale was a significant predictor, $F(1, 55) = 4.31, p < 0.043$; the variable (MAACL-R PASS) accounted for 5.6% of the variance in the second math exam scores. The beta coefficients indicated a significant finding; for every one unit increase in MAACL-R PASS posttest scores, math exam 2 scores increased by .278 units. For example, a one unit increase in MAACL-R PASS posttest scores is related to an increase of .278 in the math exam 2 score. Of the seven predictors (Anxiety, Depression, Hostility, Positive Affect, Sensation Seeking, Dysphoria, and PASS), MAACL-R PASS (a combination of Positive Affect and Sensation Seeking subscales) was the best predictor of second math exam scores. The other predictor variables did not contribute significantly to the model. Average PASS scale scores range from 22-26 for adolescents. The results of the ANOVAs are presented in Table 17. The results of the regression are presented in Table 18.

Table 17

ANOVA on MAACL-R PASS Posttest Scores Predicting Second Math Exam

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
MAACL-R PASS posttest scores					
Regression	1	774.23	774.23	4.31	.043
Residual	55	9880.02	179.64		

Table 18

Stepwise Regression Summary for MAACL- R PASS Posttest Scores Predicting Second Math Exam

Step and predictor variable	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2
Step 1:				.07*	.07*
MAACL-R PASS posttest scores	.278	.134	.270		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

In summary, the null hypotheses were accepted for several of the research questions and partially rejected with regard to math anxiety scores and math exam scores where a significant change was noted from time period 1 to time period 2. Although participants differed by group in some of the analyses, their group differences were not found when the data was examined by time period. An ancillary analysis that consisted of one stepwise multiple regression investigated the relationship between the posttest anxiety and multiple affect scores (test anxiety, math anxiety and the MAACL-R subscales) and the second math exam scores. Of the possible predictors, only the MAACL-R PASS scale was found to be a significant predictor of math exam 2.

Overall, the findings suggest that a short term expressive writing intervention had no significant impact and the psychoeducational intervention had no significant impact on general well-being, physical well-being, test anxiety, academic performance and attendance. However, partial significant findings were found for math anxiety when considering the population sample as a whole. These results will be further described in Chapter 5.

CHAPTER V

SUMMARY, CONCLUSIONS, AND FUTURE RESEARCH

Chapter I specified the purpose of the study and served as a blueprint for the carrying out the intentions of the study. Chapter II introduced and discussed anxiety constructs in the general literature and provided a critical, integrative review of the literature focusing on the specific areas of research related to the research question being studied: general, test, and math anxiety and its impact on ethnicity, gender, physiological symptoms, and achievement. Furthermore, expressive writing interventions were delineated. Chapter III organized the essential aspects of the study in a replicable manner. Chapter IV presented the results of the data analysis starting with a description of preliminary analyses and followed by a detailing of statistical procedures used to test the hypotheses and address the research questions. This chapter provides a synopsis of the study, interprets the findings, positions them in the context of the hypotheses and literature reviewed, and critically examines their limitations and implications.

Purpose and Research Design

The purpose of the present study was to evaluate the impact of a short term expressive writing intervention and an anxiety reduction focused psychoeducation intervention on reducing levels of anxiety and physiological symptoms and improving class attendance and math exam performance.

The research question that provided the foundation for this study was:

What are the effects of a short term expressive writing intervention and a psychoeducational intervention on general, test, and mathematics anxieties, physical and psychological well-being, attendance, and mathematics test scores in

a population of ninth through eleventh grade rural high school students enrolled in Algebra I?

The study was designed to evaluate the anxiety outcomes of general anxiety levels, test anxiety levels, mathematics anxiety levels, and physical symptoms. The fundamental goal of the present repeated measures experimental design was to ascertain whether there would be a degree of difference on these outcomes of two experimental conditions and the control group when participants were requested to express their thoughts and experiences about unrelated neutral topics, namely relating a hobby, discussing spring break plans, and describing a favorite vacation spot versus a skill focused psychoeducational presentation with behavioral and cognitive components vs. the control group which did not receive either treatment. A second goal of this study was to determine whether there would be an impact on daily Algebra I class attendance or academic performance as measured by attendance records and math exams.

The students were assigned to three groups; an experimental group that used expressive writing as an intervention, an experimental group that received test anxiety reduction strategies in a psychoeducational group format, and a control group. All participants completed measures of test anxiety, math anxiety, general anxiety, and physical symptoms. Additional data (i.e., attendance data) and demographic information was obtained via the student data information system. The results of the data analyses, conclusions, limitations, and implications for further research follow.

Data Analysis

Demographic data are presented as frequencies and percentages of the respondents. To assess whether differences exist by group and time, a one-between and a

one- within repeated measures analysis of variance (ANOVA) was conducted. Pre and post MAACL-R subscale means and standard deviation scores were reported by group and compared pretest and posttest. Kolmogorov Smirnov tests were conducted in preliminary analysis. Pillai's Trace statistic was used following an assumption violation. Equality of covariance assumptions were assessed by use of Box's M Test. The equality of error variances was examined with the Levene's test. Between subjects differences on the MAACL-R were compared using a Tukey post hoc comparison.

An ANOVA assessed whether there were differences on the TAI by group and time. The assumption of normality was determined by KS tests. Box's M Test evaluated the equality of covariance assumptions and the Wilks' Lambda statistic was used due to the assumption of equality of covariance being met. The Levene's test as used to determine if the assumption of equal variances was met. Tukey post hoc comparison was conducted to investigate the differences between groups.

Pre and post intervention MARS-A scores were compared to evaluate possible differences by group and time by means of an ANOVA. Tukey post hoc comparison was performed to examine the differences between the expressive writing and control groups. A follow-up step wise regression was calculated to establish the source of the main effect.

A one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math exam scores by group and time. In preliminary analysis, the assumption of normality was assessed through the use of KS tests. Box's M Test of Equality of Covariance Matrices was utilized to determine that the assumption of equality of covariance was met. The Wilks' Lambda statistic was employed to test for

significant differences between the groups on the predictor variables. The Levene's test for the equality of error variances was examined for the math exam scores pretest and posttest values; the assumption of equal variances was met for both.

A one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on physical symptoms of anxiety by group and time. The assumption of normality was assessed through Kolmogorov Smirnov (KS) tests. Box's M Test of Equality of Covariance Matrices was used to examine the assumption of equality of covariance. The Pillai's Trace assessed the multivariate between- and within-group variability. The Levene's test for the equality of error variances was examined for the physical symptoms of anxiety pretest and posttest values to determine if the assumption of equal variances was met for both. These analytical results were presented in narrative and tabular forms in Chapter IV.

Findings and Conclusions

Findings and conclusions for the outcomes of the general anxiety (MAACL-R), test anxiety (TAI), mathematics anxiety (MARS-A), and physical symptoms (adapted PILL) are organized by six research questions.

Research Question One:

“Is there a difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?”

Findings. The ANOVA results were not significant for between subjects effects, $F(2,55) = 0.77, p < .468$. Results were not significant for the within subjects results $F(1,55) = 0.96, p < .331$. There were no differences on class attendance by group and time $F(2,55) = 2.11, p < .131$.

Means differed minimally from the pretest between the expressive writing group ($M = .50$, $SD = .66$), psychoeducational group ($M = .106$, $SD = 1.43$), and control group ($M = .71$, $SD = 1.06$) and the posttest expressive writing group ($M = .42$, $SD = 1.25$), psychoeducational group ($M = .33$, $SD = .59$), and control group ($M = .88$, $SD = 1.26$). The results of an (ANOVA) suggested no significant differences between groups of students and Algebra I class attendance by time or by group and time.

Conclusion. Participation in an expressive writing intervention or psychoeducational presentation intervention did not result in a statistically significant difference in Algebra I class absences as evidenced by pre and post test differences during pre and post intervention four week time periods.

Research Question Two

Is there a difference on general anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest)?

Findings. The between subjects effects results of an ANOVA suggested there was a significant difference on anxiety by group for the between subjects effects $F(2,55) = 4.28$, $p < .019$). These differences were based on the overall group comparisons. The group means reflect post hoc results. The results showed significant differences between the expressive writing group and the psychoeducation group, suggesting that the expressive writing group had a lower mean score (49.04) pretest and posttest than the psychoeducation group ($M = 61.19$) pretest and posttest on the general anxiety measure. The average mean, for a healthy population of adolescents is 35.98 ($SD = 26.28$). Higher scores indicate greater levels of anxiety. There was no significant finding between the other groups in the analysis.

The results were not significant for the within subjects effects, $F(1,55) = 0.22, p < .775$. MAACL-R Anxiety scale scores remained similar from the pretest between the expressive writing group ($M = 49.92, SD = 11.91$), the psychoeducation group ($M = 60.56, SD = 21.88$), and the control group ($M = 54.36, SD = 17.17$) and the posttest between the expressive writing group ($M = 48.17, SD = 11.25$), the psychoeducation group ($M = 61.83, SD = 21.77$), and the control group ($M = 51.13, SD = 12.18$). The findings indicate above average levels of general anxiety for all three groups both pretest and posttest. Scores of 65-70 on the anxiety scale may indicate the presence of moderate emotional distress. Greater scores may indicate the presence of significant anxiety symptoms with extreme scores greater than 80-85 being especially significant.

The interaction of group and time failed to show a significant pretest-posttest difference by group. Therefore, there were no differences on general anxiety by time and by the group and time interaction. The null hypothesis was accepted.

Conclusion. A statistically significant reduction in general anxiety levels as evidenced by pre and post test differences in anxiety scores on the MAACL-R, indicate that general anxiety levels were lower at posttest, although the interaction of group and time did not show a significant pretest-posttest difference.

Research Question Three

Is there a difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

Findings. Tukey post hoc comparison results indicated significant differences between the expressive writing group and the psychoeducation group with a mean difference of -8.52 ($p < 0.026$), suggesting that the expressive writing group had a lower

mean score (31.31) than the psychoeducation group ($M = 39.83$) and the control group ($M = 44.88$) on the test anxiety measure. There was not a significant difference between the psychoeducation group mean score (39.83) and the control group mean score (44.88) on the TAI. The results demonstrate significant differences between the expressive writing group and the control group with a mean difference of -13.56 ($p = 0.000$), suggesting that the expressive writing group experienced less test anxiety overall than the control group.

The expressive writing group obtained lower overall pretest and posttest scores on the TAI compared with the high school norms presented in the manual (Spielberger, et al., 1980, p. 7; males: $M = 40.87$, $SD = 12.77$), $n = 527$; females: $M = 45.72$, $SD = 13.63$, $n = 591$), the psychoeducation and control groups obtained similar scores to the combined mean norm scores ($M = 43.29$, $SD = 13.20$).

For the within subjects effects, results were not significant for time, $F(1, 55) = 3.80$, $p < .056$, suggesting there was no significant difference on test anxiety between the pretest and the posttest. The interaction term between test anxiety and group was not significant, $F(2, 55) = 0.10$, $p < .910$. There were no differences on test anxiety by group and time. The means and standard deviations on test anxiety by group, at pretest, are expressive writing ($M = 32.04$, $SD = 8.99$), psychoeducation ($M = 40.94$, $SD = 12.51$), and control ($M = 46.13$, $SD = 12.78$) and posttest, expressive writing ($M = 30.58$, $SD = 9.72$), psychoeducational, ($M = 38.72$, $SD = 9.25$) and control ($M = 43.63$, $SD = 13.27$).

The null hypothesis was accepted. The difference found between the groups was not found when time period 1 scores were compared to time period 2 scores.

Conclusion. The results of an ANOVA suggested statistically significant between subjects results, $F(2, 55) = 9.01$, $p = 0.000$, indicating there was a significant difference

on test anxiety based on overall group means comparisons. Participation in an expressive writing intervention or psychoeducational presentation intervention did not result in a statistically significant reported reduction in test anxiety as evidenced by pre and post test differences in Test Anxiety Inventory scores.

Research Question Four

Is there a difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

Findings. The results of an ANOVA were significant, for the between subjects effects, $F(2, 55) = 3.74, p < .030$, suggesting there was a significant difference on math anxiety between the expressive writing group and the control group. Tukey post hoc comparison revealed significant differences between the expressive writing group and the control group with a mean difference of $-38.69 (p < 0.043)$, between pre and post scores suggesting that the expressive writing group had a lower mean score (150.69) than the control group ($M = 189.38$) on the math anxiety measure. There was no significant difference among the other groups on math anxiety. Also, when comparing math anxiety scores over time, the math anxiety pretest scores were higher ($M = 185.00$) as compared to the posttest scores ($M = 163.13$). The minimum score available for the MARS-A is 98 (low math anxiety) and the maximum score possible is 490 (extreme anxiety).

For the within subjects effects, results were significant for time, $F(1, 55) = 27.83, p = 0.000$, suggesting there was a significant difference on math anxiety by time (pretest vs. posttest). The pretest scores were higher ($M = 185.00$) as compared to the posttest scores ($M = 163.13$). However, the interaction term between math anxiety and group was not significant, $F(2, 55) = 2.57, p < .086$. There were no differences on math anxiety by

group and time. The means and standard deviations on math anxiety by group, for pretest are expressive writing ($M = 159.79$, $SD = 47.06$) vs. psychoeducation ($M = 199.72$, $SD = 56.34$) vs. control ($M = 195.50$, $SD = 52.84$) and for posttest, expressive writing ($M = 141.58$, $SD = 42.46$) vs. psychoeducation ($M = 164.56$, $SD = 44.75$) vs. control ($M = 183.25$, $SD = 64.32$).

A follow-up step wise regression was calculated to determine the basis of the main effect. The TAI posttest MARS-A posttest, and MAACL-R posttest scores were the predictor variables included. The outcome variable was math exam 2. After entering all of the predictors, only the PASS Scale of the MAACL-R was a significant predictor of the second math exam scores. As evidenced by the supplemental analysis conducted to determine which, if any, variables influenced the second math exam scores, the PASS Scale of the MAACL-R, in the first step of the regression, was a significant predictor ($F(1.55) = 4.31$, $p = 0.043$), accounting for 5.6% of the variance in math exam 2 scores. However, the other predictor variables of the MAACL-R did not contribute significantly to the model.

The null hypothesis was partially rejected. There was a difference found between the groups and between the two time periods, however, the interaction between group and time on math anxiety scores was not significant. Participants, as a whole, had lower math anxiety scores at the second time period.

Conclusion. Participation in an expressive writing intervention, psychoeducational presentation intervention, or control group did not result in a statistically significant reported reduction in math anxiety as evidenced by pretest (expressive writing group, ($M = 159.79$, $SD = 47.06$); psychoeducation group, ($M = 199.72$, $SD = 56.34$); control group

($M = 195.50$, $SD = 52.84$) and post test differences (expressive writing group, ($M = 141.58$, $SD = 42.46$); psychoeducation group, ($M = 164.56$, $SD = 44.75$); control group ($M = 183.25$, $SD = 64/2$), in the MARS-A scores. Although the differences by time were not significant, all three groups' posttest MARS-A scores resulted in a reduction of means (expressive writing group (-18.21); psychoeducation group (-35.16); control group (-12.25). It is possible, that through participation in the study, the some of the participants benefitted from a reduced level of math anxiety based on the reduction in mean scores on the MARS-A. Even though the results were not significant by time, as an overall population, the means difference in MARS-A scores at posttest was a -27.87 reduction.

Research Question Five

Is there a difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

Findings. The results of an (ANOVA) suggested there was no statistically significant difference between the expressive writing, psychoeducational, and control groups on math performance as measured by the Algebra 1 class exams. Means and standard deviations for math exam by group, for math exam 1, were expressive writing ($M = 77.67$, $SD = 15.91$), psychoeducation ($M = 82.17$, $SD = 12.60$), and control ($M = 70.64$, $SD = 13.36$) and for math exam 2, were expressive writing ($M = 82.79$, $SD = 13.20$), psychoeducation ($M = 82.06$, $SD = 15.19$), and control ($M = 80.00$, $SD = 14.28$). For the between subjects effects, results were not significant, $F(2, 53) = 1.34$, $p < .271$, suggesting there was no significant difference on math exam scores by group.

For the within subjects effects, results were significant for time, $F(1, 53) = 5.08$, $p < .028$, suggesting there was a significant difference on math exam scores by time (pretest vs. posttest). When taking all of the participants' scores into account, the scores varied to some extent. Math exam 1 had a lower mean value ($M = 76.82$) than math exam 2 ($M = 81.61$). The mean difference between the expressive writing group math exam means difference was 5.12, the psychoeducation group means difference was -0.11 and the control group means difference was 9.36. However, the interaction term between math exam scores and group was not significant, $F(2, 53) = 1.50$, $p < .233$.

Significant differences were found; when taking all of the participants' scores into account, math exam 1 had a lower mean value ($M = 76.82$) than math exam 2 ($M = 81.61$). However, there were no differences on math exam scores when group was added to the model and the null hypothesis was partially rejected. Participants, as a whole, had higher math exam 2 scores.

Conclusion. Participation in an expressive writing intervention or psychoeducational presentation intervention did not result in a statistically significant math performance improvement as evidenced by math exam means differences in two math exams. When comparing math exam scores over time, for all three groups, the pretest math exam scores were lower at pretest ($M = 76.82$) compared to posttest ($M = 81.61$). Although the difference was not significant, the expressive writing scores resulted in a +5.12 increase in means, the psychoeducation group scores remained relatively similar with a +.10 increase in means, and the control group math exam scores resulted in a +9.6 increase in means when pretest was compared to posttest. When the control group intact class average was below passing on the review test for exam 2, the teacher provided several

days of intensive remediation that the expressive writing and psychoeducation groups did not receive. The differences in test preparation between the groups may have had an impact on the math exam scores.

Research Question Six

Is there a difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

Findings. The results of an ANOVA indicated there was no statistically significant difference between the expressive writing, psychoeducational, and control groups on anxiety related physical symptoms as measured by a modified version of the PILL. For the between subjects effects, results were not significant, $F(2, 55) = 1.96, p < .150$, suggesting there was no significant difference on physical symptoms of anxiety by group. For the within subjects effects, results were not significant, $F(1, 55) = 1.10, p < .300$, suggesting that there was not a significant difference on physical symptoms by time (pretest vs. posttest). The interaction term between physical symptoms of anxiety and group was not significant, $F(2, 55) = 0.66, p < .523$. There were no differences on physical symptoms by group and time. Means and standard deviations for physical symptoms of anxiety by group, for the pretest, are expressive writing ($M = 4.83, SD = 3.53$), psychoeducational ($M = 4.72, SD = 3.53$), and control ($M = 6.00, SD = 3.33$). For the posttest, means and standard deviations are, expressive writing ($M = 3.38, SD = 2.99$), psychoeducational ($M = 4.39, SD = 5.34$), and control ($M = 6.00, SD = 2.83$).

Conclusion. Participation in an expressive writing intervention or psychoeducational presentation intervention did not result in a statistically significant reported reduction in physical symptoms evidenced by pre and post test differences in the adapted PILL

measurement scores. When comparing physical symptoms over time, the physical symptoms pretest scores were higher ($M = 5.18$) as compared to the posttest scores ($M = 4.59$) for the three groups. The self-reported physical symptoms were lower than the average mean (6.66) and, although the difference was not significant, there was a -.59 reduction in means.

Results support the finding that various contributors to anxiety have differing effects on multiple affect scores (test anxiety, math anxiety, and the MAACL-R scales) and math exam 2 scores, with one predictor variable having a significant impact. The largest percentage in variance (5.6%) in math exam 2 scores was attributable to the MAACL-R PASS scale. The PASS scale was the only significant contributor of math exam 2 scores. The PASS scale is a composite of the Positive Affect (e.g. affectionate, free, friendly, glad, good) and Sensation Seeking (e.g. active, adventurous, aggressive, daring, energetic, enthusiastic) scales which ask respondents to indicate adjectives describing how they feel presently. As indicated by the beta weight (.270), the relationship between the significant positive affect sensation seeking scale and academic achievement was in the direction hypothesized and had been reported in previous research (Papousek, I., et al., 2009; Kannan & Miller, 2009). Affect is widely understood to be a factor in determining academic success (Gray, 2004) as the stepwise multiple regression analyses reveal. Students with higher levels of positive affect (therefore less anxiety) scored higher on the second math exam.

Discussion

Hypotheses one through six examined possible differences between groups and time on the Test Anxiety Inventory, Math Anxiety Rating Scale for Adolescents, a

modified version of the Pennebaker Inventory of Limbic Languidness, and the Multiple Affect Adjective Checklist – Revised. Although participants differed by group in some of the analyses, group differences were not found when the data was examined by time period. An auxiliary analysis that consisted of one stepwise multiple regression investigated the relationship between the posttest anxiety and multiple affect scores (test anxiety, math anxiety, and the MAACL-R scales) and the second math exam scores. Of the possible predictors, only the MAACL-R PASS Scale was found to be a significant predictor of math exam 2. This finding suggests that, although differences were not found between groups, participating in the study may have reduced math anxiety levels and improved math exam scores for the Algebra I population as a whole.

The goal of the current study was to examine the efficacy of a short-term expressive writing intervention and a psychoeducational presentation for reducing levels of anxiety and physiological symptoms as experienced by adolescent participants anticipating a high school math exam and its related impact on attendance and math exam performance. While prior work has noted the correlation between anxiety and academic performance generally, this study focused on an adolescent population using two interventions. More commonly, expressive writing is used with clinical populations or college aged students.

Although participant overall GPA was not a research variable in this study, the participants' grade point averages (GPA), an indicator of overall academic performance (representative of the final end of semester grades for all of the students' classes), were measured at two time periods (GPA 1 at the end of the preceding semester and GPA 2 at the end of the semester in which Algebra I) to provide demographic information. Using a

4 point grading scale, at GPA 1, the control group had a mean GPA of 2.44 ($SD = 0.95$) as compared to the psychoeducation group ($M = 2.98$, $SD = 0.83$), and the expressive writing group ($M = 3.59$, $SD = 0.82$). At GPA 2, the control group had a mean GPA of 2.45 ($SD = 0.95$), a +0.02 increase as compared to the psychoeducation group ($M = 2.96$, $SD = 0.82$), a -0.08 decrease, and the expressive writing group ($M = 3.53$, $SD = 0.74$), a -0.06 reduction in overall GPA. The participants' overall GPAs remained similar from GPA 1, which did not include a mathematics course for the majority of students, to GPA 2.

Relationship to the Literature

The present study established several connections between the literature and its theoretical framework. The topics addressed included the universal prevalence of test anxiety among school populations, general anxiety, test anxiety and math anxiety within the continuum of anxiety and its related disorders, gender differences, multicultural differences, expressive writing, psychoeducational interventions, and the improvement of academic performance.

Despite an extensive body of international literature regarding the correlates and effects of and treatments for test anxiety, and math anxiety, there has been little research using samples of students drawn from the secondary population. There is a need to increase research with high school students in order to establish whether findings for other student populations may generalize to the secondary education level.

The prevalence of test anxiety, (McDonald, 2001, Putwain, 2007, Somers, Goldner, Waraich, & Hsu, 2006) and math anxiety (Betz, 1978, Richardson & Suinn, 1972, Ashcraft & Moore, 2009) among students in general, has been identified in the

literature. In the present study, both test anxiety and math anxiety were evident among the Algebra I students in all three groups. The self reported test anxiety, as measured by the TAI, for the total population ($M = 37.70$) would be considered to be in the moderate range. Total scores range from 20 to 80. For example, the norm of the TAI for male high school students living in the United States is 40.87 ($SD = 12.77$). A score of 23 would be considered to be low whereas a score of 60 would be regarded as being high. Given that the population was a nonclinical sample, the evidence of test anxiety was readily apparent among the students as a whole. The pretest and posttest self reported levels of mathematics anxiety for the total population in the current study, as measured by the Math Anxiety Rating Scale for Adolescents, was 171.12. Normative information for secondary high schools was obtained (Suinn & Edwards, 1982) with 197.6 being the mean MARS-A score. Considering that the majority of the students participating in the present study were in the ninth grade, the percentile equivalent for ninth graders with a score of 171 would be approximately in the 40th percentile. This study expressly supported the body of literature; test anxiety and math anxiety were prevalent at the secondary level as evidenced by participants in both the experimental and control groups.

Expressive Writing

Numerous studies throughout the past two decades, have shown that a brief expressive writing intervention can affect physical health, emotional well-being, and general functioning (for a review, see Smyth, 1998). For example, recent studies demonstrate that expressive writing reduces physical symptoms in cancer patients (Creswell, Lam, Stanton, Taylor, Bower, & Sherman, 2007), lowering elevated blood pressure (Beckwith-McGuire, Greenberg, & Gevirtz, 2010), better kidney transplant-

related quality of life (Possemato, Ouimette, & Geller, 2010), lessening the impact of rheumatoid arthritis (Broderick, Stone, Smith, & Kaell, 2004), and lowering pain levels in chronic pain patients (Norman, Lumley, Dooley, & Diamond, 2004). Emotional well being improvements were recently noted among higher education students (Nandagopol, 2010), intimate partner violence survivors (Holmes, et al., 2007, Koopman, et al., 2005), and outpatient psychotherapy clients experiencing anxiety and depressive symptoms (Graf, Gaudino, & Geller, 2008).

The results of the present study did not support the majority of studies reporting the effectiveness of expressive writing interventions. Specifically, levels of anxiety were not significantly lower following the intervention. Nevertheless, Pennebaker (2007) and health psychologists are exploring the efficacy of extended expressive writing interventions.

Limitations

In understanding the results of the current study, various limitations warrant further consideration. The results require cautious consideration of limitations, replication, and extension to other populations prior to drawing strong conclusions. First, sampling limitations (e.g., adolescent population only, sample size) reduced the potential generalizability of the current findings to other samples of adolescent populations with greater levels of diversity, those that are located in urban or suburban settings, and those that are located in different regions of the country. The sample, which is not representative of the diverse population of adolescents in the United States of America, included primarily Caucasians living in a rural area. Consequently, it is unclear whether an expressive writing intervention or psychoeducational presentation would be effective

with a sample of more ethnically diverse adolescents, though a replication of the study with students yielding significant results would lend support to the current findings. Therefore, it would be informative to test the generalizability of the interventions to a diverse population from an urban area thereby reducing the external validity threat.

The current sample size ($N = 58$) yielded a response rate of 82.85% and resulted in sufficient power levels to enable a reasonable interpretation of the outcomes and findings. However, a greater statistical power would have allowed for analysis by other subgroup characteristics (e.g. ethnicity, test preparation habits, knowledge of study skills, previous mathematics learning, or time spent completing homework). Because only the intervention and control groups and their interactions were studied, a more concise understanding of other within-group differences (e.g. socioeconomic status, math competency, year in school, math self-efficacy) was not undertaken. By considering the impact of other potential compounding variables, a richer population description may yield additional findings. Perhaps one or more of these variables should be examined as potential moderators of anxiety effects.

Although the design of the study is conducive to the analyses used, a larger sample size and obtaining data from multiple sources would have increased the statistical power, allowed for improved generalizability. Although the study provides information regarding rural adolescents, the results are limited to the experiences of those who participated in the study. Obtaining data from multiple sources would have increased the generalizability.

A second limitation of this study was its reliance of investigating self-reported data even though the self-report nature of the instruments are considered to be very

reliable indicators of internalizing behaviors (Reynolds, 1994). It is possible that the data collected did not fully represent the adolescents' anxiety related experiences. The adolescents may have replied in a more positive or negative, socially desirable, or pleasing manner than what may be reflected by their realistic experiences.

Third, data collection instrument limitations, such as the length of the MARS-A (98 items) and MAACL-R (132 adjectives), may have altered the accuracy of the responses, an instrumentation threat. Examinee motivation on instruments, particularly those who may experience test anxiety, can be impacted by test length, Taylor and Deane (2002) found. Although the MARS-A was used in conjunction with the 20 item TAI and the MAACL-R was used with an adapted version of the PILL (20 items), which are favored for their lengths, the resulting questionnaires can be long for some adolescents, particularly for students who may respond negatively to a large number of items despite the similarity to the length of other assessments (Taylor & Deane, 2002). However, both the MARS-A and MACCL-R can be administered in a short amount of time.

Furthermore, all of the instruments are over twenty years old and therefore may not reflect some of the factors associated with the more current stresses associated with testing. Additionally, the structure of the instruments limits the amount and richness of information which may be gathered from a source other than the instrument (e.g., interview).

Fourth, there are natural limitations in quantitative research itself, thus its ability to establish cause-effect relationships is hindered. Putwain (2009) presents an alternative methodological approach to studying test anxiety which considers situated and contextual factors of experience. Furthermore, multimethod measurement is commonly employed in

social science research. Using more than a singular method or source to assess the anxiety construct is strongly encouraged (Eid & Diener, 2006).

Finally, time limitations related to the data collection may have hindered the emerging of possible differences due to the four week interval between pretest and posttest. It is likely that there was not an adequate amount of time for significant differences to emerge. A potential limitation transpires when only two time points are considered, as in the present study; identification and estimation problems can occur more frequently (Geiser, Eid, Nussbek, Courvoiseier, & Cole, 2010) whereas longitudinal multitrait-multimethods can analyze change more effectively.

In spite of these limitations, the study contributes useful information, though the findings are not consistent with much of the previous research. It does not imply causality or suggest possible associations between anxiety, physical symptoms, attendance, academic performance, and anxiety reducing interventions. Nevertheless, these findings provide additional information to the understanding of adolescents and anxiety in an evaluative situation involving algebraic concepts. The study also highlights areas of research which may be worthy of future exploration.

Implications for Future Research

There is a considerable lack of research on test anxiety reduction programs for students including those at the elementary, middle, and secondary levels (Ergene, 2003), with most of the existing research focusing on college populations. More test anxiety (Wigfield, 1989, Hembree, 1988) and math anxiety (Luzzo, Hasper, Albert, Bibby, & Martinelli, 1999; Furner & Duffy, 2002) interventions are needed to address the development of related anxiety components experienced by students. Further anxiety

related research is needed to examine the association between achievement and achievement-oriented variables by comparing groups of classes (Leitenberg, 1990). In addition, more wide-ranging information concerning the characteristics of adolescents involved in test anxiety intervention programs is necessary to determine which interventions are effective with below college age populations.

Investigating the math testing experiences of adolescents of varying ages, from a range of ethnic groups, from different regions of the country, and from divergent socio-economic backgrounds is imperative. With particular regard to this study, attempts to gain more information from rural locations with lower educational levels and poverty are useful. Examining adolescent populations with differing levels of anxiety as well as highly anxious only or students who choose not to reveal their anxieties related to both testing and math is essential for increased understanding.

In particular, retrospective studies addressing earlier math achievement levels, quality of instruction and test anxiety experiences are needed to further explore anxiety and achievement developmental patterns.

To provide a more comprehensive overview of test anxiety and its impact on adolescents, forthcoming research could encompass other populations including teachers, counselors, administrators, and parents. Future research can also examine the education profession's role in reducing anxiety levels before and during evaluative situations. Investigating mathematics instructional practices is necessary in order for students to prevail over math anxiety (Griest, 2010).

Future research can address issues related to how anxiety reduction programs are implemented in high schools. Particularly, information regarding intervention

components and length of treatment is necessary to present potential opportunities for preventative, developmental, and remedial strategies and techniques.

In addition, future researchers may evaluate the degree to which research findings on anxiety and academic performance in mathematics relate to one another, as well as how they convey to intervention effectiveness. Information regarding the range of classroom and cognitive difficulties associated with anxiety and the means that they mediate mathematic achievement outcomes remain inadequately understood. Also, determining the extent to which schools can assist students with these behaviors and emotions is constructive. Partnering academically related interventions with more therapeutic opportunities may be worthwhile.

Topics for future research in the area of anxiety related to testing and mathematics may include assessing other confounding negative emotions (e.g. depression) and behaviors (e.g. testing preparedness). Some of the consequences of math anxiety, including how students “think about thinking” and their math self-efficacy and performance illuminate a possible link between metacognition and anxiety (Legg & Locker, 2009), which warrants further examination. In addition, future research designs should include multiple sources of data (e.g., teacher observations, focus groups, academic records, parental concerns).

Furthermore, qualitative research methods may yield further insight regarding factors that may contribute to or deter experiencing anxiety and its related symptoms in a testing situation. By focusing on specific aspects of the problem, numerous opportunities for research exist which may, in turn, result in knowledgeable and helpful contributions to the field of test anxiety and math anxiety.

Summary

The purpose of the study was to examine the efficacy of a short-term expressive writing intervention and a psychoeducational presentation for reducing levels of anxiety and physiological symptoms as experienced by adolescent participants anticipating a high school math exam and determine the impact of anxiety reducing interventions on class attendance and math examination performance.

The results of the present study indicate that general anxiety, test anxiety, math anxiety, physiological well-being, as measured by the MAACL-R, TAI, MARS-A, PILL (modified), attendance, and math test performance did not improve significantly by group and by group and time. In contrast, when all of the participants are viewed as one population, some significant differences occurred. Although the results of the study approached significance, it was not reached.

Future research, including quantitative, qualitative, and mixed methods studies, is recommended to further investigate the relationship between anxiety and academic performance in adolescent populations by linking general anxiety, test anxiety, or math anxiety with academic achievement or other confounding variables.

CHAPTER VI
MANUSCRIPT

The Effects of Two Anxiety Reducing Interventions on Algebra I Test Scores for a
Sample of Rural High School Students
Sharon Wisinger and Nina W. Brown

Abstract

The effects of expressive writing on test and general anxiety, physical and psychological well-being, attendance, and test scores of ninth through eleventh grade adolescents in attending two rural public high schools was investigated. Participants ($N = 58$) adolescents in three intact Algebra I classes were assigned to write about neutral topics during three classroom sessions (first experimental group) ($n = 24$), participate in a psychoeducational presentation during one classroom session (second experimental group) ($n = 18$), or receive regular classroom instruction (control group) ($n = 16$). At baseline and six weeks after writing, physical symptoms, levels of anxiety, attendance, and test scores were assessed.

Key words: adolescents; expressive writing; anxiety; test anxiety; math anxiety; math achievement

The Effects of Two Anxiety Reducing Interventions on Algebra I Test Scores for a Sample of Rural High School Students

As the nation strives to reach the goal of 100% proficiency in reading and math in the midst of high stakes testing under the No Child Left Behind Act of 2001 (NCLB) requirements, and funding remains tight, students face growing pressures to produce results (Lee, 2006). This reliance on mandated testing in schools has shifted teaching practices (e.g. targeted teaching or “teaching to the objective”), intensified the importance of classroom exams, and initiated various educational reforms. In concurrence with the dramatic increase in the use of test scores to determine accountability following the No Child Left Behind enactment and its penalties for schools that fail to make adequate yearly progress, test anxiety has been accorded increased interest (Cizek & Burg, 2006).

The impact of test anxiety on academic performance is wide ranging. An abundance of evidence suggests that test anxiety is negatively associated with academic performance (Naveh-Benjamin, McKeachie, Lin and Holinger, 1981; Hill and Wigfield, 1984, Ziedner, 1998). As the level of expectations for students rises in response to the means to hold schools accountable for student achievement (Hembree, 1988; Hill and Wigfield, 1984; Watt, Powell, Mediola, & Cossio, 1006; Reyes, 2008), an understanding of the part test anxiety may have on academic performance, particularly the possibility of bias in test scores (Wren & Benson, 2004), has become even more pertinent, along with other mediating factors.

Students, teachers, counselors, administrators, parents, guardians, and others are frequently distressed by the effects of test anxiety (Casbarro, 2004). Anxiety and its

biological correlate, physiological symptoms are related to both academic performance and emotional well-being. Students may experience test anxiety related physiological symptoms (e.g., headaches, gastrointestinal discomfort, perspiration or chills, sleeping difficulties, and shortness of breath) which may cause uneasiness, embarrassment or exacerbate related conditions. School related stress and pressure to pass an exam or course, to be promoted to the next grade, to graduate from high school, to pursue secondary education, or to access career opportunities bears weight on the students' emotional well-being (Aysan, Thompson & Hamarat, 2001; Linn, 2001; Spielberger & Vagg, 1995) particularly for African American and Latino students (Kellow & Jones, 2008; Walpole & McDonough, 2005; Hembree, 1988; Catsambis, 1994).

Test Anxiety

Anxiety difficulties are among the most commonly experienced conditions affecting youth (Kendall, Safford, Flannery-Schroeder, & Webb, 2004). Whereas generalized anxiety reflects a pattern of worry that lacks a distinct content (Klein, 2009), test anxiety exacerbated general anxiety during evaluations and math anxiety is particular to general anxiety experienced while attempting math tasks or math evaluations.

Because test anxiety is a multifaceted construct, it has been defined and measured in a diverse attempt to conceptualize it within the broader context of anxiety. Putwain (2008) differentiates test anxiety from the construct of general anxiety by indicating the specific context in which the anxiety occurs; test anxiety transpires in a situation involving the evaluation of assessment performance. Test anxiety may be related with anticipating, experiencing, or recovering from a test (Zeidner, 1998). Test anxiety, as defined by Maxfield and Melnyk (2000), involves apprehensive and negative thought

ruminations associated with physiological responses and emotional distress. Along with test phase reactions and cognitive, physiological, and emotional factors, test anxiety may be accompanied by fear, worry, and apprehension experienced to an excessive degree (McDonald, 2001).

Test anxiety may appear as being mild, moderate, or severe in form (Rothman, 2004). Similar to conceptualizations of general anxiety, test anxiety exists along a continuum (McDonald, 2001), ranging from facilitative effects which aid or enhance performance (Alpert & Haber, 1960; Zeidner, 1998) to incapacitating test anxiety which inhibits academic performance (Alpert & Haber, 1960; Naveh-Benjamin, McKeachie, Lin and Holinger, 1981; Hill and Wigfield, 1984, Zeidner, 1998). Facilitative effects notwithstanding, the dearth of research has concentrated on how test anxiety negatively influences academic performance (McDonald, 2001; Zeidner, 1998). This emphasis is due, in part, to the consequences related to not passing course exams and standardized exams required to pass a course needed for graduation. Consequentially, there is an increased likelihood that more students experience anxiety when taking these exams. While some students have an optimal level of anxiety, others may fail these exams despite being familiar with the material.

Physiological Symptoms

Hughes, Lourea-Waddell, and Kendall (2007) hypothesized that children with anxiety disorders would show signs of more somatic symptoms than non-anxious control children and that an increased number of symptoms would predict poorer academic performance. The results demonstrate that the treatment group, comprised of students with high levels of anxiety, experienced more physical symptoms (e.g., dizziness,

tiredness, headaches, stomach aches, nausea, and vomiting) and demonstrated lower academic performance than the control group according to the child report measure.

Attendance

Although academic success is a high priority focus in schools, efforts to enhance students' physical and emotional well-being are also considered to be important. Anxiety-based school refusal may involve 5 to 28% of youth and can lead to waning academic performance and dropping out of school, among other short and long term problems (Kearney, 2001). Anxiety related components may involve a misguided attempt to avoid experiencing anxiety (e.g. an examination or attending a specific class). Attendance concerns may result in negative outcomes (e.g. missed instructional time, possibility of suspension or failing a course due to lack of attendance if the limit was exceeded). Students who experience anxiety in the school setting deal with a range of issues that may affect physical and emotional well-being as well as attendance, achievement, and behavior. Overanxious individuals with absenteeism concerns may benefit from relaxation training, systemic desensitization, and cognitive procedures (Lauchin, 2003). Therefore, although the antecedent reasons and behaviors for non-attendance may vary, school and parental involvement is imperative for an effective multi-systemic approach. In particular, school personnel can strategically monitor student attendance, complete a functional analysis of non-attendance, develop systemic, group, and individual approaches to intervention, and inform parents and guardians.

Considerable evidence has accumulated demonstrating the impact of anxiety on academic performance. As opposed to facilitative anxiety, test and mathematics anxieties can be debilitating because the anxiety is associated with possible negative repercussions,

which may be evidenced in the form of class absenteeism, poor preparation, difficulties understanding course content, classroom test results which are not aligned with actual ability, and feelings of uncertainty.

Mathematics Related Anxiety

In the growing empirical literature, there is evidence that mathematics anxiety, a particular form of test anxiety (Sapp, 1999), may have a substantial impact on adolescents. Mathematics anxiety is linked with test anxiety through a common concern for testing situations. Unlike the test anxiety construct, math anxiety does not have a theoretical foundation. Math anxiety, lacking an independent theoretical base, is often conceptualized within the theoretical support of test anxiety (Hembree, 1990). Math anxiety may be viewed as a focused, subject specific form of test anxiety according to many researchers (e.g., Hembree, 1990; Richardson & Woolfolk, 1980; Bandalos, Yates, & Thorndike-Christ, 1995). Furthermore, Bandalos, Yates, and Thorndike-Christ (1995) described math anxiety as an amalgamation of test anxiety, poor self-confidence, a fear of failing, and a perceived negative attitude toward learning math. Theoretical models of the association between math anxiety and math performance have been difficult to establish. Although the theoretical foundations and causes of math anxiety are not firmly established, students with high levels of math anxiety are known to experience negative reactions to mathematical content and testing (Richardson & Woolfolk, 1980). A negative relationship between higher levels of anxiety and lower levels of achievement is apparent to many researchers (Hembree, 1990; Ma, 1999).

Math anxiety, though lacking a single cause (Jain & Dowson, 2009), may have numerous significant effects including math avoidance during high school and college

(Betz, 1978; Dew, Galassi & Galassi, 1984) which may interfere with preparation to compete globally given the current emphasis on mathematics (Furner & Duffy, 2002; Rapee, et al., 2000) in college and career preparation. Career paths are shaped by math curricular choices, background dispositions, and the suitability of math class enrollment that achieved grades communicate (McFarland, 2006). Correlations between math anxiety and other factors (e.g., motivation and self-confidence in math) are robustly negative, ranging between $-.47$ and $-.82$ (Ashcroft, 2002). Highly math anxious students tend to shun math related high stakes testing, higher level courses, career paths, and professions that involve frequent math use (Scarpello, 2007; Beilock, 2008; Ashcraft, 2002; Ashcraft & Faust, 1994). These otherwise intelligent and capable individuals circumvent opportunities, which may have proved rewarding.

Research demonstrates that adolescents, who exhibit high levels of math anxiety, have lower levels of math achievement and may be less likely to take higher level math courses, both in high school and college, or pursue math-related careers. Math anxiety has been shown to predict later career choices (Luzzo, et al, 1990; Furner & Duffy, 2002). Moreover, as early as grade 9, math achievement categorizes students' future career aspirations, even after controlling for overall academic achievement (Ashcraft, 2002; Shapka, Domene, & Keating, 2006). Math-anxious students then to have negative attitudes toward math and may avoid math classes (e.g. absenteeism, selecting lower level courses) which may result in lower achievement.

The importance of algebra is considerable, according to a progression of research positioning algebra as a gateway to college, in line with the goals of the National Council of Teachers of Mathematics (2000), and the academic standards movement to prepare

students for college and work. A decade ago, it was possible to graduate from high school without having passed an algebra course. Presently, most states compel students to not only take one or more algebra classes required for graduation, but to pass an examination that assess whether they are able to meet or surpass state algebra-specific benchmarks (Chazan, 2008). Students who succeed in algebra often succeed in higher level math courses, making math a gateway to higher educational pursuits. Students who excel at algebra have the foundation to succeed in pre-calculus and enter the science, technology, engineering, and mathematics professions. Students who struggle with algebra and other college preparatory math coursework frequently find that math serves as a gatekeeper to future success in college level math courses and are more likely to require as many as four remedial courses before taking college level algebra (Bryk, A., & Treisman, U., 2010), placing them at risk academically.

The cognitive literature enumerates how critically math performance depends on cognitive processing and, in turn, how math anxiety compromises the functioning of working memory to such an extent that even individuals with strong abilities in math will function ineffectively (Beilock & Carr, 2005). Consequences of math anxiety include lower performance on math achievement tests as a result of impaired working memory due to the influence of math anxiety (Ashcraft & Krause, 2007).

With the understanding that anxiety among students, often in the forms of test anxiety and math anxiety, has been negatively linked with test performance, and selection of courses and professions, minimizing levels of anxiety is an important component of test anxiety and math anxiety research. Various ways of approaching its treatment include efforts stemming from a physiological and emotional perspective aimed at

reducing physiological symptoms through behavioral methods, behavioral approaches (e.g. progressive muscle relaxation training), cognitive behavioral treatments (e.g. cognitive behavioral modification, self-talk), and skill improvement (e.g. study skills, test-taking strategies), as well as combined interventions. Overall, these and other anxiety reduction interventions have received support from the literature, and are commonly used in student populations, including high school adolescents, although the generalizability of some of the research has been scrutinized (Ergene, 2003).

Math anxiety and related attitudes toward math can impact attention, motivation, conscientiousness, working memory and cognition. These important research threads, along with others, are important ways to approach the math anxiety and achievement confound.

Expressive Writing

“The pen is the tongue of the mind,” is a quote by Miguel de Cervantes which may suitably capture the essence of expressive writing; writing is good for your physical and mental health as an abundance of literature over the past few decades demonstrates (Esterling, L’Abate, Murray, & Pennebaker, 1999; Smyth, 1998; Graf, Gaudiano, & Geller, 2008). Current research builds on decades of work by James Pennebaker, who espoused the beneficial nature of writing; the process enables a person to process and then disclose thoughts with the ability to do so nonverbally. In their landmark study Pennebaker and Beall (1986) commenced a new line of research by examining health benefits within the context of a writing intervention. The notion that writing helps people to feel better is the basic premise supporting expressive writing. A wide range of individuals have engaged in the process, with the vast majority stating that “the writing

experience was valuable and meaningful in their lives” (Pennebaker, 1997, p. 162). The often repeated process began with Pennebaker managing the writing experience of a group of college aged students. The procedure involved the students writing for 20 to 30 minutes daily for several days. The treatment group wrote about a stressful, personal experience whereas the control group committed to writing about neutral events. In numerous studies during the past two decades, this paradigm has produced findings positively associated with increased physical and mental health benefits (Pennebaker, 1997).

The Basic Writing Paradigm (Pennebaker, 1997) involves randomly assigning each participant to one of two or more groups. Each group is tasked with writing for 15 to 30 minutes each consecutive day about an assigned value-laden topic. Typically, participants in a disclosure group write about thoughts and feelings connected to a stressful occurrence (Lepore & Smyth, 2002). Participants assigned to the control group write about trivial or neutral topics. Groups are compared on changes in well-being from baseline to follow-up, which is most commonly within several months of writing.

Consistently, studies using an expressive writing intervention have demonstrated noteworthy contributions encompassing a broad spectrum of psychological and physical health. Albeit that disclosure often indicates an immediate but transitory increase in negative mood, ensuing follow-up shows a marked reduction in stress levels (Manier & Olivares, 2005; O’Connor & Ashley, 2008; Smyth & Helm, 2003), depressive symptoms (Gortner, Rude, & Pennebaker, 2006), interpersonal conflict (Landry, Rachal & Rosenthal, 2005), asthma symptoms (Warner, Lumley, Casey, Pierantoni, Salazar, Zoratti, Enberg, & Simon, 2006), and an improvement in the emotional well being of

women living with metastatic breast cancer (Laccetti, 2007), lupus and rheumatoid arthritis (Danoff-Burg, Agee, Romanoff, Kremer, & Strosberg, 2006). Increased working memory function (Klein & Boals, 2001; Yogo & Fujihara, 2008) and immune functioning improvement (Petrie, Booth, Pennebaker, Davidson, & Thomas, 1995; Esterling, L'Abate, Murray, & Pennebaker, 1999) have also been associated with the utilization of expressive writing interventions. A meta-analytic review of the substantial empirical research indicates that expressive writing interventions have positive effects on indicators of health, both physical and mental (Smyth, 1998; Frattaloli, 2006).

Most expressive writing studies have exemplified positive results with a healthy population of primarily adults. Research involving mostly adults with health problems is altogether less promising, in some studies. No effects from the expressive writing treatment were generated from some studies (Broderick, Stone, Smyth, & Kaell, 2004, Corter & Petrie, 2008; D'Souza, Lumley, Kraft, & Dooley, 2008; Rivkin, Gustafson, Weingarten, & Chin, 2006). Contrary to expectations, depression was not affected by the expressive writing intervention (Danoff-Berg, et al., 2006). Mixed results were reported in Harris' health utilization meta-analysis of randomized control trials (2006) where the results were impacted by whether the population was healthy. Health care utilization was reduced in healthy populations only when participants wrote about stressful events whereas studies involving participants experiencing preexisting medical conditions, stress or other psychological factors did not show significant effects. Frisna, Borod, and Lepore (2004) meta-analyzed nine studies and determined that expressive writing significantly improved health. Expressive writing was found to be more effective on physical outcomes than psychological. In contrast, other findings beginning with Pennebaker and

Beal (1986) suggest that expressive writing generates meaningful differences in individuals who are physically and psychologically healthy (Frisna, Borod, & Lepore, 2004).

The majority of studies employing expressive writing have focused on an adult population (Warner, et al., 2005; Soliday, Garofalo, & Rogers, 2004), although a small number involve healthy adolescent populations in addition to adolescents experiencing illness or emotional difficulties (e.g., Stice, Burton, Bearman, & Rohde, 2006; Soliday, Garofalo, & Rogers, 2004; Stice, Shaw, Burton, & Wade, 2006).

Writing about life events, traumatic experiences, and even writing about neutral topics can provide noteworthy benefits for emotional and physical well-being.

Expressive writing has been effectively used as an intervention in various research settings and conditions. Smyth's meta-analysis (1998) of expressive writing studies validated the generalizability of the intervention effects for various populations' gauges of physical and mental health. Research consistently suggests that expressive writing enhances physical healthiness in diverse populations (Holmes, et al., 2007) although several studies indicate otherwise (Gridon et al., 1996; Kaufman & Sexton, 2006; Smyth, Nazarian, & Arigo, 2008).

Exploring the use of expressive writing with adolescents in a high school setting, offers promise, based on the effectiveness of expressive writing interventions, the conduciveness to a classroom setting (e.g. low cost, minimal resources, time efficient, replicability), and the possibility of improved well-being and academic achievement.

Expressive writing is an intervention which is conducive to a school setting. The potential cost effectiveness of the treatment, concurrent with its ability to be used in a

group setting and the opportunity to bring about meaningful changes in overall health, based on earlier experimental work and more recent studies, warrants consideration of the intervention.

Adolescent use of the internet and text messaging has spurred an incentive for the population to write spontaneously and perhaps more openly. Taken further, a simple intervention like expressive writing is somewhat familiar to students who reflect and respond to prompts consistently. Although Frattaroli's (2006) meta-analysis revealed that the overall effect size of expressive writing is unexceptional (a Cohen's d approximately .08), the realization of a brief, short intervention having an impact on a consequential outcome is notable. The majority of available research has found that disclosure is generally beneficial to a wide range of individuals. If expressive writing often leads to improved physical and emotional well-being, such an intervention might be especially beneficial to an adolescent population in a school setting. The use of expressive writing as an intervention may result in improvements on measures of physical, psychological well-being, and academic performance measured by Algebra I exams.

Method

Participants

The participants involved in this study were mixed gender ninth, tenth, and eleventh grade students enrolled in Algebra I high school mathematics courses and attending two small, Middle Atlantic public high schools located in a rural community. The participant pool ages ranged between 14 and 18 years. Participants included male and female students of varying ethnic and socioeconomic backgrounds from the Mid-

Atlantic region and military dependents from several branches of the armed services representing various geographic locations throughout the county.

Group Assignment

The first section of Algebra I designated as being the first experimental group, expressive writing. The second class section was determined to be the second experimental group, the psychoeducation presentation group. The third Algebra 1 section was designated to the control group.

Procedure

Following approval from the university's Human Subjects Institutional Review Board, school administrators, and an Algebra I teacher, the purpose of the study and its relevance to students was explained. Parents and legal guardians of the participants were provided with a written explanation of the study procedures and review board approved informed consent and assent forms. The students were verbally notified about the study during a classroom visit and informed about the confidential nature of their responses. Demographic information was obtained from the data management system and teacher records. The researcher administered the TAI, MARS-A, modified PILL, and MAACL-R were to intact class groups in their regular classroom setting. These measures serve as a baseline measure of current physical, psychological, and anxiety functioning. All completed measures were secured.

A short-term expressive writing sample was completed prior to the Algebra I exam 1 for the experimental-writing group. The participants wrote for twenty minutes, uninterrupted over a period of three consecutive days. The first prompt for the first experimental group writing was, "What is your favorite hobby?" The adolescents wrote

about their spring break activities and their favorite place to vacation for the following prompts, respectively.

A week prior to the math test 2 administrations, a school counselor conducted an evidence-based, one hour psychoeducational intervention which included didactic and experiential approaches to reducing test anxiety. The most effective interventions for addressing test anxiety are reported to be a blend of cognitive and behavioral methods with skill-focused interventions (Hembree, 1988 & Ergene, 2003). The intervention was designed to expand the student's behavioral options in response to situations with anxiety provoking potential. The goal of the intervention was to facilitate anxiety reduction to a level which is conducive rather than remaining at a dysfunctional level.

Following the introduction of the topics, various physical responses (e.g., illness, increased heart rate, sweating), behavioral responses (e.g., fidgeting, staring, lower attendance, difficulty sleeping, cheating), and emotional responses (e.g., mind going blank, withdrawing or worrying about performance) were identified. After highlighting the common occurrences and effects of test and math anxieties, the school counselor shared practical, student focused techniques to prevent and reduce test anxiety and math anxiety so that the related consequences are minimized (e.g., test preparation, study skills, positive self-talk, relaxation, mental visualizations).

Measures

Physical Symptoms

The Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1980) measures the frequency general physical symptoms and sensations experienced. The PILL is a 54 item instrument with a five point scale designed to evaluate the rate of

occurrence of physiological correlates of the psychological process components of disclosure.

The PILL has high construct validity when compared with other self-report measures of physical symptoms (Richards, Beal, Seagal, & Pennebaker, 2000). In terms of reliability, acceptable test-retest reliabilities over a two month period (for 177 participants) were reported to range from .79 to .83 (the reliability of the binary and summed methods, respectively). The scale has no stable factor structure (Pennebaker, 1982). The item reliability averaged across all 54 symptoms was found to be .725, for 60 participants tested two weeks apart (Pennebaker, Burnam, Schaeffer, & Harper (1977). The internal consistency of the PILL is high. The Cronbach alpha internal consistencies range from .88 (when scored using the binary method) to .91 (the summed method alpha).

A number of construct validation studies indicate that high PILL scorers, compared with low PILL scorers, report more symptoms across various settings (Pennebaker, 1982). Cross-validation analyses with additional symptom inventories show that the PILL moderately correlates with the Hopkins Symptom Checklist .48 ($N = 231$), the Autonomic Perception Questionnaire .50 ($N = 75$), the Cornell Medical Index composite score .57 ($N = 100$), and Pennebaker's standard symptom checklists .45 ($N = 1248$). Pennebaker offered the differences in item numbers, item response methods, and severity of symptoms variations as possible explanations for a moderate correlation between the PILL and other symptom inventories (1982).

An adapted Pennebaker Inventory of Linguistic Languidness (PILL) was used to measure physical symptoms of anxiety. Items which were most relevant to anxiety

symptoms reported in the literature were selected (Hughes & Kendall, 2008; Janssens, et al., 2010; Kingery, Ginsburg, & Alfano, 2007). This measure was modified by shortening the length of the instrument to twenty questions. Respondents rate the frequency of symptoms such as *dryness in mouth*, *body perspiring*, and *headaches*. The range of response possibilities was from a low of 0 to a maximum of 20 on a three point scale ranging from 1 = have never or almost never experienced the symptom to 3 = more than once a week. Each response is summed in order to get the total score on the Likert-type scales. The higher the responder's score, the greater the amounts of physical symptoms are commonly experienced (Pennebaker, 1982).

State Anxiety

The Multiple Affect Adjective Checklist-Revised (MAACL-R), developed by Lubin and Zuckerman (1999), may be used to measure affect states and traits. A frequent use of the State version of the MAACL-R is to measure change as a result of experimental interventions. The MAACL-R consists of 132 adjectives measuring positive and negative affect (Luberman & Zuckerman, 1999). The MAACL-R consists of five scales: anxiety, depression, hostility, positive affect, and sensation-seeking. Only the anxiety subscale was used; its internal consistency (Cronbach's Alpha) was 0.77 with adolescent samples (Luberman & Zuckerman, 1999). Respondents indicate those adjectives that signify their mood state (general feeling for now or today). Examples of adjectives include terrified, nervous, inspired, and active. The State form has been correlated with the State-Trait Personality Inventory (STPI); the Anxiety scale correlates .56 with STPI anxiety ($p < .001$). Correlations with the Positive Affect and Negative

Aspect Schedule (PANAS) scales are very high; Dysphoria with Negative affect ($r = .77$, $p < .001$), showing evidence of good discriminant validity.

Test Anxiety

The Test Anxiety Inventory (TAI; Spielberger, 1980) is a 20 item self-report inventory which measures test anxiety as a situation specific personality trait. Using a four point Likert-type frequency scale for rating, respondents designate how often they experience the feeling described in each statement. The TAI measures the combination of high worry and emotionality scores that are thought to affect test performance.

The instrument, devised for use with an adolescent and young adult population, provides a total test anxiety score (range 20-80) with worry and emotionality factorially derived subscales, each based on eight items. Raw scores from the TAI are converted into standardized t-scores with a mean of 50 and standard deviation of 10, using tables of norms. Spielberger (1980) reports test-retest reliability and an internally consistent measure of test anxiety obtained by factor analysis. Validity coefficients of .82 for males and .83 for females were reported (Spielberger). Reliability coefficients were reported at .80 for three weeks and .81 for 1 month intervals. Significant negative correlations among grades and the TAI are evidenced by a lower range of -.18 and an upper range of -.31. After six months, the reliability was .62 for a group of high school students. The alpha coefficients for the TAI normative sample, which consisted of high school and college students, ranged from .92 to .96. The TAI total and subscale scores are highly correlated (.82 to .83) with Sarason's Test Anxiety Scale (TAS), suggesting that the two scales are measuring essentially the same construct. The relationship between other generally used test anxiety instruments (Liebert & Morris' Worry and Emotionality

Questionnaire (WEQ), the STAI State and Trait Anxiety scales) provide evidence of convergent validity. Robust concurrent and discriminant validity evidence was presented by the relatively high correlations of the TAI Worry (*W*) and Emotionality (*E*) subscales with the Worry – Emotionality Questionnaire (WEQ) Worry and Emotionality scales.

Math Anxiety

The Math Anxiety Rating Scale (MARS), initially a 98 item inventory developed for secondary school students and adults, was developed by Suinn to provide a one-dimensional measure of anxiety related to the number operations and other mathematical concepts (Suinn, Edie, Nicoletti, & Spinelli, 1972). Participants indicate the degree of anxiety produced in response to situational items by indicating a range from one to five. Total scores reflect the sum of item values. High scores reflect high anxiety associated with mathematics. Normative data for the MARS involving two university populations (for a review see Anton & Klisch, 1995) have been reported. The test-retest reliability coefficient was .78 following 2 weeks, and .85 following seven weeks, significant at $p < .001$. Internal consistency reliability, measured by coefficient alpha was reported to be .97 for 397 participants (Richardson & Suinn, 1972), suggesting that items consistently cluster around a solitary factor. Item-total correlations were more than .50 for more than half of the correlations for the items (Richardson & Suinn, 1972). Construct validity shown in the significant correlation between MARS scores and a performance test under stress ($r = -.64, N = 30$). The two factor-derived subscales of the MARS are Mathematics Test Anxiety (MTA) and Numerical Anxiety (NA).

The MARS-A is a revised form of the MARS that involves changes in some of the wording or the substitution of new items suitable for an adolescent population. The normative sample consists of middle and high school students.

Construct validity was determined by the 30th and 75th percentile values based on the scores of students ($N = 483$). The 159 and 230 respective values were used to identify low and high levels of anxiety in students at the other two schools. The math course grade averages for students who scored at or below the 30th percentile and those at or above the 75th percentile on the MARS-A were compared. Results for one school ($N = 28$) demonstrated statistically significant main effects for MARS-A scores ($F = 14.08, p < .001$) but no interaction effects. Students with high MARS-A scores had lower math course grade averages than students with low math anxiety. This relationship was confirmed with results from a second school ($N = 1,009$) with statistically significant MARS-A scores ($F = 40.68, p < .001$)

Reliability

Internal coefficients based on percentile norms for seventh through twelfth grade students ($N = 1,313$) vary according to the statistical formula used. The Guttman Split-half Method revealed a reliability coefficient of .89, and the Spearman-Brown split-half reliability coefficient was .90. A coefficient alpha was used as an index of internal consistency and was found to be .96.

Data Analysis

Data was analyzed using descriptive statistics. Quantitative analysis was used to explore the effects of the interventions, to compare changes in the groups over time, and to investigate the association between variables.

Demographic Data

Demographic information regarding age, gender, ethnicity, mathematics course enrollment, special education status, grade level, attendance, and gender was obtained from the schools' data management system. Class attendance and mathematics exam grades were acquired through teacher records.

Survey Data

The instruments yield interval data whereas the math exam scores are total percentage scores. The TAI, the MARS-A, the MAACL-R and the PILL (Modified) were administered prior to participating in the short term expressive writing or psychoeducational treatment and math exam as well as following the interventions.

Statistical Analysis

Data was entered into SPSS version 18.0 for Windows for analytical purposes. Descriptive statistics were conducted to describe the characteristics of the sample. For nominal or categorical data, frequencies and percentages were conducted.

The difference between interventions, across three groups, in terms of their scores on several adjustment measures (general anxiety, physical symptoms, attendance, test, and math anxiety), pre and post intervention was analyzed using an analysis of variance (ANOVA).

To examine research question 1, a one-between and a one-within ANOVA was conducted to assess if there are differences on attendance by group (expressive writing

vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Attendance was acquired from official school records and was measured both as a pretest and as a posttest. The ANOVA results impart information for the main effects of the variables, including a main effect within time, a group by time interaction, and a difference between the subjects.

To examine research question 2, a one-between and a one-within Analysis of Variance (ANOVA) was carried out to assess if there were differences on general anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducational presentation vs. control). General anxiety levels were obtained from the Multiple Affect Adjective Checklist-Revised (MAACL-R) and were used both as a pretest and as a posttest. The results of the ANOVA presents findings for the main effects of the variables including a main effect within time, a group by time interaction, and a difference between subjects.

To examine research question 3, a one-between and a one-within Analysis of Variance (ANOVA) was conducted to assess if there are differences on test anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Test anxiety levels were obtained from the Test Anxiety Inventory (TAI)

and were used both as a pretest and as a posttest. The results of the ANOVA portray findings for the main effects of the variables, including a main effect within time, a group by time interaction, and a difference between subjects.

To examine research question 4, a one-between and a one-within Analysis of Variance (ANOVA) was performed to assess whether there were differences on math anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Math anxiety levels were obtained from the Math Anxiety Rating Scale-Adolescents (MARS-A), and was used both as a pretest and as a posttest. The results of the ANOVA provide findings for the main effects of the variables, including a main effect within time, a group by time interaction, and a difference between the subjects.

To examine research question 5, a one-between and a one-within Analysis of Variance (ANOVA) was conducted to assess if there were differences on math exam scores by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducational presentation vs. control). Math exam scores were obtained from a mathematics examination that was administered to participants at pretest and at posttest. The results of the ANOVA presents findings for the main effects of the variables including a main effect within time, a group by time interaction, and a difference between subjects.

To examine research question 6, a one-between and one-within Analysis of Variance (ANOVA) was conducted to assess if there are differences on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). A 2 x 3 ANOVA was determined due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducation vs. control). Physical symptoms of anxiety were measured using a modified version of the Pennebaker Inventory of Linguistic Languidness (PILL). This score was obtained at pretest and at posttest. The results of the ANOVA provide findings for the main effects of the variables including a main effect within time, a group by time interaction, and a difference between subjects.

The one-between and one-within form of ANOVA is used when subjects are measured on one continuous variable between two or more groups or independent variables repeated more than once (Tabachnick & Fidell, 2001). In this study, there are three groups (expressive writing vs. psychoeducational presentation vs. control) and the groups are measured at two points in time (pretest and posttest). A 2 X 3 ANOVA is an appropriate design due to a total of two testing conditions (pretest and posttest) by three groups (expressive writing vs. psychoeducational presentation vs. control). The ANOVA uses the F test, which allows for making an overall comparison on whether group means differ. If the F is larger than the critical F, the null hypothesis is rejected (Pagano, 1990). The results of the one-between and one-within ANOVAs introduce findings for the main effects of the independent variables on the dependent variable. The findings also assess the overall differences by time (within subjects) and also separately, by group (between

subjects). The interaction of group by time determines whether differences exist among group and time concurrently.

The assumptions of normality and homogeneity of group variances were assessed to normalize the data. Normal distribution assumes that data will peak at the mean (bell shaped distribution). To compare a sample with a reference probability distribution, a one-sample Kolmogorov-Smirnov test (K-S test) was used. To satisfy the assumptions of ANOVA, Levene's test was used to assess the equality of variance in the different groups. Box's Test of Equality of Covariance Matrices and Pillai's trace This analysis was followed by post hoc comparisons (Tukey's Test) to determine which means are significantly different from one another and to test each of the individual tests at a particular significance level.

Sample Size, Power, and Significance

It is necessary to establish an acceptable significance level for determining when to reject the null hypothesis (i.e., the probability of committing a Type I error). For the purposes of this research, the level ($\alpha = 0.05$), which is a traditional value in social science research for this parameter (Lipsey, 1990), was utilized. An acceptable level of power for this study is 0.80, making the Type II error 4 times as likely as the Type I error. Since it is typically more serious to make a false positive claim than it is to make a false negative one, this level is acceptable in the determination of the sample size a priori (Cohen 1992a).

The current study involves ANOVA with three groups (expressive writing vs. psychoeducational presentation vs. control). For an ANOVA, effect sizes are small if they are 0.10, medium if they are 0.25 and large if they are 0.40, according to Cohen

(1992a). A large or medium effect size was determined as being appropriate for this study. Both were utilized in the determination of the sample size. G*Power 3.1.0 was used to calculate sample size. Taking into account the large effect size of 0.40, a generally accepted power of 0.80, and a 0.05 level of significance, 21 participants per group would yield the greatest levels of statistical power. Intact class group samples were used in the research. One of the class groups had a total of 17 students. Therefore, a medium effect size of 0.25, a generally accepted power of 0.80, and a 0.05 level of significance, showed the necessary sample size to achieve empirical validity for this study is 14 participants per tested group (writing vs. psychoeducation vs. control) for a total sample size of 42 participants needed to achieve empirical validity. A total of 58 students participated in the study, attaining the compulsory sample size needed.

Post expressive writing intervention scores, the MAACL-R, the modified PILL, the TAI, and the MARS-A were compared between the experimental groups and the control group using an ANOVA to measure how much of the variance in math exam scores and physical symptoms can be explained by general, test, and math anxieties.

Results

Attendance

Attendance was the number of days absent from the Algebra I class during a set time frame totaling eight weeks. This was measured at two time periods: four weeks prior to administration of pretest items (measure 1) and four weeks after the administration of posttest items (measure 2). Overall, the average class absenteeism rate was only .80 classes.

General Anxiety

General anxiety was measured at pretest and at posttest using the Multiple Affect Adjective Checklist-Revised (MAACL-R) anxiety scale. For general anxiety, as measured by the Anxiety Scale at pretest, the psychoeducation group had a mean score of 60.56 ($SD = 21.88$) as compared to the expressive writing group ($M = 49.92, SD = 11.91$) and the control group ($M = 54.06, SD = 16.79$). Similarly, at posttest, the psychoeducation group had a mean score of 61.83 ($SD = 21.77$) as compared to the expressive writing group ($M = 48.17, SD = 11.25$) and the control group ($M = 51.13, SD = 12.18$). Mean scores for the Anxiety Scale range from 36-177. The minimum MAACL-R Anxiety Scale Score (very low, if any, anxiety) is 36. The maximum MAACL-R Anxiety Scale score (very high anxiety) is 177. Average scores for this scale fall into the range of approximately 40-60. For adolescents, the mean Anxiety Scale score is 49. Pretest and posttest means fell within the average range for adolescents on the MAACL-R Anxiety Scale, with the exception of the psychoeducation group which fell slightly above the mean both pretest and posttest.

Test Anxiety

The test anxiety variable was measured using total scores calculated at pretest and at posttest, using the Test Anxiety Inventory (TAI; Spielberger, 1972). Scoring weights are reversed on item one only. TAI scores range from 20 to 80. The minimum TAI Total Score (very low, if any anxiety) is 20. The maximum TAI Total Score (very high anxiety) is 80. Average scores for this instrument fall into the range of approximately 40-50. For pretest test anxiety scores among the three groups, the control group received a mean score of 46.13 ($SD = 12.78$) as compared to the expressive writing group ($M = 32.04, SD = 8.99$) and the psycho education group ($M = 40.94, SD = 12.51$).

Math Anxiety

The math anxiety variable was measured with the Math Anxiety Rating Scale-Adolescents (MARS-A) and obtained at pretest and at posttest. On the math anxiety pretest, the expressive writing group had a mean of 159.79 ($SD = 47.06$), considered to represent a moderate level of math anxiety as compared to the moderately high levels of math anxiety associated with the psychoeducation group ($M = 199.72$, $SD = 56.34$) and the control group ($M = 195.50$, $SD = 52.84$).

Academic Performance

Academic performance, another variable of interest in this study, was measured by math examination performance. Participants took a math examination at two time periods (math exam 1- at pretest and math exam 2- at posttest). At math exam 1, the control group had a mean score of 70.64 ($SD = 13.36$) as compared to the expressive writing group ($M = 77.67$, $SD = 15.91$), and the psychoeducation group ($M=82.06$, $SD = 15.19$).

Physical Symptoms

The adapted Pennebaker Inventory of Linguistic Languidness (PILL) was used to measure physical symptoms of anxiety at pretest and at posttest. At pretest, the control group had a mean score of 6.00 ($SD = 3.33$) as compared to the expressive writing group ($M = 4.83$, $SD = 3.53$) and the psychoeducation group ($M= 4.72$, $SD = 3.75$). The participants' reporting of physical symptoms indicated an average (control group) to low (expressive writing group and psychoeducation group) range.

Summary of Findings

Research Question 1:

Is there a difference on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 1, a one-between and one-within analysis of variance (ANOVA) was conducted to assess whether differences exist on attendance by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant suggesting that the attendance values were not normally distributed by group. However, according to Stevens (2009), data that is not normally distributed has only a slight effect on the rate of Type I errors. The F statistic was robust with regard to normality assumptions, even when the distributions were highly skewed. Box's M Test of equality of covariances was found to be significant, violating the assumption of equality of covariance. The Pillai's Trace statistic was used. The Levene's test for the equality of error variances was examined for the attendance pretest and posttest values and the assumption of equal variances was met for both.

For the between subjects effects, the results were not significant, $F(2, 55) = 0.77$, $p = .468$, $\eta^2 = .027$, suggesting there was not a significant difference on attendance by group. For the within subjects effects, results were not significant, $F(1, 55) = 0.96$, $p = .331$, $\eta^2 = .017$, suggesting there was no significant difference on attendance by time (pretest vs. posttest). The interaction term between attendance and group was not significant, $F(2, 55) = 2.11$, $p = .131$, $\eta^2 = .071$. There were no differences on attendance by time or by group and time.

Research Question 2:

Is there a difference on general anxiety by group (expressive writing vs. psychoeducational presentation vs. control) and time (pretest vs. posttest)?

To examine research question 2, a one-between and one-within Analysis of Variance (ANOVA) was conducted to assess whether there were differences on general anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant suggesting that the general anxiety scores were not normally distributed by group. However, according to Stevens (2009), data that is not normally distributed has only a slight affect on the rate of Type I errors. The F statistic was robust with regard to normality assumptions, even when distributions are highly skewed. Box's M Test of Equality of Covariance Matrices was found to be significant, violating the assumption of equality of covariance. The Pillai's Trace statistic was used. The Levene's test for the equality of error variances was examined for the anxiety pretest and posttest values; the assumption of equal variances was met for pretest, but not posttest. However, according to Stevens (2009), unless group sizes are sharply unequal (largest/smallest > 1.5); the F statistic is robust for unequal variances.

For the between subjects effects, results were significant, $F(2, 55) = 4.28, p = .019, \eta^2 = .135$, suggesting there was a significant difference on anxiety by group. Tukey post hoc comparison was conducted to investigate the differences between groups. The results show significant differences between the expressive writing group and the psychoeducation group with a mean difference of -12.15 ($p = 0.015$), suggesting that the expressive writing group had a lower mean score (49.04) than the psychoeducation group

($M = 61.19$) on the anxiety measure. There was no significant finding between the other groups in the analysis.

For the within subjects effects, results were not significant, $F(1, 55) = 0.22, p = .638, \eta^2 = .004$, suggesting there was no significant difference on anxiety by time (pretest vs. posttest). The interaction term between anxiety and group was not significant, $F(2, 55) = 0.26, p = .775, \eta^2 = .009$. There were no differences on anxiety by time and group and time.

Research Question 3:

Is there a difference on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 3, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if there were differences on test anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for the expressive writing group at posttest suggesting that those scores were not normally distributed. The other KS tests were not significant and the assumption of normality was met. Box's M Test of Equality of Covariance Matrices was not significant and the assumption of equality of covariance was met. The Wilks' Lambda statistic was engaged to test for significant differences between the groups. The Levene's test for the equality of error variances was examined for the test anxiety pretest and posttest values; the assumption of equal variances was met for both measures.

For the between subjects effects, results were significant, $F(2, 55) = 9.01, p = .000, \eta^2 = .247$, suggesting there was a significant difference on test anxiety by group. Tukey post hoc comparison was conducted to investigate the differences between groups. The results indicate significant differences between the expressive writing group and the psychoeducation group with a mean difference of $-8.52 (p = 0.026)$, suggesting that the expressive writing group had a lower mean score (31.31) than the psychoeducation group ($M = 39.83$) on the test anxiety measure. The results show significant differences between the expressive writing group and the control group with a mean difference of $-13.56 (p = 0.000)$, suggesting that the expressive writing group had a lower mean score (31.31) than the control group ($M = 44.88$) on the test anxiety measure. There was not a significant difference between the psychoeducation group and the control group on test anxiety.

For the within subjects effects, results were not significant for time, $F(1, 55) = 3.80, p = .056, \eta^2 = .065$, suggesting there was no significant difference on test anxiety by time (pretest vs. posttest). The interaction term between test anxiety and group was not significant, $F(2, 55) = 0.10, p = .910, \eta^2 = .003$. There were no differences on test anxiety by group and time.

Research Question 4:

Is there a difference between math anxiety levels by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 4, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest).

In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for the expressive writing group and the control group at posttest suggesting that those scores were not normally distributed. The other KS tests were not significant and the assumption of normality was met. Box's M Test of Equality of Covariance Matrices was significant and the assumption of equality of covariance was violated. The Pillai's Trace statistic was used. The Levene's test for the equality of error variances was examined for the math anxiety pretest and posttest values; the assumption of equal variances was met for pretest, but not posttest. Despite the unequal variances in the posttest, the F statistic is considered robust except when group sizes are greatly unequal (Stevens, 2009)

For the between subjects effects, results were significant, $F(2, 55) = 3.74, p = .030, \eta^2 = .120$, suggesting there was a significant difference on math anxiety by group. Tukey post hoc comparison was conducted to investigate the differences between groups. The results show significant differences between the expressive writing group and the control group with a mean difference of $-38.69 (p = 0.043)$, between pre and post suggesting that the expressive writing group had a lower mean score (150.69) than the control group ($M = 189.38$) on the math anxiety measure. There was no significant difference among the other groups on math anxiety.

For the within subjects effects, results were significant for time, $F(1, 55) = 27.83, p = .000, \eta^2 = .336$, suggesting there was a significant difference on math anxiety by time (pretest vs. posttest). The pretest scores were higher ($M = 185.00$) as compared to the posttest scores ($M = 163.13$). However, the interaction term between math anxiety and

group was not significant, $F(2, 55) = 2.57, p = .086, \eta^2 = .086$. There were no differences on math anxiety by group and time.

Research Question 5:

Is there a difference on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 5, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on math exam scores by group (expressive writing vs. psychoeducation vs. control) and time (pretest-math exam 1 vs. posttest-math exam 2). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for all three groups at pretest and at posttest, suggesting that the math exam scores were not normally distributed by group. Despite the abnormal distributions, the data has only a slight affect on the rate of Type I errors Stevens (2009). The F statistic is robust with regard to normality assumptions, even when distributions are highly skewed. Box's M Test of Equality of Covariance Matrices was not significant and the assumption of equality of covariance was met. The Wilks' Lambda statistic was utilized. The Levene's test for the equality of error variances was examined for the math exam scores pretest and posttest values; the assumption of equal variances was met for both.

For the between subjects effects, results were not significant, $F(2, 53) = 1.34, p = .271, \eta^2 = .048$, suggesting there was no significant difference on math exam scores by group. For the within subjects effects, results were significant for time, $F(1, 53) = 5.08, p = .028, \eta^2 = .087$, suggesting there was a significant difference on math exam scores by

time (pretest vs. posttest). When considering all of the participants' scores, math exam 1 had a lower mean value ($M = 76.82$) than math exam 2 ($M = 81.61$). However, the interaction term between math exam scores and group was not significant, $F(2, 53) = 1.50, p = .233, \eta^2 = .053$. There were no differences on math exam scores when group was added to the model.

Research Question 6:

Is there a difference on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest)?

To examine research question 6, a one-between and one-within analysis of variance (ANOVA) was conducted to assess if differences exist on physical symptoms of anxiety by group (expressive writing vs. psychoeducation vs. control) and time (pretest vs. posttest). In preliminary analysis, the assumption of normality was assessed through the conduction of six Kolmogorov Smirnov (KS) tests. The results of the KS tests were significant for the psychoeducation group at pretest and at posttest suggesting that those scores were not normally distributed. The other KS tests were not significant and the assumption of normality was met. Box's M Test of Equality of Covariance Matrices was significant and the assumption of equality of covariance was violated. The Pillai's Trace statistic was employed. The Levene's test for the equality of error variances was examined for the physical symptoms of anxiety pretest and posttest values; the assumption of equal variances was met for both.

For the between subjects effects, results were not significant, $F(2, 55) = 1.96, p = .150, \eta^2 = .07$, suggesting there was no significant difference on physical symptoms of anxiety by group. For the within subjects effects, results were not significant, $F(1, 55)$

=1.10, $p = .300$, $\eta^2 = .020$, suggesting there was not a significant difference on physical symptoms of anxiety by time (pretest vs. posttest). The interaction term between physical symptoms of anxiety and group was not significant, $F(2, 55) = 0.66$, $p = .523$, $\eta^2 = .023$. There were no differences on physical symptoms of anxiety by group and time.

Discussion

Hypotheses one through six examined possible differences between groups and time on the Test Anxiety Inventory, Math Anxiety Rating Scale for Adolescents, a modified version of the Pennebaker Inventory of Limbic Languidness, and the Multiple Affect Adjective Checklist – Revised. Although participants differed by group in some of the analyses, group differences were not found when the data was examined by time period. An auxiliary analysis that consisted of one stepwise multiple regression investigated the relationship between the posttest anxiety and multiple affect scores (test anxiety, math anxiety, and the MAACL-R scales) and the second math exam scores. Of the possible predictors, only the MAACL-R PASS Scale was found to be a significant predictor of math exam 2. This finding suggests that, although differences were not found between groups, participating in the study may have reduced math anxiety levels and improved math exam scores for the Algebra I population as a whole.

The goal of the current study was to examine the efficacy of a short-term expressive writing intervention and a psychoeducational presentation for reducing levels of anxiety and physiological symptoms as experienced by adolescent participants anticipating a high school math exam and its related impact on attendance and math exam performance. While prior work has noted the correlation between anxiety and academic

performance generally, this study focused on an adolescent population using two interventions. More commonly, expressive writing is used with clinical populations or college aged students.

Although participant overall GPA was not a research variable in this study, the participants' grade point averages (GPA), an indicator of overall academic performance (representative of the final end of semester grades for all of the students' classes), were measured at two time periods (GPA 1 at the end of the preceding semester and GPA 2 at the end of the semester in which Algebra I) to provide demographic information. Using a 4 point grading scale, at GPA 1, the control group had a mean GPA of 2.44 ($SD = 0.95$) as compared to the psychoeducation group ($M = 2.98$, $SD = 0.83$), and the expressive writing group ($M = 3.59$, $SD = 0.82$). At GPA 2, the control group had a mean GPA of 2.45 ($SD = 0.95$), a +0.02 increase as compared to the psychoeducation group ($M = 2.96$, $SD = 0.82$), a -0.08 decrease, and the expressive writing group ($M = 3.53$, $SD = 0.74$), a -0.06 reduction in overall GPA. The participants' overall GPAs remained similar from GPA 1, which did not include a mathematics course for the majority of students, to GPA 2.

Limitations of the Study

In understanding the results of the current study, various limitations warrant further consideration. The results require cautious consideration of limitations, replication, and extension to other populations prior to drawing strong conclusions. First, sampling limitations (e.g. adolescent population only, sample size) reduced the potential generalizability of the current findings to other samples of adolescent populations with greater levels of diversity, those that are located in urban or suburban settings, and those

that are located in different regions of the country. The sample, which is not representative of the diverse population of adolescents in the United States of America, included primarily Caucasians living in a rural area. Consequently, it is unclear whether an expressive writing intervention or psychoeducational presentation would be effective with a sample of more ethnically diverse adolescents, though a replication of the study with students yielding significant results would lend support to the current findings. Therefore, it would be informative to test the generalizability of the interventions to a diverse population from an urban area thereby reducing the external validity threat.

The current sample size ($N = 58$) yielded a response rate of 82.85% and resulted in sufficient power levels to enable a reasonable interpretation of the outcomes and findings. However, a greater statistical power would have allowed for analysis by other subgroup characteristics (e.g. ethnicity, test preparation habits, knowledge of study skills, previous mathematics learning, or time spent completing homework). Because only the intervention and control groups and their interactions were studied, a more concise understanding of other within-group differences (e.g. socioeconomic status, math competency, year in school, math self-efficacy) was not undertaken. By considering the impact of other potential compounding variables, a richer population description may yield additional findings. Perhaps one or more of these variables should be examined as potential moderators of anxiety effects.

Although the design of the study is conducive to the analyses used, a larger sample size and obtaining data from multiple sources would have increased the statistical power, allowed for improved generalizability. The study provides information regarding rural adolescents, but the results are limited to the experiences of those who participated

in the study. Obtaining data from multiple sources would have increased the generalizability.

A second limitation of this study was its reliance of investigating self-reported data despite findings that the self-report nature of the instruments is considered to be very reliable indicators of internalizing behaviors (Reynolds, 1994). It is possible that the data collected did not fully represent the adolescents' anxiety related experiences. The adolescents may have replied in a more positive or negative, socially desirable, or pleasing manner than what may be reflected by their realistic experiences.

Third, data collection instrument limitations, such as the length of the MARS-A (98 items) and MAACL-R (132 adjectives), may have altered the accuracy of the responses, an instrumentation threat. Examinee motivation on instruments, particularly those who may experience test anxiety, can be impacted by test length, Taylor and Deane (2002) found. Although the MARS-A was used in conjunction with the 20 item TAI and the MAACL-R was used with an adapted version of the PILL (20 items), which are favored for their lengths, the resulting questionnaires can be long for some adolescents, particularly for students who may respond negatively to a large number of items despite the similarity to the length of other assessments (Taylor & Deane, 2002). However, both the MARS-A and MACCL-R can be administered in a short amount of time.

Furthermore, all of the instruments are over twenty years old and therefore may not reflect some of the factors associated with the more current stresses associated with testing. Additionally, the structure of the instruments limits the amount and richness of information which may be gathered from a source other than the instrument (e.g., interview).

Fourth, there are natural limitations in quantitative research itself, thus its ability to establish cause-effect relationships is hindered. Putwain (2009) presents an alternative methodological approach to studying test anxiety which considers situated and contextual factors of experience. Furthermore, multi-method measurement is commonly employed in social science research. Using more than a singular method or source to assess the anxiety construct is strongly encouraged (Eid & Diener, 2006).

Finally, time limitations related to the data collection may have hindered the emerging of possible differences due to the four week interval between pretest and posttest. It is likely that there was not an adequate amount of time for significant differences to emerge. A potential limitation transpires when only two time points are considered, as in the present study; identification and estimation problems can occur more frequently (Geiser, Eid, Nussbek, Courvoiseier, & Cole, 2010) whereas longitudinal multitrait-multimethods can analyze change more effectively.

In spite of these limitations, the study contributes useful information, though the findings are not consistent with much of the previous research. It does not imply causality or suggest possible associations between anxiety, physical symptoms, attendance, academic performance, and anxiety reducing interventions. Nevertheless, these findings provide additional information to the understanding of adolescents and anxiety in an evaluative situation involving algebraic concepts. The study also highlights areas of research which may be worthy of future exploration.

Implications for Future Research

There is a considerable lack of research on test anxiety reduction programs for students including those at the elementary, middle, and secondary levels (Ergene, 2003),

with most of the existing research focusing on college populations. More test anxiety (Wigfield, 1989, Hembree, 1988) and math anxiety (Luzzo, Hasper, Albert, Bibby, & Martinelli, 1999; Furner & Duffy, 2002) interventions are needed to address the development of related anxiety components experienced by students. Further anxiety related research is needed to examine the association between achievement and achievement-oriented variables by comparing groups of classes (Leitenberg, 1990). In addition, more wide-ranging information concerning the characteristics of adolescents involved in test anxiety intervention programs is necessary to determine which interventions are effective with below college age populations.

Investigating the math testing experiences of adolescents of varying ages, from a range of ethnic groups, from different regions of the country, and from divergent socio-economic backgrounds is imperative. With particular regard to this study, attempts to gain more information from rural locations with lower educational levels and poverty are useful. Examining adolescent populations with differing levels of anxiety as well as highly anxious only or students who choose not to reveal their anxieties related to both testing and math is essential for increased understanding.

To provide a more comprehensive overview of test anxiety and its impact on adolescents, forthcoming research could encompass other populations including teachers, counselors, administrators, and parents. Future research can also examine the education profession's role in reducing anxiety levels before and during evaluative situations. Investigating mathematics instructional practices is necessary in order for students to prevail over math anxiety (Griest, 2010).

Future research can address issues related to how anxiety reduction programs are implemented in high schools. Particularly, information regarding intervention components and length of treatment is necessary to present potential opportunities for preventative, developmental, and remedial strategies and techniques.

In addition, future researchers may evaluate the degree to which research findings on anxiety and academic performance in mathematics relate to one another, as well as how they convey to intervention effectiveness. Information regarding the range of classroom and cognitive difficulties associated with anxiety and the means that they mediate mathematic achievement outcomes remain inadequately understood. Also, determining the extent to which schools can assist students with these behaviors and emotions is constructive. Partnering academically related interventions with more therapeutic opportunities may be worthwhile.

Topics for future research in the area of anxiety related to testing and mathematics may include assessing other confounding negative emotions (e.g. depression) and behaviors (e.g. testing preparedness). Some of the consequences of math anxiety, including how students “think about thinking” and their math self-efficacy and performance illuminate a possible link between metacognition and anxiety (Legg & Locker, 2009), which warrants further examination. In addition, future research designs should include multiple sources of data (e.g. teacher observations, focus groups, academic records, parental concerns).

Furthermore, qualitative research methods may yield further insight regarding factors that may contribute to or deter experiencing anxiety and its related symptoms in a testing situation. By focusing on specific aspects of the problem, numerous opportunities

for research exist which may, in turn, result in knowledgeable and helpful contributions to the field of test anxiety and math anxiety.

Summary

The purpose of the study was to examine the efficacy of a short-term expressive writing intervention and a psychoeducational presentation for reducing levels of anxiety and physiological symptoms as experienced by adolescent participants anticipating a high school math exam and determine the impact of anxiety reducing interventions on class attendance and math examination performance. The results indicate that general anxiety, test anxiety, math anxiety, and physiological well-being, as measured by the MAACLR, TAI, MARS-A, PILL (modified), attendance, and math test performance did not improve significantly by group and by group and time. In contrast, when all of the participants are viewed as one population, some significant differences occurred. Although the results of the study approached significance, it was not reached.

Future research, including quantitative, qualitative, and mixed methods studies, is recommended to further investigate the relationship between anxiety and academic performance in adolescent populations by linking general anxiety, test anxiety, or math anxiety with academic achievement or other confounding variables

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APPENDICES

APPENDIX A: Institutional Review Board Application

Appendix A

**OLD DOMINION UNIVERSITY
HUMAN SUBJECT RESEARCH REVIEW APPLICATION FORM**

Responsible Project Investigator (RPI)		
Responsible Project Investigator: The RPI must be a member of ODU faculty or staff who will serve as the project supervisor and be held accountable for all aspects of the project. Students cannot be listed as RPIs.		
First Name: Nina	Middle Initial: W.	Last Name: Brown
Telephone: 757.683.3245	Fax Number: 757.683.5756	E-mail: nbrown@odu.edu
Office Address: Old Dominion University, Darden College of Education, Department of Counseling and Human Services		
City: Norfolk	State: Virginia	Zip: 23529
Department: Counseling		College: Counseling and Human Services
Complete Title of Research Project: The Effects of Two Anxiety Reducing Interventions on Pre-algebra Test Scores for a Sample of Rural High School Students.		Code Name (one word): Anxiety
Investigators		
<small>If more investigators exist than lines provide, please attach a separate list.</small>		
Investigator(s): Individuals who are directly responsible for any of the following: the project's design, implementation, consent process, data collection, and/or data analysis.		
First Name: Steven	Middle Initial:	Last Name: Myran
Telephone: 757-683-6694	Fax Number: 757-683-4413 (Dept.)	Email: smyran@odu.edu
Office Address: Old Dominion University, Darden College of Education, Educational Foundations and Leadership Office 157		

City: Norfolk	State: VA	Zip: 23529
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Department: Educational Leadership	College: Educational Foundations and Leadership
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Affiliation: Faculty Graduate Student Undergraduate Student
 Staff Other

First Name: Sharon	Middle Initial:	Last Name: Wisinger
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Phone:	Fax Number:	Email: swisi001@odu.edu
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Address: Hampton Blvd.

State: Virginia	Zip: 23529
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Department: Counseling	College: Counseling and Human Services
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Affiliation: Faculty Graduate Student Undergraduate Student
 Staff Other

List all information for additional investigators on attachment and check here:

Type of Research

1. This study is being conducted as part of (check all that apply):
 Faculty Research Non-Thesis Graduate Student Research
 Doctoral Dissertation Honors or Individual Problems Project
 Masters Thesis Other _____

Funding

2. How is the research project funded?
 Research is not funded
 Research is funded
 Funding decision is pending (funding decision has not been made)

2a. What is the type of funding source? (Check all that apply)
 Federal Grant or Contract Agency Proposal Number _____
 Grant Start Date (MM/DD/YY) _____ Grant End Date (MM/DD/YY) _____
 State or Municipal Grant or Contract
 Private Foundation
 Corporate contract
 Other (specify): _____

2b. Who is the point of contact at the funding source?
Name:
Mailing Address:
Telephone: **Email:**

Research Dates3a. Date you wish to start research (MM/DD/YY): 01 / 30 / 20103b. Date you plan to end research (MM/DD/YY): 1 / 21 / 2011 (End date for data collection and analysis)**Research Location****4. Where will the experiment be conducted? (Check all that apply)** On Campus (Building and Room Number) Off-Campus**Human Subjects Review**

5. Has this project been reviewed by any other committee (university, governmental, private sector) for the protection of human research subjects?

 Yes No

5a. If yes, is ODU conducting the "primary" review?

 Yes No

5b. Who is conducting the primary review?

Study Purpose**6. Describe the rationale for the research project.**

An aim of the study is to contribute to the research literature by addressing whether two interventions (an expressive writing intervention and a psychoeducational group intervention) are effective in reducing anxiety and to expand to the body of research involving an adolescent population within an academic setting. A lack of research evidence for the effectiveness of expressive writing as an intervention for students experiencing general, test, or math anxiety provides and impetus to examine the possible impact of a short term writing intervention and a psychoeducational intervention on academic performance, attendance, and the reduction of anxiety and its related physical and psychological symptoms.

Subjects**7. What will be the maximum number of subjects in the study?**75**7a. Indicate the approximate number of:** Males 30Females 30**7b. What is the age of subjects? (Check all that apply)** Children (1-17 years old) Adults (18-65 years old) Elderly (64-years and older)**7c. Will students be enrolled in the study? (Check all that apply)** Undergraduate students(dept)* _____ Advanced students (dept) _____

*If students are under 18 years old, parental consent must be obtained

The students are under 18 years of age, parental consent will be obtained.

Informed consent will be obtained for students under 18 years of age and 18 years of age or older. A letter of explanation explaining the purpose and goals of the study and of their right to refuse participation in the study without consequence and a consent form will be mailed to each parent or guardian's physical address. Written consent will be obtained prior to student participation.

7d. Provide rationale for the choice of subjects. Enumerate any additional defining characteristics, including age, of the subject population. (e.g., symptomatology, history, socio-economic status).

The subjects were selected because the rural high school population is rarely studied, and these 14 through 18 year old students are enrolled in a gateway mathematics course which leads to further college preparatory coursework. The entire county population of secondary students enrolled in the Algebra I courses will be used. This study would provide data about the role of anxiety, test anxiety, and mathematics anxiety on their test scores in mathematics, and if either or both experimental interventions effectively reduce the anxiety and improve test performance. Student participants will remain in intact class groups which are representative of various socio-economic backgrounds.

Vulnerable Subjects

8. Are research subjects being used whose ability to give informed voluntary consent may be in question? (e.g., children, persons with AIDS, mentally disabled, psychiatric patients, prisoners.)

Yes

No

The adolescents will be under the general protection of the Board of Education, high school administrators, a school counselor, and a mathematics teacher. Only students whose parents or guardians provided written consent will be given the opportunity to participate in the study.

8b. What type of vulnerable subjects are being enrolled? (check all that apply)

Critically Ill Patients

Mentally Disabled or Cognitively Impaired Individuals

Prisoners

Physically Handicapped

Pregnant Women

Children

Other

Recruitment

9. How will participants be recruited? (Please submit a copy of the sign-up sheet, newspaper advertisement, or any other protocol or procedure which will be used to recruit subjects.)

Internet

Newspaper/radio/television advertising

Posters/brochures/letters

Other The participants will be recruited through their mathematics teacher.

Comments:

The participants will be recruited through their mathematics teacher. Intact class groups will be used as the sample. The intact class groups represent all students enrolled in Algebra I classes. The participants' mathematics teacher was consulted to secure collaboration and support.

Inclusion and Exclusion Criteria

10. Are subjects equitably chosen for participation in the study? (no one group is excluded without justification)

Yes

No

10a. Does the study require special evaluation and screening of potential subjects to determine their appropriateness for inclusion in the study?

Yes

No

Experimental Procedures

11. Describe the experimental procedures that will be followed. (Include a succinct, but comprehensive statement of the methodology relating to the human subjects. You are encouraged to include a discussion of statistical procedures used to determine the sample size.)

What is the impact of two interventions — short term expressive writing and psychoeducational group presentation — on the general test anxiety, mathematics anxiety, and related physical symptoms for performance on a mathematics test for a sample of adolescents enrolled in Algebra I courses attending rural public high schools? The effect of two the treatments on general anxiety, test anxiety, and physical symptoms for a sample of ninth through twelfth grade high school adolescents will be examined. Subjects will be selected based on a participant variable, specifically, mathematics level classification. The participants are enrolled in Algebra I mathematics courses. Nonrandom, intact class groups of students from two high schools will be used as the sample. The socioeconomic status is varied. Both genders are represented. 75% of the potential participants self-identify as being Caucasian, 16% are African American, 5% are multiracial, and 3% are Hispanic. 75 participants are anticipated. Written consent will be obtained prior to participation. The subjects will be assigned to one of two treatment groups (expressive writing intervention or the psychoeducational group intervention) or the control group. The entire school population of students enrolled in the algebra I math courses will have the opportunity to participate in the study.

The research design will be a repeated measures experimental design. Both treatments aim to reduce levels of anxiety and improve math test performance. One treatment group will receive an expressive writing intervention. Given a prompt, participants will write for 15 minutes about their favorite hobby daily for three consecutive days. The second treatment group will receive a psychoeducational presentation. The topics of general anxiety, test anxiety, and mathematics anxiety will be introduced. Practical techniques and strategies for reducing test and math anxiety will be provided (e.g. positive self-talk, study skills, test preparation tips, and relaxation techniques). The control group will receive standard educational instruction. All of the groups will receive pre and post assessments of physical symptoms, psychological well being (general anxiety), test anxiety, math anxiety, and math test performance.

11a. Will any aversive or painful procedures be employed (e.g., shock, the threat of shock or punishment, experimentally induced stress?)

Yes
 No

11b. Will the deliberate deception of research participants be involved as part of the experimental procedure?

Yes
 No

Attach copies of the following items:

- Research Protocol(s)
- Questionnaire
- Copies of any instructions or debriefings given

N/A If the research is part of a research proposal submitted for federal, state or external funding, submit a copy of the FULL proposal

Compensation

12. How much time will be required of each subject?

Less than 5 hours, in total, will be required of each subject.

The time will not extend beyond the class period.

12a. Will research subjects receive course credit for participating in the study?

Yes

No

Comments:

12b. Are there any other forms of compensation that may be used? (e.g. Money)

Yes

No

Comments:

To encourage participation and attendance, students will be compensated with a \$5 gift certificate to a local retail store and snack food.

12c. Are there any penalties for subjects who do not show up for a research session?

Yes

No

Comments:

Students not wishing to participate in the study will meet with their mathematics teacher to receive small group instruction at an alternative location within the schools.

Informed Consent

13. Do you intend to obtain informed consent from subjects?

Yes

No

13a. Describe the procedures that will be used to obtain Informed Consent and attach the Informed Consent Document (follow the guidelines for preparation of the University Informed Consent Form).

Note: Subjects MUST be given a description of the procedures and rationale for the study to the extent possible. The benefits and ANY risks associated with participating in the study MUST be enumerated. The subjects MUST be informed of their right to terminate the experiment at any time. If there is no risk associated with the study and participants' signature on the informed consent sheet is the only identifying information about the name of the subject, then the subjects' signature may not be necessary.

A letter of explanation explaining the purpose and goals of the study and of their right to refuse participation in the study without consequence and a consent form will be emailed to each parent or guardian's email address. If this means is not feasible, a letter will be mailed to the students' home address. The parental informed consent letter will include the study title, identify the researchers, introduce the study, identify possible risks and potential benefits, identify costs and payments, will explain the confidentiality measures and the privilege to withdraw, and an agreement to participate in the study. Written consent will be obtained prior to student participation. The study will be described to the participants in the classroom setting. The researcher will explain the steps which will be taken to maintain confidentiality, reaffirm that the parents, guardians, faculty members and administrators will not have access to the writing samples or individual assessments, and remind the participants that they may withdraw at anytime without affecting their grade in the class.

Risks

- **What are potential risks of the research? (Check all that apply)** **14.**
- Physical harm __phy
- Psychological harm __psy
- Release of confidential information __Rel
- Other _____ __Oth
- **Describe any potential risks to subjects for the activities proposed and describe the steps that will be taken to minimize the risks. Include any risks to the subject's physical well being, privacy, dignity, emotions, employability, and criminal and legal status. A detailed, comparative statement of the risk (harm or likelihood) must also be described in the consent form.** **14a.**
- If any (unexpected) psychological distress is encountered as a result of taking the instruments, the students may stop at any time, without penalty, and have the option to talk with a school counselor. This option does not include distress experienced when taking the math test required by the participants' math teacher.
- The participants will be informed that the information is confidential and will not be seen by their teacher. The participants may withhold or withdraw from participating at any time, without penalty.
- The participants' privacy will be protected through the use of a coded number assigned to each individual instrument and writing sample instead of a name. The instruments and writing samples will be locked in a file cabinet within a file room within a school office. Only coded data will be used for analysis.
- Please attach the following (if you have developed them)
- The script by the experimenter to disclose potential harm and likelihood (risk) prior to the subject's choice to participate. X T

Benefits

15. Assess the potential benefits that may accrue to the individual subject as well as to others as a result of the proposed study. Do the potential benefits justify the possible risks involved? Although you may mention general benefits to society, such speculative benefits should not be presented to a subject as a direct benefit for informed consent.

There are no direct benefits for participation in this study. The individual subject will have the opportunity to have possible levels of general anxiety, test anxiety, math anxiety, and potential common, general physical symptoms measured through the utilization of valid and reliable instruments considered to be appropriate for use with an adolescent population. This potential indirect benefit justifies the possible risk involved because the students would have an opportunity to gain awareness and information regarding possible test and math anxiety. The identifiable risks are minimal.

Protection of Anonymity

16. Describe in detail the procedures for protecting the anonymity (meaning that no one will ever be able to know the names) of the research subjects. If anonymity is impossible, then describe in detail the procedures for safeguarding data and confidential records. These procedures relate to how well you reduce the risk that a subject may be exposed or associated with the data.

Students will be identified by a coded student number only. Data and confidential records will be stored in a locked file cabinet located within a locked file room housed within three outer doors which are locked whenever a school employee is not within the room. Writing samples and instrument answers are not shared with the participants' teacher.

Drugs or Devices

17. Will any drugs, devices, or chemical biological agents be used with the subjects?

Yes
 No

Biological Materials

18. Will this research involve the collection, analysis, or banking of human biological materials (cells, tissues, fluids, DNA?)

Yes
 No

Training

19. Briefly explain the nature of the training and supervision of anyone who is involved in the actual data collection, research design, or in conducting the research. This information should be sufficient for the IRB to determine that the RPI and investigators possess the necessary skills or qualifications to conduct the study.

An Old Dominion University doctoral student will collect the data, formulate a research design and conduct the research. The doctoral student is a school counselor employed by the school system where the research will take place. A different school counselor, who works with adolescents, will lead the psychoeducational session. The school counselors are licensed, practicing school counselors working with an adolescent population. The study will be supervised by Dr. Nina Brown, Dr. Steven Myran, and Dr. Radha Horton-Parker

Human Subjects and HIPPA Training

20. A. The RPI must document completion of NIH Training.

Date RPI completed NIH Training: 10/20/2009 Certification Number: 324868

B. RPI's who propose studies with patient populations must document HIPPA training by accessing the NIH booklet entitled "Protecting Personal Health Information in Research: Understanding the HIPPA Privacy http://privacyruleandresearch.nih.gov/pr_02.asp and must submit an attachment to the review application stating that the material has been read and will be adhered to in the proposed research. The attachment must include the date the material was read, which must be within the 12 months prior to the application.

PLEASE NOTE:

- ◆ You may begin research when the University Human Subjects Review Board gives you final WRITTEN notice of its approval.
- ◆ You MUST inform the committee of ANY adverse event, changes in the method, personnel, funding, or procedure.
- ◆ At any time the committee reserves the right to re-review a research project, to request additional information, to monitor the research for compliance, to inspect the data and consent forms, to interview subjects that have participated in the research, and if necessary to terminate a research investigation.

Responsible Project Investigator (Must be original signature) obtained Date

APPENDIX B

Informed Consent and Assent

INFORMED CONSENT

Dear Parents and Guardians,

We are conducting a study involving looking at interventions to reduce anxiety when students are taking a math test. To conduct this study we need the participation of male and female adolescents between the ages of 14 and 18. The attached "Permission for Child's Participation" form describes the study and asks your permission to participate.

Please carefully read the attached "Permission for Child's Participation" form. It provides important information. If you have any questions pertaining to the attached form or to the research study, please feel free to contact Sharon Wisinger or Dr. Nina Brown.

After reviewing the attached information, please return a signed copy of the "Permission for Child's Participation" form to your child's Algebra I teacher if you are willing to participate in the study. Keep the additional copy of the form for your records. Even if you provide consent, your child will be able to participate only if he/she is willing to do so.

We thank you in advance for taking the time to consider your participation in this study.

Sincerely,

Sharon Wisinger, C.A.S.

Dr. Nina Brown, Ed.D., LPC, NCC

Informed Consent

Title of Research Project: “The Effects of Two Anxiety Reducing Interventions on Pre-algebra Test Scores for a Sample of Rural High School Students.”

Introduction: The purpose of this form is to provide you with information that may affect your decision whether or not to participate in this research study and to record the consent of participants who agree.

Researchers: The Responsible Project Investigator is Nina W. Brown, Ed. D., LPC, NCC, FAGPA; Professor and Eminent Scholar of Counseling, College of Education, Department of Counseling and Human Services. Sharon Wisinger, M.S., C.A.S.; School Counselor, is a co-investigator.

Description of Research Study: Research investigating the impact of test anxiety and mathematics anxiety on academic performance involving secondary high school populations is limited. Intervention strategy effectiveness studies are needed to identify best practices for secondary settings. This research study will investigate the outcomes of two interventions on anxiety levels and mathematics test performance for a sample of adolescent students compared to a control group.

If you decide to participate, you will be part of a study conducted in your high school mathematics class. All involved participants will be administered questionnaires regarding physical concerns, mathematics anxiety, test anxiety, and a scheduled mathematics exam before and after their classroom activities. You may be asked to participate in either a guided writing activity for 15 minutes each day for a total of three days, a classroom guidance lesson about test and math anxiety, or a regular Algebra I educational lesson. Individuals not participating in the study will receive a regular Algebra I lesson and take the scheduled math exam.

If you provide permission (say YES), then your participation will cover four days during which data may be collected and the possibility of participating in a classroom guidance lesson may occur. Approximately 75 subjects will be participating in this study.

Exclusionary Criteria: None. All students enrolled in your teacher’s mathematics classes are eligible to participate.

Risks and Benefits: No identifiable risks are associated with this research project. There is some possibility, as with any research, that you may be subject to risks that have not been identified. If, at *any* time your participation causes you to experience any increase in psychological or physical discomfort, you may stop your participation. You may contact your teacher, school nurse, parent or guardian if you so desire.

Benefits: There are no direct benefits for participation in this research.

Costs and Payments: Participation in this study is voluntary. If you are present during the data collection, you will receive a \$5 gift certificate or gift card to a local retail establishment and snack food.

New Information: If the researchers uncover new information that could reasonably change your decision about participating in this study, then you will be provided with the relevant information.

Confidentiality: All information pertaining to you in this study is held strictly confidential unless disclosure is required by law. The results of this study may be used in reports, presentations, and specifically.

Withdrawal Privilege: You have the right to withdraw from this study at any time. You are allowed to change your mind even if you provide permission to participate. Your test grade and course grade will not be affected by whether or not you participate in the study. Your lack of participation or decision to not participate will not cause a loss of benefits to which you might otherwise be entitled.

Compensation for Illness or Injury: If you agree to participate in this study, your consent does not waive any of your inherent legal rights. However, in the event of harm, injury, or illness arising from this study, neither Old Dominion University, nor the school board, your school faculty or administrators, the researchers will provide you with any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in this research project, you may respond accordingly then contact Dr. Nina Brown at (757) 683-3245 or nbrown@odu.edu. Dr. George Maihafer (757) 683-4520 and the Old Dominion University Office of Research (757) 683-3460 can provide you with additional assistance.

Voluntary Consent: By signing this form and providing permission to participate, you are acknowledging that you have read this form or have had it read to you, that you understand this form, the research study, and any related risks and benefits. The researchers can answer any questions you may have about the research. Please contact the researchers if you have any questions in the future as well. If, at any time, you feel pressured to participate, or if you have questions about this form or your rights, contact Dr. George Maihafer (757) 683-4520 or the Old Dominion University Office of Research at 757-683-3460.

By signing below, you are telling the researchers YES, that you agree to participate in this research study. You will be given a copy of this form for your records.

Participant Printed Name

Participant Signature

Date

Parent/Guardian Printed Name

Parent/Guardian Signature

Date

Investigator's Statement: I certify that I have explained the nature and purpose of this research, including benefits, costs, risks, and any experimental procedures to this subject. I have described the rights and protections afforded to human subjects and haven't pressured, coerced, or falsely enticed this subject to participate. I am aware of my obligations under state and federal laws, and promise compliance. I have answered the subject's questions and have encouraged him/her to ask additional questions at any time during the course of this study.

Investigator's Printed Name

Investigator's Signature

Date

Investigator's Printed Name

Investigator's Signature

Date

ASSENT

Test Anxiety and Math Anxiety Study

This study is designed to investigate the effects of two Interventions to reduce levels of anxiety which may precede taking an Algebra I test. All Algebra I students are eligible to participate.

I am Sharon Wisinger, your school counselor and a graduate student at Old Dominion University.

I am asking you to take part in a research study because I am trying to learn more about test anxiety and math anxiety. I want to learn about the types of interventions that reduce the amount of anxiety that students might experience when testing.

If you agree, you will be asked to complete several questionnaires. You will be asked about how you generally feel before taking a math test. You will use a code instead of your name when you complete the assessment.

Participating in this study is your choice. You do not have to participate in this study. Even if you start to participate, you can change your mind later. No one will be upset with you if you decide not to participate in the study. You may ask questions about the study.

If you decide to be in the study, your responses will not be identified as belonging to you personally.

You can talk with Dr. Nina Brown (757) 683-3245 or nbrown@odu.edu, Dr. George Maihafer (757) 683-4520, or the Old Dominion University Office of Research (757) 683-3460 if you have more questions at any time during the study or have any concerns about how you have been treated in the study.

If you sign your name at the end of this form, it means that you agree to be in this study. I will give you a copy of this form to keep after you sign it and a copy to your parents.

Last Name

First Name

Signature

Date

Script to Disclose Potential Harm and Likelihood of Risk

The title of this research project is, “The Effects of Two Anxiety Reducing Interventions on Algebra I Test Scores for a Sample of Rural High School Students.”

Dr. Nina Brown, a professor, counselor, and Eminent Scholar affiliated with Old Dominion University located in Norfolk, VA is the research investigator responsible for this project. Sharon Wisinger, School Counselor, is the co-investigator. The study we are conducting aims to closely examine two different ways of lessening feelings of nervousness, worrying, and physical symptoms experienced by some high school students taking math classes. One math class will experience one method. A different math class will experience a different method. One math class will not receive either method. All three groups will be compared with each other to see if any method was better than the other method or no method at all.

If you decide to participate, you will be part of a study conducted in your high school mathematics class. All involved participants will be administered questionnaires regarding physical concerns, mathematics anxiety, test anxiety, and a scheduled mathematics exam before and after their classroom activities. You may be asked to participate in either a guided writing activity for 15 minutes each day for a total of three days, a classroom guidance lesson about test and math anxiety, or a regular Algebra I educational lesson. Individuals not participating in the study will receive a regular Algebra I lesson and take the scheduled math exam.

If you provide permission (say YES), then your participation will cover four days during which data may be collected and the possibility of participating in a classroom guidance lesson may occur. Approximately 75 subjects will be participating in this study.

All students enrolled in your teacher’s mathematics classes are eligible to participate in this study. But you will not be able to select which, if any, method or treatment you receive.

There are no direct benefits for participation in this research. There are no identifiable risks which are related to this study. However, any research study means that there is some possibility that you may be subject to risks that are unknown at the present. If your participation causes you any increased psychological uneasiness, you may stop participating at any time. It is unlikely that you would experience any discomfort beyond normal test taking experiences. You may speak with an administrator, school counselor, a teacher, a parent or guardian, or an Old Dominion University professor, Dr. Nina Brown (757) 683-3245 or nbrown@odu.edu, if you would like to talk about any distress that you might experience.

Your participation in this study is completely voluntary. If new information arises that may affect your decision to volunteer to participate, then you will be provided with it. The information that you provide is held strictly confidential unless disclosure is required by law. The results of this study may be used in reports, publications, and presentation using group results only, which will not be traceable to you.

You may stop participating in the study at any time, even if your parent or guardian provided permission. You are allowed to change your mind. Your grade will not be affected whether you participate or not. You may ask questions at any time.

The main benefit to you for participating in this study is the possibility of experiencing increased self-awareness and the possibility of improved mathematics test performance.

Participation in this study is voluntary. If you are present during the data collection, you may receive a \$5 gift certificate or gift card to a local retail establishment and snack food.

All information pertaining to you in this study is held strictly confidential unless disclosure is required by law. The results of this study may be used in reports, presentations, and specifically.

You have the right to withdraw from this study or stop participating at any time. You are allowed to change your mind even if you provide permission to participate. Your decision to participate or withdraw will not affect your relationship with your school faculty or Old Dominion University. Your lack of participation or decision to not participate will not cause a loss of benefits to which you might otherwise be entitled. If you choose not to participate, you will meet with your teacher in the media center and receive instruction.

If you agree to participate in this study, your consent does not waive any of your inherent legal rights. This means that you are still protected by the law if you participate in the research project. However, in the event of harm, injury, or illness arising from this study, neither Old Dominion University, nor the school board, your school faculty or administrators, the researchers will provide you with any money, insurance coverage, free medical care, or any other compensation for such injury. If you suffer any injury as a result of participation in this research project, you may respond to the injury or problem right away. Next, contact myself or Dr. Nina Brown at 757-683-3245 or nbrown@odu.edu.

By signing the consent form and providing permission to participate, you are acknowledging that you have read this form or have had it read to you, that you understand this form, the research study, and any related risks and benefits. The researchers can answer any questions you may have about the research. Please contact the researchers if you have any questions in the future as well. If, at any time, you feel pressured to participate, or if you have questions about this form or your rights, contact the Old Dominion University Office of Research at 757-683-3460.

By signing the form with your parent or guardian, you are telling the researchers YES, that you agree to participate in this research study. You will be given a copy of the consent form for you to keep.

Appendix C

The PILL: The Pennebaker Inventory of Linguid Languidness (Modified)

The PILL: Modified

Common symptoms which most people have experienced them at one time or another are listed. We are currently interested in finding out how prevalent each symptom is among high school students. All data will be remain confidential.

Next to the number corresponding to the symptoms shown below, darken the circle which indicates how frequently you experience that symptom. For all items, use the following scale:

	Have never or almost never experienced the symptom	Less than 3 or 4 times a year	Every month or so	Every week or so	More than once a week
Increased heart rate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faster breathing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dryness in mouth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nausea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Upset stomach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sudden need to use the restroom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hands perspiring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Body perspiring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Face flushes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cold and clammy hands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweaty palms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hands shaking or trembling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Body shaking or trembling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Muscle tension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twitching or muscle spasms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lump in throat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling dizzy or faint	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eyes water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Headaches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX: D**The MAACL-R: The Multiple Affect Adjective Test List Revised**

The Multiple Affect Adjective Checklist Revised

Sample Adjectives

1. Active
19. Calm
44. Fine
83. Nervous
102. Shaky

APPENDIX E

The TAI: The Test Anxiety Inventory

For use by Sharon Wisinger only, Received from Mind Garden, Inc on January 3,2010

mind garden

www.mindgarden.com

To Whom it May Concern,

This letter is to grant permission for the above named person to use the following copyright material;

Instrument: *Test Anxiety Inventory*

Author: *Charles D. Spielberger, Ph.D.*

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for his/her thesis research.

Five sample items from this Instrument may be reproduced for inclusion in a proposal, thesis or dissertation. The entire Instrument may not be included or reproduced at any time in any other published material.

Vicki Jairnez

Mind Garden, Inc.

www.mindgarden.com

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Published by Mind Garden, INC. www.MindGarden.com

Test Anxiety Inventory

Please provide the following Information:

Gender (*Please circle*): **Male** **Female** core: T_____ W_____ E_____

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel: There are no wrong or right answers. Do not spend too much time on one statement but give the answer which seems to describe how you generally feel. Please answer every statement.

1 ALMOST NEVER 2 SOMETIMES 3 OFTEN 4 ALWAYS

- | | | | | |
|--|-----|---|---|---|
| 1. I feel confident and relaxed while taking tests | 1 | 2 | 3 | 4 |
| 2. While taking examinations I have an uneasy, upset feeling | 1 | 2 | 3 | 4 |
| 3. Thinking about my grade in a course interferes
with my work on tests | ..1 | 2 | 3 | 4 |
| 4. I freeze up on important exams..... | 1 | 2 | 3 | 4 |
| 5. During exams I find myself thinking about whether I'll ever
get through school | . 1 | 2 | 3 | 4 |

APPENDIX F

The MARS-A: The Math Anxiety Rating Scale

MATHEMATICS ANXIETY RATING SCALE (MARS-A)

The items in the questionnaire refer to things and experiences that may cause tension or apprehension. For each item, place a check in the circle under the column that describes how much you would be made anxious by it. Work quickly, but be sure to think about each item.

How anxious...	Not at all	A little	A fair amount	Much	Very Much
1. Deciding how much change you should get back from buying several items.	0	0	0	0	0
2. Having someone watch you as you add up a column of numbers.	0	0	0	0	0
3. Having someone watch you as you divide a five digit number by a two digit number.	0	0	0	0	0
4. Being asked to add up $976 + 777$ in your head.	0	0	0	0	0
5. Adding up $976 + 777$ on paper.	0	0	0	0	0

VITA

Sharon Wisinger

EDUCATION

- 1997 C.A.S., Counseling
Old Dominion University, Norfolk, VA
- 1993 M.S., Counseling
Old Dominion University, Norfolk, VA
- 1985 B.S., Elementary and Kindergarten Education
The Pennsylvania State University, State College, PA

Current Licensure

North Carolina Licensure, School Counseling, K-12

PROFESSIONAL EXPERIENCE

- 2005-present School Counselor, Camden County Public Schools, Camden, NC.
Provide positive direction for students' academic, social, and emotional well-being.
- 1988-1996 First-Grade Teacher, Norfolk Public Schools, Norfolk, VA. Successfully developed child-centered, integrated, thematic unit curricula with team members, enabling students to master academic skills. Recipient of Norfolk Public Schools School Bell Award.
- 1985-1988 Sixth Grade Teacher, Caroline County Public Schools, Preston, MD. Fostered and active learning environment, high student expectations, and individualized instruction.

UNIVERSITY TEACHING EXPERIENCE

- FALL, 1996 COUN 411 "Counseling Skills for Children" (TeleTechNet) Old Dominion University