THE EFFECTS OF A CLASSROOM BASED YOGA INTERVENTION
ON TEST ANXIETY, ACADEMIC PERFORMANCE, AND ATTENTION
IN THIRD GRADE STUDENTS

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THE EFFECTS OF A CLASSROOM BASED YOGA INTERVENTION ON TEST ANXIETY, ACADEMIC PERFORMANCE, AND ATTENTION IN THIRD GRADE STUDENTS

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Thesis

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With increased pressure on school districts to increase state test scores, time allocated for physical activity has been drastically decreased in order to provide more learning time for core subjects (Ardoy et al., 2014; Coe et al., 2006; Donnelly & Lambourne, 2011; Ma et al., 2014; Sallis et al., 1999). Thus, extreme pressure is placed on young students. This stress can lead to a high level of anxiety, an inability to focus, stay on task. Consequently, when students do not have a proper outlet to expend excess energy, there is great potential for classroom management problems for teachers (“Test + stress = problems for students,” 2000). Therefore, students and teachers need a mechanism to deal with lessen these pressures.

The purpose of this investigation was to evaluate the effectiveness of a classroom based yoga intervention on student’s test anxiety, academic performance, and attention level within a traditional mathematics class. Forty-four third grade students in two different classrooms participated in the study. The study had a pre- and post-test phase. A pre-Measurements of Academic Progress (MAP), Children Test Anxiety Scale (CTAS and Children’s Stroop test was given prior to the yoga intervention. The yoga intervention was given 4 days a week for 6 weeks to the intervention group only. The control group had no modifications added to their daily lessons. A post-intervention assessment was given using the same aforementioned instruments. The classroom
teacher was asked to report any observations she made about her students during the 
intervention. The participants were also asked to write about their opinions and 
experiences they had during the intervention. The intervention group was compared to 
the control group to assess the level of anxiety, academic performance, and attention 
level. It was found that the intervention group improved more academically on a state 
math test than the control group. The academic performance was statically significant. 
Anxiety levels decreased in the intervention group, while the anxiety levels increased for 
the control group. Overall for anxiety, the girls revealed a larger benefit from the yoga 
intervention with the intervention group. The attention results showed no difference 
between the intervention and control, but the boys did see a greater ability to focus after 
the intervention. The intervention grouped lowered their time on the test. The findings 
indicated that a yoga intervention can increase academic performance and lower anxiety. 
Further research is need to investigate the gender differences and the effect of a yoga 
intervention on attention level.
DEDICATION

I dedicate this thesis to all my fellow physical educators who are just as passionate and dedicated as I am to our profession. This study inspired my hope for physical activity to be integrated more into a traditional classroom. As a physical education professional, I hope to prove that physical activity needs to be a regular part of elementary students’ curriculum. Whether it be formal PE class, structured recess or brain breaks, young students’ need more physical activity. My hopes were for this study to provide an example of how physical activity can be easily incorporated into the traditional classroom with minimal equipment and disruption. I hope it would also provide scientific evidence that physical activity within a classroom can also help improve students’ academic success and create a positive learning environment. I feel this study has helped to strengthen the agreement for classroom structured physical activity and has provided a positive example on how it can successfully be implemented.
ACKNOWLEDGMENTS

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I could have never completed this project without the special love and support from my two best friends who were behind me all the way. Thank you for being there.

Finally, I could not have completed this journey without the love and support from all my family. A very special thank you to my husband and daughters who endured every twist and turn right behind me.
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CHAPTER I
INTRODUCTION

In recent years, tremendous pressure has been placed on teachers and administrators to have students perform well on standardized state testing (Castelli, Hillman, Buck, & Erwin, 2007; Donnelly, Hillman, Catelli, Etherer, Lee, & Tomporowski, 2016; Katz, Cushman, Reynolds, Njike, Treu, & Walker, 2010). The No Child Left Behind Act of 2002 (NCLB), which grew out of concern that the American education system became no longer internationally competitive, significantly increased the federal role in holding schools responsible for the academic progress of all students. States did not have to comply with the new requirements, but if they didn’t, they risked losing federal Title I money. Under the NCLB law, states must test students in reading and math in Grades 3 through 8 and once in high school. With the NCLB emphasis on math and reading tests, schools have narrowed the curriculum, forcing schools to spend less time on subjects that aren’t explicitly tested, like social studies, foreign language, and the arts (Klein, 2017). This pressure has led many school districts to try to discover methods to ameliorate test scores (“Test + stress = problems for students,” 2000). Thus, many school districts have begun to increase time spent on the core subjects of Science, Math, and Language Arts (Ardoy, Fernandez-Rodriguez, Jimenez-Pavon, Castillo, Ruiz, & Orteg, 2014; Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Donnelly &
Lambourne, 2011; Ma, Mare, & Gurd, 2014; Sallis, McKenzie, Kolody, Lewis, Marshall, & Rosengard, 1999).

As school districts have begun to search for more time for core subjects, administrators are beginning to eliminate recess and classes such as physical education are being shortened or completely cut from the curriculums (Adroy et al., 2014; Wilkins Parker, Westfall, Fraser & Tembo, 2003). The results of the decrease in recess and physical education classes has led to a reduction in the time allotted for physical education and as a result, physical education teachers are challenged to provide adequate amounts of time for students to participate in physical activity (Donnelly & Lambourne, 2011). The implementation of policies aimed at minimizing or replacing physical activity opportunities from the school day with an effort to increase academic performance, has led to the declining health of youth (Institute of Medicine, 2013). The National Association for Sport and Physical Education (NASPE) and the U.S. Centers for Disease Control and Prevention (CDC) recommend that children should be receiving 150 minutes per week for elementary-aged and 225 minutes per week for middle school and high school-aged students of structured physical activity. Statistics from the School Health Policies and Practices Study (2006) found that 63% of elementary schools, 83.9% of middle schools, and 98.2% of high schools didn’t reach the recommended amount presented by NASPE and the CDC. Not only has this aided in the rise of childhood health problems such as obesity, cardiovascular disease, and diabetes, it is also having an effect on academic performance. For instance, decrease of physical activity has contributed to the significant increase of sedentary behaviors in children (Erwin, Fedewa & Ahn, 2012). However, participating in physical activity has shown to be a positive
influence on children’s cognitive functioning (Fedewa & Ahn, 2011; Trudeau & Shephard, 2010).

Previous research has demonstrated that physical activity and physical education has a positive impact on student attendance, participation, and enthusiasm for academic subjects, motivation to learn, as well as reduced behavior and discipline problems (e.g., Pellegrini, Huberty & Jones, 1995; Strong, Maliar, Blimkie, Daniels, Dishman, Gutin, & Trudeau, F. 2005). Also, numerous studies demonstrate significant positive association of physical activity with cognitive performance and academic performance in children and adolescents (Ardoy et al., 2014; Fox., Barr-Anderson, Neumark-Sztainer, & Wall, 2010; Hillman, , Erickson, & Kramer 2008; Rasberry, Lee, Robin, Laris, Russell, Coyle & Nihiser, 2011; Sibley & Etnier, 2003; Tomporowski, Davis, Miller, & Naglieri, 2008; Trudeau & Shepard, 20087), and improved performance on state standardized tests because of increased physical activity.

It has been recommended that school districts continue to determine what physical activity interventions can help to assist with improving state testing scores (California Department of Education, 2001; Castelli et al., 2007; Coe at al., 2006; Cooper Institute for Aerobics Research, 1999). Thus, if school districts can be convinced of the positive learning outcomes associated with increased physical activity, they may be more inclined to utilize various types of physical interventions as a means to increase state testing scores.

One physical activity intervention that has been recommended as a physical activity to use in the classroom environment is yoga (Eggleston, 2015). Schools are beginning to understand how the use of physical activity and yoga can benefit students
Physical activity and yoga have different ways of influencing fitness, academic performance, and self-esteem (Telles, Singh, Bhardwaj, Kumar, & Balkrishna, 2013). Physical exercise and yoga differ in three main ways since yoga emphasizes breath awareness, regulated breathing, and conscious relaxation (Telles et al., 2013). Yoga is also one practice that has shown to be effective for a variety of physical and psychological learning challenges (Eggleston, 2015). Also, yoga has been found to be an effective complementary therapy to promote health and reduce many of the factors related to physiological diseases and psychological disorders (Serwacki, & Cook-Cottone, 2012).

Previous research has revealed that the use of yoga has been an effective tool in reducing anxiety. Butzer, Day, Potts, Ryan, Coulombe, Davies, & Khalsa (2015), White (2012), and Kauts and Sharma (2009) all found that using yoga in a school setting achieved in lowering anxiety in their participants. The same can be said about the use of a yoga intervention and its effects on academic performance. Manjuntha and Telles (2004), Chaya, Nagendra, Selvam, Kurpad, & Srinivasan, (2012), and Oaklander (2016) discovered that yoga interventions used in schools to assist in raising test scores were successful. All of three of these studies found that academic performance increased after the yoga intervention. The current study results concur with these previous study results. Finnan (2015), Jensen & Kenny (2004), and Harrison, Manocha, &Rubia, (2004) used observational instruments to record the finding of yoga intervention on attention. These observational instruments detected an increase in the student’s attention abilities.

The current study is unique in this area of research because it is examining all three variables in the same study. This study used a yoga intervention as the
independent variable. The dependent variables were the effects on a student’s anxiety level, academic performance, and attention abilities. These variables are important because of the current trend in school districts to produce positive test results (Adroy et al., 2014; Wilkins et al., 2003). If students have low anxiety and higher attention abilities, their academic performance should increase (Beauchemin, Hutchins, & Patterson, 2008; Butzer et al., 2015; Chaya et al., 2012; Finnan, 2015; Jensen & Kenny, 2004; Kauts & Sharma, 2009; Oaklander, 2016). Based on the precious research it is hypothesized by the researcher that the participants in the current study will lower anxiety level, increase academic performance, and increase attention abilities by the use of an in-classroom yoga intervention. Accordingly, the purpose of this study is to examine the effect of six weeks of yoga intervention on anxiety, academic performance, and attention.
CHAPTER II
REVIEW OF THE LITERATURE

In this chapter, the review of literature will first examine the benefits of physical activity on academic performance and how it effects an individual physiologically. Next this chapter will explore the yoga practice and the effects of yoga on each of the dependent variables: (a) academic performance; (b) anxiety; and (c) attention. Finally, this chapter will summarize the review of literature and how its importance is related to this study.

Physical Activity Effects on Academic Performance

Being physically active causes a physiological change within the brain, specifically in the hippocampus (Erikson, Voss, Prakash, Basak, Szabo, Chaddock, & Kramer, 2011). The hippocampus is the section of the brain that deals with memory, specifically, long term memory (Chaddwick, Erickson, Prakash, Kim, Voss, Vanpatter, Kramer, 2010). The hippocampus seems to play a major role in declarative memory, the type of memory involving things that can be purposely recalled, such as facts or events (www.healthline.com). Chaddwick et al. (2010) demonstrated that children with a higher aerobic fitness levels also have a larger hippocampal volume compared to lower-fit children. Furthermore, larger hippocampal volumes were associated with superior relational memory task performance (Chaddwick et al., 2010). In other words, the
students had an increase in memory function and ability. Another example, in a study conducted by Erikson et al. (2011), found that exercise training increased the size of the hippocampus and improved memory. The results of the study indicated that exercise intervention was effective at increasing the size of the hippocampus (Erickson et al., 2011).

Chemical changes occur in the brain when individuals are physically active. Brain-derived neurotrophic factor (BDNF) is active within the hippocampus, cortex, and basal forebrain, and all these areas are vital for learning, memory and critical thinking (Erikson et al., 2011). BDNF is one of the most active neurotrophins and plays a vital role in neurogenesis which supports learning and memory (Kamijo, Takeda, Takai, & Haramura, 2015). One such study that looked at the concentration and focus levels of physically high-fit and low-fit children using a 32-channel Quik cap to measure brain activity was completed by Kamijio et al., (2015). The results demonstrated that the higher fit children were more successful on an Odd Ball cognitive test than the lower fit children. This finding suggests that greater childhood fitness is associated with more efficient ability to concentrate and focus on the task that needed to be completed (Kamijo, et al., 2015). This same type of result was found in a similar study using 20-year-old participants. Researchers found that increased hippocampal volume is associated with greater serum levels of BDNF; therefore, increased hippocampal volume translates into improved memory function and higher production of BDNF levels (Erickson et al., 2011).

Other research suggests that physical activity and aerobic fitness training can have a positive effect on multiple brain functions and cognition (Hillman, Erickson &
Kramer, 2008). Research has shown that cardiovascular performance and motor skill performance also has a positive effect on academic skills in children. For instance, Haapala (2013) found that there is an association between poorer motor performance and poorer academic achievement among children. Other studies have also shown that poorer cardiovascular performance shows a lower cognitive ability, such as functions needed for school and memory (Haapala, Poikkeus, Tompuri, Kukkonen-Harjula, Leppänen, Lindi, & Lakka 2014; Mullender-Wijnsma et al., 2015). This contributes to the conclusion that lower levels of cardiovascular performance have been linked to smaller hippocampal volume (Haapala et al., 2014). Fitness was also associated with cognitive processing speed (Hillman, Castelli, & Buck, 2005). The results of previous studies support the fact that exercise helps children become more physically and cognitively fit.

Since physical activity helps students’ cognitive and memory development, some have designed models in school setting to help strengthen these findings. Schools provide a unique opportunity to influence children and adolescent’s health since they are required to attend school by law (Ardoy et al., 2014). These studies also support the fact that increasing time spent being physical active within the school day does not decline test scores in the core participants, in fact it may help to increase them. In a study by Davis and colleagues (2011), overweight children attended an after-school exercise program. The results showed they improved their executive functions, mathematical achievement and altered brain activation (Davis, Tomporowski, Mcdowell, Austin, Miller, Yanasak, Naglieri, 2011). Educational benefits of physical activity can stimulate immediate chemical changes in the brain that increases attention and may enhance
cognitive achievement. In the long term, regular physical activity could lead to morphological changes in the brain regions that are important for learning (Mullender-Wunsma, Hartman, Greeff, Bosker, Doolaard, & Visscher, 2014). In this study, the researchers combined learning activities with physical activity. The results were that the students that participated in the physically active academic lessons scored higher on the mathematical and reading academic tests in comparison with the control group (Mulender-Wunsma et al., 2014).

**The Yoga Practice**

Yoga originated in ancient India over 5,000 years ago. It is one of the longest surviving practices of holistic health care in the world (Flynn, 2013). Yoga is a mind-body activity that involves movements and poses done in coordination and rhythm with the breath (Eggleston, 2015). One type of yoga practice is Pranayama. Here, the coordination of poses and breathing assist to control the concentration of the mind. The breath plays an important role because it is considered the energy present in living things (White, 2009). Early yoga practitioners recognized the relationship between human emotions and their rate of breathing. If someone was upset, their breathing was rapid and shallow, but if relaxed the breath was slow and even. The early yoga practitioners believed if one deliberately controlled their breath, the individual could achieve a calm mind (Feuerstein, 2003). Yoga assists to facilitate a connection between body and mind allowing individuals to manage emotions and reactions, to focus and concentrate and to calm themselves (Flynn, 2013).

Within the past 25 years, the emergence of complementary or alternative medicine (CAM) therapies as effective tools has led to the exploration of meditation for
treatting and managing various illnesses (Beauchemin, Hutchins, & Patterson, 2008). Yoga is a recognized form of complementary and alternative medicine by the National Institutes of Health (NIH) and the National Center for Complementary and Alternative Medicine (NCCAM) in the category of “mind-body” medicine (Kaley-Isley, Peterson, Fischer, & Peterson, 2010). The use of yoga as a therapy places the emphasis on adapting the techniques of yoga to address a specific need or concern for an individual or group (Kraftsow, 1999). In a 2002 and 2007 the National Health Interview Survey (NHIS) reported a growing trend of yoga practice by adults and children in the United States (Kaley-Isley, Peterson, Fischer, & Peterson, 2010). Data from the 2007 National Center for Complementary and Integrated Health survey indicated that deep breathing and yoga were the third and fourth most popular forms of CAM among children (“Ten most common therapies,” 2007). A 2012 survey indicated that between 2007 and 2012, the number of children between the ages of 4 and 17 years who practiced yoga increased by approximately 400,000. The high rates of use may be partly due to a growing body of research showing that some mind and body practices can help manage pain and reduce stress (“Nationwide survey reveals widespread use of mind and body practices,” 2015). Yoga is growing in popularity and being recognized as a valid modality of CAM. It is not surprising that yoga and mindfulness education is being incorporated into the classroom setting.

**The Effects of Physical Activity and Yoga**

Physical activity and yoga have been separately found to influence the physical fitness, cognitive function, and emotional wellbeing in children (Telles et al., 2013).

Today, yoga is being used by a growing number of children and adults as a means of
improving overall health and fitness (Kaley-Isley et al., 2010). There has been much research in recent years that indicate the use of physical activity and yoga helps school children be successful in the classroom. Literature suggests that there is a relationship between exercise and cognitive performance (McMorris, Tomporowski & Audiffren, 2009). Incorporating movement and physical activity into formal education settings has been shown to reduce student stress and improve health and academic outcomes (Finnan, 2015). Schools provide an ideal setting in which to promote healthy lifestyles and well-being (Serwacki & Cook-Cottone, 2012).

There is a need for an alternative and complimentary treatment to optimize therapeutic effects. Yoga is one such complementary intervention. The focus of yoga intervention research has examined the use of yoga to help students with mental disabilities and/or disorders, mainly Attention Deficit/Hyperactivity Disorder (ADHD). This research has proven that yoga has a positive effect on their stress coping skills, classroom behavior and aids in their attention/mindfulness abilities and a connection between yoga and Attention Deficit Hyperactivity Disorder seems to be positive (Abadi & Madgaonkar, 2008). Also, yoga has been shown as an effective tool for students who have difficulty concentrating. Academically, yoga has been shown to help students and teachers can use yoga as alternatives to assist children with learning challenge (Eggleston, 2015). If such yoga intervention has shown to help improve the needed skills of academic success in ADHD students, yoga could be beneficial for the others. Yoga intervention has the potential to be implemented not only with a small group but also for an entire classroom (Peck, Bray & Theodore, 2005). Therefore, teachers need to develop innovative methods of teaching their students skills that they can use to help
themselves be successful. Most teachers understand that physical activity has a positive effect on academic success; yoga can be one vehicle that can be easily utilized within the traditional classroom setting to help achieve this goal. Yoga supports and helps to maximize the learning process, improve concentration, foster creative thinking, and manages emotions and reactions to stressors that may occur within the school setting (Flynn, 2013).

**Yoga Intervention on Academic Performance**

Apart from the beneficial effects on physical fitness, yoga practice improves several aspects of cognition and executive functions because yoga could influence the functioning in the pre-frontal cortex of the brain (Telles et al., 2013). The pre-frontal cortex (PFC) is the region of the brain that regulates thought in terms of decision making. It allows humans to plan and create strategies, and to adjust actions or reactions in changing situations. The PFC also helps to focus thoughts, which enables people to pay attention, learn, and concentrate on goals (Siddiqui, Chatterjee, Kumar, Siddiqui, & Goyal, 2008). This area is also the part of the brain that allows humans to consider several different yet related lines of thinking when learning or evaluating complex concepts or tasks (Anissimov & Foster, 2017). One such study that examined this was conducted by Manjunath and Telles (2001). They used a yoga intervention and tested girls aged 10 to 13 on a timed mental test. The amount of time it took the girls to complete the test decreased after the yoga intervention. They suggested that yoga increased the blood flow to the frontal lobe which resulted in the rapid realization and correction of errors (Manjunath & Telles, 2001).
Yoga may also influence neurotransmitter function (White, 2009). Such neurotransmitter as Gamma-Amino Butyric acid (GABA) can be affected by yoga practices. GABA is an amino acid which acts as a neurotransmitter in the central nervous system. It inhibits nerve transmission in the brain, calming nervous activity (http://www.denvernaturopathic.com/news/GABA.html). A study found that adults who were experienced yoga practitioners compared to non-practicing adults with a 27% increase in their GABA levels. Lower levels of GABA have been associated with depression and anxiety (Streeter et al., 2007).

There have been a few research studies about the effects of yoga on academic performance with school-aged children. Visual and spatial skills of students aged from 11 to 16 were examined in a study by Manjunath and Telles (2003). Students were split into two groups, one attended a yoga camp and the other a fine arts camp. The group that attended the yoga camp showed a significant increase in spatial memory scores. Spatial memory is important because children use visual-spatial processing in map reading and solving some math problems. Math requires visual-spatial processing. Students looking at a math problem will need to perceive how numbers and symbols are placed in relation to each other on a page and how that placement matters when solving an equation (Kelly, n.d.).

In a different study by Chaya et al. (2012), a group of students aged from 7-9 that were socioeconomically disadvantaged were examined. The students were placed into two groups; one a physical activity group and the other a yoga activity group. The student’s cognitive performance was evaluated using an intelligence test. The findings from this study revealed that yoga compares well with physical activity in enhancing
cognitive performance in school children (Chaya et al., 2012). The study also proved that the yoga group performed better in cognitive domains of Visuo-Spatial attention.

Kauts and Sharma (2009) used two groups of 14 and 15 years old students. One group received the yoga intervention (module) and the control group did not. Kauts and Sharma used the students Math, Science, and Social studies grades for comparison and found that the group that experienced the yoga intervention had performed better not only in these three subject areas but in overall academics than the students that did not experience the yoga intervention.

To summarize, these studies have helped to demonstrate that the use of a yoga intervention can have positive effect on a student’s academic performance. This study hypothesizes that yoga will have a positive effect on the students’ performance on their standardized math test.

**Yoga Intervention and Anxiety**

A small but growing body of literature in alternative health treatments has demonstrated that meditation and relaxation training may be effective for reducing anxiety (Barnes, Davis, Murynowki, & Trieber, 2004). Yoga has been found to promote relaxation concentration and greater self-awareness/control among children with a variety of physical diagnosis (Krusche, 1999). Calm breathing is thought to help focus the mind and regulate the autonomic nervous system and helps foster relaxation (Steiner, 2013). The postures and breathing in yoga may improve the strength and flexibility of muscles while increasing circulation and uptake of oxygen (White, 2009).

Deep breathing benefits the body’s overall circulation by releasing tension and increasing levels of blood and oxygen throughout the entire body (Gupta, Sinha, Pribesh,
& Maira, 2014). The autonomic nervous system regulates involuntary functions of the body. These functions include, the heart muscle activity, the smooth muscles (including the muscles of the intestinal track), and the glands. The autonomic nervous system has two divisions: (a) the sympathetic nervous system, which accelerates the heart rate, constricts blood vessels, and raises blood pressure; and (b) the parasympathetic nervous system, which slows the heart rate, increases intestinal and gland activity, and relaxes sphincter muscles” (“Medical definition of autonomic nervous system,” n.d.). Yoga breathing exercises influenced these two sub systems by deactivating the sympathetic and activating the parasympathetic system (Gupta et al., 2014). It helps to regulate and balance the systems. By doing yoga breathing, the student can slow down their “fight or flight” mechanism and calm their bodies. This aids in calming the mind. Yoga breathing helps to contribute to a sense of calm, emotional balance and tranquility and increased concentration (Bronsan, 1982).

Yoga may promote the kind of calmness and personal resources that are associated with coping with stress successfully (Khalsa, Hickey-Schultz, Cohen, Steiner & Cope, 2012). Learning stress reeducation techniques, such as yoga, is particularly important during childhood (White, 2012). It has become increasingly important for teachers and researchers to show an interest in classroom-ready strategies for anxiety reduction (Berger, Silver, & Stein, 2009).

In the present age of high-stakes testing and assessment, a yoga intervention provides a cost-effective and minimally invasive approach to improving student performance (Gupta et al., 2014). A study by Kauts and Sharma (2009) assigned students to a high-stress level and low-stress level group according their test results on
the Bisht Battery of Stress Scale (BBSS). The experimental group received a yoga intervention. The group had their stress level measured using the BBSS and their academic achievement measured using an academic performance pre- and posttest. The results showed that the students who had the yoga intervention performed better academically. The study further showed that the students classified as low stress performed better than the high-stressed students. The researchers concluded that stress was the major factor in affecting their academic performance (Kauts & Sharma, 2009).

Another study that examined the cortisol’s level in second and third grade students’ salivary cortisol, a potential biological marker of stress tends to increase as part of the physiological stress response (Butzer et al., 2015). The results of their study showed the students displayed a decrease in the baseline cortisol from before to after the intervention. In this study, it is hypothesized that the yoga intervention will assist in the reduction of test anxiety.

The National Institute of Health (NIH; Beesdo, Knappe, & Pine, 2009) stated that girls are more likely to have anxiety disorders compared to boys by a ratio of 2:1. Research by Origiles, Méndez, Espada, Carballo, and Piqueras (2012) revealed that girls scored higher on an anxiety scale instrument that was used to screen anxiety disorder symptoms. Girls are also more likely to internalize their feelings and report depression, and use emotional-focused strategies (Griffith, Dubow, & Ippolito, 2000; Hampel & Peterman, 2006; Washburn-Omarachea, Hillman, & Sawilowski., 2004; White, 2012). Therefore, there is a need for coping mechanisms. White (2012) used female participants and a mindful yoga training to help the girls learn coping skills to manage
their anxiety and stress levels. The girls in the study could recognize when they were experiencing anxiety and were able to lower their overall anxiety level.

**Yoga Intervention and Attention**

National and state standards now demand high academic performance on standardized tests. This has created a high stress environment that makes it difficult for students to concentrate (Eggleston, 2015). Many of the interventions previously used have included behavior modifications, cognitive behavioral treatment, and medication. These types of methods have shown some success in helping students manage their attention problems.

Yoga can assist the student with focus and attention on the present moment. Focus is the ability to attend to some aspect of the environment, while ignoring or blocking others (Nakamura & Csikszentmihalyi, 2005). Focus is developed during yoga practice by concentration on focal points and breath control (Finnan, 2015). Yoga is an alternative method that is showing promise as an intervention for a variety of social, emotional, behavioral and academic difficulties (Nardo & Reynolds, 2002).

There have been very few studies conducted which examined effectiveness, specifically for attention problems with students (Peck, Bray & Theodore, 2005). In the study conducted by Peck, Bray, and Theodore (2005), it was discovered that a small group yoga intervention conducted in a school setting can influence a student’s attention. Finnan’s (2015) ethnographic research at an urban elementary school of primarily low-income African American students, used a classroom yoga program as part of their curriculum. All kindergarten through sixth grade students participated in at least one 40-minute yoga session. Finnan (2015) stated that many students mentioned that yoga
helped them to focus on their work. Other students stated that the use of yoga breathing helped them to refocus and allowed them to pay better attention in class. Harrison, Manocha and Rubia (2004) implemented Sahaja Yoga Mediation (SYM) as therapy for children diagnosed with ADHD and their families. The results of their study showed a reduction in the ADHD symptoms. The core symptoms of ADHD rated by parents using the Connors Parent-Teachers Questionnaire, which assessed hyperactivity, attention, and impulsivity were all reduced over the course of the program (Harrison, Manocha & Rabia, 2005). Jensen and Kenny (2004) reported similar findings. This study used boys ages 8-13 who had been diagnosed with ADHD. The yoga intervention in this study used as a complimentary form of therapy along with medication. In this study, students participated in an afterschool yoga program weekly for 20 weeks. It was found that the boys experienced a decrease in hyperactivity, inattention, and impulsivity after the completion of the yoga program. The Centers for Disease Control and Prevention (CDC) 2011 report on Children and Attention Deficit Hyperactivity Disorder (ADHD) stated that boys are more likely to be diagnosed with ADHD than females. According to the report, 13.2% of boys and 5.6% of girls are diagnosed with ADHD. They felt that yoga was considered a complementary treatment in addition to their regular medication regimen.

The use of yoga intervention has been proven to have a positive effect on students with ADHD and other behavioral disorders. Yoga has been used widely as a complimentary treatment to help facilitate better self-management of the symptoms associated with not only ADHD but the everyday anxiety that occurs within a normal school setting.
Summary

Schools are in need of ways to help students better state test scores (Castelli, Hillman, Buck, & Erwin, 2007; Donnelly et al., 2016; Katz et al., 2010). This has caused a trend of reducing physical activity during the school day. Research shows that students who participate in a form of physical activity such as yoga find more success academically, pay attention better in class, and have reduced test anxiety. Some schools are beginning to recognize the need for such interventions to help better their students and to teach the whole child. Yoga use has become a growing trend within the schools. It is important to research the benefits of the use of yoga in a school classroom. This present study investigates the effects of yoga intervention on academic performance, anxiety and attention within a traditional math classroom of third grade students.
CHAPTER III

METHOD

In this chapter, the methods of the study will be explained. First the design type chosen for this study will be explained, followed by a description of the participants, setting and instrumentation used. Next the procedures for the intervention will be discussed. Finally, the data collection and analysis will be explained. It was the intention of the researcher to gain knowledge from using this method to provide an analysis into whether six weeks of a yoga intervention effects anxiety, academic performance, and attention on third grade students.

Study Design

This study utilized a quasi-experimental design with a non-randomized participant sampling. The researcher was not able to use a randomized sample for this study, but instead used a sample of convenience. The current study was quantitative in nature. The study consisted of a pre-post testing method with the yoga intervention being applied to the experimental group. A control group was used and did not receive the intervention. The independent variable for this study was the yoga intervention. There were three dependent variables measured for this study: (a) test anxiety, (b) academic performance, and (c) attention abilities.
Participants

All students (n = 44) in both classrooms were invited to participate in the study in February of 2017. Only the homeroom students (n = 23) were invited to participate in the yoga intervention. The intervention class consisted of 11 females and 12 males, for a total of 24 students ranging in age from 8 to 10 years old. The control group consisted of 10 females and 11 males for a total of 21 students ranging in age from 8 to 10 years old,

Setting

The setting for this study was two third-grade classrooms in one elementary school in Ohio. Third grade was chosen because it is an important testing year in the State of Ohio. Not only do the students complete a Reading and Math Ohio Achievement Assessment (OAA), but they also must take the Third-Grade Reading Guarantee, which must be passed in order to be promoted to the next grade level. This classroom was selected because the teacher volunteered both of her classes for the study.

The two classrooms are both taught by the same teacher. The experimental classrooms were the teacher’s homeroom students and one of her two math classrooms. The other math class she teaches has a different teacher for homeroom. This class was the control group and did not receive the yoga intervention.

The students had formed relationships with their teacher and their teacher knew the students’ strengths and weaknesses in their math lesson and test taking performances. Students have already been assessed twice via the MAP’s state test, and are very familiar with the testing procedure and format. Classroom routines and procedures have been
established and are easily followed by the students. These are important because the students will take the same test and will be familiarized with the format of the test.

**Instrumentation**

This study employed the use of the following instrumentations to measure the effects of the independent variable, the yoga intervention, on three dependent variables; (a) academic performance, (b) test anxiety, and (c) attention abilities.

**Academic performance: Measures of Academic Progress (MAP).** To measure academic improvement in the student’s math scores, the Measures of Academic Progress (MAP) test was utilized. The MAP test is a standardized test the Ohio Department of Education school districts use to measure academic progress in Mathematics, Reading and Language Arts (“Third-Grade-Reading-Guarantee,” n.d.). The test is taken on the computer and is designed to measure the individual student’s achievements. Test questions adjust to the level of the test taker based upon how they answer, (correct vs. incorrect). The program builds a test for that student based upon their grade and skill level. It helps to determine exactly where the student is performing academically at that time of testing. Student MAP testing results are reported in RIT scores (short for Rasch Unit). A RIT score is an estimation of a student’s instructional level and also measures student progress or growth in school. RIT score indicates the level at which the student was answering questions correctly 50% of the time (Says et al., 2015).

**Test anxiety: Children’s Test Anxiety Scale (CTAS).** The Children’s Test Anxiety Scale (CTAS) developed by Wren and Benson (2004) was utilized for
measuring the level of test anxiety. The purpose of CTAS is to assess self-reported test anxiety in school-aged children. The questionnaire is a grade level appropriate paper/pencil inventory in which the students use a 4-point Likert scale to answer a series of 30 questions that pertain to how the student feels while taking a test (see Appendix A). The children are first presented with the stem, “While I am taking tests…” and they select from a list of possible responses such as, “I worry about doing something wrong,” “My heart beats fast,” and “It is hard for me to remember the answers.” The CTAS was developed to provide a valid and current version of Test Anxiety Scale for Children. This test had a coefficient alpha of 0.92 and the subscale alpha ranged from 0.76-0.89 (Wren & Benson, 2004).

**Attention abilities: Stroop color and word test.** A children’s version of the Stroop Test (Stroop, 1935), more currently the Stroop Color and Word Test (Golden & Freshwater 2002) was administered via computer to assess the student’s ability to focus and their attention capabilities. The Stroop Test is a quick and frequently used test that measures selective attention and cognitive flexibility (Afsaneh, Alireza, Mehdi, Farzad, Reza, Mehdi, & Mojtaba, 2012). The Stroop Color and Word test assists in diagnosing brain dysfunctions and the evaluation of stress, personality cognition and psychopathology (Golden and Freshwater, 2002). The Stroop Color Word is a widely used test in a range of studies with children with disabilities (Golden & Freshwater, 2002). In addition, the Stroop Color and Word test has been used to measure cognitive inhibition and selective attention in individuals with Attention Deficit Hyperactive Disorders (Homack & Riccio, 2003). A children’s online version was employed for this study (see Appendix B). The participants are timed while they identified a series of
animal pictures with names of animal printed on the front. The first phase of the test has the picture of an animal with the name of the animal printed on the picture. For example, the picture would be a penguin and the name on the front of the picture would say penguin (see Appendix D for an example). The second phase of the test would be again timing the individual while they identified the animals. The difference would be the name of the animal written on the front of the picture. For example, the picture of the penguin would now have the name spider written on the front of the picture (see Appendix D). This trial is timed as well. The second stage will take the subject longer to complete due to the distraction of the wrong name being written on the picture and the brain having to process the information differently. The participants’ ability to concentrate and ignore the distractor helps to indicate their attention ability. The Stroop test has had reported reliability scores of .88, .79, and .71 (Freshwater, Golden, & Golden, 2002).

**Procedures**

The timing of the study was near the middle of the school year following Christmas break and just before the end of the third quarter. Before starting the study, the researcher sought permission to conduct the study from the principal, who was granted permission from the Superintendent to allow the study to be conducted by an individual from outside of the district. Additionally, the researcher was granted permission from The University of Akron Institutional Review Board to conduct the study.

After receiving permission to conduct the study parent consent and student assent forms were sent home with each student. Those that received permission from their
parents and signed the assent form were permitted to take part in the yoga intervention. Those that did not return signed forms or were not granted permission were excluded from the yoga intervention and were asked to work or read quietly at a specified area of the classroom. All student forms and test results were coded to secure confidentiality.

**Baseline phase.** Baseline MAP testing scores were taken in December and collected. A baseline score for the Test Anxiety Test and Stroop Color test were collected one week prior to the yoga intervention commencing.

**Experimental phase.** The yoga intervention began the first week of February and continued for six weeks for the experimental group. The yoga intervention was provided prior to the start of the math lesson. It was given 4 days a week; 2 days by the researcher on Monday/Wednesdays in the morning and 2 days by the classroom teacher, Tuesday/Thursday in the afternoon. The yoga session lasted approximately 10 to 15 minutes. It began with 1 minute of relaxation breathing, followed with 6 to 10 minutes of strength and flexibility poses, ending with 2 to 3 minutes of breathing/relaxation routine cool down. On days that a math quiz/test was being given, a 1-minute breathing/relaxation/centering exercise was performed prior to start of the quiz/test. The researcher and classroom teacher encouraged the students to use any of the techniques taught throughout the school day when the students would feel anxious, stressed or unfocused.

The yoga intervention incorporated elements from the *Yoga 4 Classrooms* program developed by Lisa Flynn (2011). The tool used from this program is the *Yoga 4 Classrooms Card Deck*. The deck consisted of 67 cards that included a mix of yoga postures, brain boosting movements, breathing exercises, visualizations mindfulness
activities, creative movements and community-building games. Many of the sequences and poses come either from her book *Yoga for Children* (2013) or from the *Yoga 4 Classrooms Card Deck*. Flynn (2013) explained in the program that certain postures, poses and breathing techniques benefit students in different capacities. The following breathing technique, yoga postures and sequences were selected because of their specific benefit to help inhibit anxiety and stress in elementary students; to help enrich mindfulness and attention; to be physically beneficial for the student; and to be used within the classroom setting to foster a positive learning environment (see Appendix C, D).

1. Breathing Techniques. In yoga, breath control exercises with emphasis on slow and deep breathing benefits the entire body increasing circulation, releasing tension and increasing blood and oxygen throughout the entire body (Gupta et al., 2014). The yoga intervention and before test/quiz taking began with the following breathing exercise (see Appendix C).

2. Postures—used to help lower anxiety and improve the student’s concentration due to an increase in executive functions. Performing yoga can benefit students at school by concentration, comprehension and memory (Flynn, 2013). The postures were used in different sequences and increased in difficulty as the students began to master the posture. This yoga sessions were conducted every day before the math lesson for approximately 6 to 8 minutes. (See Appendix D).

3. Relaxation—used at the end of the yoga postures and occasionally before a test. The students are asked to tense and relax muscle groups starting at the
top of the body and moving down to the toes. Visualization scenarios were also utilized during this study. The students were guided through visualization activities designed to bring positive thinking, confidence, affirmation and empowerment.

**Control phase.** The control group did not receive any intervention. This group continued with their daily lessons as they had prior to the intervention group receiving the treatment. There was no change or addition prior to the control groups math class.

**Post-intervention interviews and observational notes.** The classroom teacher was asked to observe any changes within her class during the intervention period. She was asked to note how the students focus on attention, their behavior and if the students used any of the poses and techniques on their own volition anytime during the school day. At the end of the intervention, the students were asked to write their answers to the questions, “What did you enjoy most about yoga,” “Did you learn anything using yoga,” and “What was your favorite pose or relaxation technique that you like to use on your own?”

**Posttest phase.** A post MAP test, Test Anxiety Test and Stroop Color test were administered following the conclusion of the six-week yoga intervention to measure their current scores in the three categories.

**Data Analysis**

To determine the effectiveness of the yoga intervention on academic performance a two-sample T-test was utilized. A pre-intervention MAP score was compared to the post-intervention MAP score. Differences within the control and
intervention groups were also analyzed. Gender differences in pre- and posttest and within control and intervention groups were also examined.

A pre- and posttest was given in order to determine the effectiveness of the yoga intervention on the students’ concentration abilities and their stress levels during math testing. A two-sample T-test was employed to determine the difference between pre-post, gender differences and within the groups.

Additionally, a post intervention conversation was held between the researcher and classroom teacher. The teacher was asked what she observed the students doing different during the intervention. She was asked specifically to comment on any behavior changes, students being able to focus more, students using the yoga techniques during the school day and how she felt about using the yoga intervention in general. The students were asked to write their answer to three questions during their daily morning board work at the conclusion on the intervention. The three questions to be answered were: (1) What did you enjoy most about yoga? (2) Did you learn anything using yoga? and (3) What was your favorite pose or relaxation technique that you like to use on your own? These written essays were read to help give the researcher insight into what benefits the students may have received from participating in a yoga intervention research study.
CHAPTER IV
RESULTS

In this chapter, the results of the study will be reviewed. The purpose of this study was to examine the effect of a 6-week yoga intervention on anxiety, academic performance, and attention. The research also examined whether a yoga intervention effected the posttest scores differently of males and females on the three dependent measures of anxiety, academic performance, and attention. This study employed a quasi-experimental design and utilized nonprobable sampling since the classroom teacher volunteered her classes for use in this study. Minitab and SPSS software was used to calculate a mix methods two-sample T-test to analyze the data. Additionally, a qualitative analysis within the present study included a post-intervention teacher observation interview student opinion essays.

The sample for this study consisted of 44 third grade students from an elementary school in Ohio. Three students’ scores were removed due to being a low academic functioning special needs student and parent’s refusal to consent. The sample size for this study was 44 third grade students; 23 males and 21 females. The intervention group consisted of 12 males and 11 females with a sample size of 23. The control group was similar, with 11 males and 10 females with a total sample size of 21.
Using an alpha level of .05, an independent-samples t-test was conducted to evaluate whether the intervention and control group differed significantly on the testing instruments. Posttests were conducted for the intervention and control group using the MAP standardized test, the Test Anxiety Test and the Children’s Stroop Test. Normality from Shapiro-Wilk test of normality all contained group measures were normal \( p = .05 \). However, for treatment from pre-post MAP \( (p = .004, p = .005) \) violated the assumption of normality. The data for these groups was analyzed for pre- and posttest differences, differences between intervention and control and differences between gender using a two-sample t-test.

**MAP Test Results**

The results of the two-sample t-test revealed that there was a significant difference between the pre-and posttest for the experimental and control group. The test was significant, \( t (36) = -2.96, p < .005 \) with a 95% confidence interval for the test mean, which ranged from -6.79 to -1.27. The yoga intervention can account for only 17.9% of the variance of the MAP test. The MAP pretest control group scored \( M = 202.3, SD = 6.0 \), and the intervention group revealed \( M = 202.8, SD = 7.2 \). For the posttest, the control group scored \( M = 204.0, SD = 6.5 \), and the intervention group scored \( M = 208.5, SD = 7.2 \). The differences between the groups showed a statistically significant difference. The intervention group increased by 5.7 points compared to the 1.7 points for the control group (see Appendix E and Table 1). There was no significance difference between genders.
Children’s’ Test Anxiety Scale Results

The Children’s Test Anxiety Scale (CTAS) showed a significant difference $t(41) = 2.21, p < .033$ with a 95% confidence interval for the test mean ranged from .85 to 18.96. Slightly more than 10% (10.4%) of the variance of anxiety can be accounted for by the yoga intervention. The pretest for the control group scored $M = 57.0$, $SD = 19.4$ and the intervention group scored $M = 62.0$, $SD = 17.1$. The posttest mean scores were $M = 63.1$, $SD = 20.0$ for the control group and $M = 58.4$, $SD = 20.5$ for the intervention group (see Appendix F and Table 2). There was a significant difference between the intervention and control group. The intervention group showed an average of a 3.5 decrease in the test anxiety scale while the control group displayed an average of a 6.4 increase.

The two-sample T-test revealed a difference between genders. The females showed a higher difference between pre- and posttest. The average difference between the girls for the intervention group was $M = -6.0$, $SD = 20.0$ and the control group had $M = 10.5$, $SD = 14.8$. The boys showed an average of $M = -.8$, $SD = 7.9$ for the interventions and a $M = 2.7$, $SD = 13.7$ for the control with a $p$-value of .014 (see Appendix G and Table 3).

Stroop Test Results

The Stroop test yielded no differences $t(41) = -.16, p = .875$ with a 95% confidence interval for the test mean ranged from -4.47 to 3.82. 0.01% of the variance Stroop Test can be accounted by the yoga intervention. The pretest for the control group scored a $M = 18.0$, $SD = 5.9$ and the intervention group scored $M = 17.2$, $SD = 7.8$. For the posttest data, the control group had a $M = 13.3$, $SD = 5.8$ and the
intervention group a M = 12.7, SD 4.3. The differences between the groups revealed a M = -5.0, SD = 7.0 for the control group and a M = -4.6, SD 7.0 for the intervention (see Appendix H, Table 4). The findings here were not statistically significant. The two-sample t-test did reveal a trace of evidence that indicated that the males in the intervention group did slightly better on the posttest compared to the control group. The intervention scored a M = -6.0, SD = 8.1 and the control group had M = -1.7, SD = 6.8 (see Appendix I, Table 5).
CHAPTER V
DISCUSSION

This chapter examines the effects of a yoga intervention on a third grade student’s academic performance, anxiety, and attention. It will also analyze the difference the yoga intervention may have had based on gender. Conclusions are drawn from the Chapter IV analysis and findings regarding yoga and its influences on academic performance, anxiety, and attention. The implications followed by suggestions for future research are also contained in this chapter.

Summary of Study

A baseline for all testing measures was taken prior to the yoga intervention. The post-intervention data was collected the week following the 6-week yoga intervention. Three instruments were utilized in the measuring of academic performance, anxiety, and attention. To measure academic performance, the MAP standardized math test was given. The Children’s Test Anxiety Scale (CTAS) was used to measure a student’s test anxiety level. The Stroop Test was used to determine the level of attention and measure executive function. At post intervention, the classroom teacher was interviewed to examine any observational changes students may have displayed. The students were instructed to briefly reflect by writing their thoughts about the intervention and how they may use yoga in the future.
The results of the two-sample t-test revealed a significant positive difference between the control and experimental group on the measures of academic performance and anxiety. The intervention group for both these measures revealed an increase in overall performance. The academic performance variable displayed a greater increase for the experimental group compared to the control group; and the anxiety level of the experimental group decreased while the control group displayed an increase in anxiety. Between gender, the yoga intervention displayed a benefit with anxiety among females and attention for the males. To evaluate the effects of gender a two-sample t-test revealed no significant differences between the experimental and control groups for the attention variable.

**Discussion**

The primary purpose of this study was to examine the effect of a six-week yoga intervention on anxiety, academic performance, and attention on third grade students in a traditional mathematics classroom. Additionally, the study sought to examine gender differences among the outcomes of the dependent measures. Statically significant differences were found between some variables and with positive results with students favoring the yoga intervention. The current findings indicated that test anxiety levels decreased within the intervention group for both genders with a larger decrease among female students. The academic performance on standardized test within the intervention group showed a larger increase in the scores when compared to the control group. The statistical analysis indicated no significant differences between the control and intervention group on the Stroop Test measure.
Effects of the Yoga Intervention on Academic Performance

The first purpose of the present study was to examine if a yoga intervention could increase academic performance on a mathematical state test. The results of the present study suggest that a yoga intervention can significantly increase academic performance scores. The analysis of the academic performance measure revealed the most significant statistical difference in the study. The analyses indicated that the scores of the experimental group were significantly higher than the control group at posttest. The control group averaged a 1.7-point increase with students; MAP test score and the intervention group increased their scores on average by a 5.7 increase.

Findings demonstrated that the yoga intervention lowered anxiety among third grade students thereby increasing the test scores of the experimental group. Results are consistent with previous studies utilizing a yoga intervention and other forms of physical activity to help lower anxiety and/or increase academic performance (Beauchemin et al., 2016; Chaya et al. 2012; Manjunath & Telles, 2003).

Effects of the Yoga Intervention on Anxiety:

The results of the study provided interesting findings related to the anxiety measure. Statistical analyses revealed a significant difference between the experimental group and the control group. The test anxiety scores of the experimental group at posttest were lower significantly lower than the control group. Although the analysis showed some significance, this data could have had a lower \( p \)-value. The reason for the higher \( p \)-value was due to an outlier score of one participant who had a 57-point difference between pre- and posttest scores. The statistical software identified this as the probable reason for the increase in the \( p \)-value score. Additional research evaluating the
effects of a yoga intervention on anxiety should investigate potential reasons for such large differences.

Overall this investigation demonstrated that a yoga intervention decreased the posttest anxiety scores of an experimental group more than a control group who did not receive a yoga intervention. The results of the present study are consistent with the Kauts and Sharma (2009) participants found that the high level of stress group not only increased their academics but, had a lower level of stress than the low stress group post-intervention.

It is also important to state that findings displayed a difference between gender for the anxiety component of this study. The analyses revealed that females in the intervention group had a larger decrease in anxiety than the males in the same group. The finding indicates that females may have been more responsive to the yoga intervention in helping to lower test anxiety. These are similar findings to a study conducted by White (2012). Qualitative feedback from the classroom teacher provides support for implementing yoga in the classroom as a way to decrease the anxiety levels of students. The teacher noted that she observed students using yoga techniques at their desks while working independently. She also noticed the students using the relaxation techniques when they appeared stressed. In addition to these observations made by the classroom teacher, post-intervention student feedback supported the teacher’s assertions. Many students wrote that yoga helped them be “calm” or “relaxed.” One student stated, “It’s fun and when I’m stressed I can do some poses because they help me.” Another student wrote, “[Yoga] made me feel calm.” A female student noted that, “When I do them before a test, I feel relaxed and calm. It makes me do better on my work.” Thus,
the qualitative feedback and observations suggest that the students in the experimental group have begun to learn how to use their favorite pose or technique to help them relax and feel calm in a stressful or anxious moment during the school day. This is an important applied practical implication that provides support the use of yoga within a tradition classroom as a positive tool to help students control anxiety levels.

**The Effects of the Yoga Intervention on Attention**

Contrary to previous research that has indicated that a yoga intervention would reduce students’ test anxiety, therefore affecting their attention (Jensen & Kenny, 2004; Harrison, Manocha & Rubia, 2004), this result of the present study did not support the findings from previous research. However, similar to the results found for the anxiety measure in the present study, the Stroop Test scores also revealed a gender difference. Specifically, there was a decrease in the difference scores for the males of the experimental group. This may indicate that males in the experimental group improved their Stroop test scores. Thus, they were able to focus more on the Stroop test as compared to the boys in the control group. The results of the present study seemed consistent with Jenson and Kenny’s study (2004) in which participants used a yoga intervention to help alleviate their symptoms from ADHD. Their findings showed that the yoga intervention helped increase the attention of male participants.

Previous studies which used the Stroop Test to measure attention while using either a yoga/meditation or a physical/aerobic intervention resulted in positive outcomes (Prakash et al., 2010; Telles et al., 2013). These studies indicated a lower score in the posttest compared to the pretest for the experimental group. Participants in the studies were able to correctly read the color words faster and with less mistakes. A possible
reason why the outcome of the present study was not consistent with previous studies may be due to the duration of yoga intervention not being long enough make an impact on the experimental groups level of attention.

**Qualitative Observations of the Effects of the Yoga Intervention**

In the posttest interview with the classroom teacher, supportive feedback was provided as the teacher stated that she now uses the yoga poses instructed during the research intervention to help students regain focus after long periods of work. Since the start of the yoga intervention she noticed an increased ability of the experimental group participants to focus after executing a few poses and breathing techniques. Additionally, the classroom teacher believed that permitting students time during the day to focus on a physical activity intervention has helped students regain focus. She also noted that yoga has taught students to be aware of themselves and this body awareness is helping students to learn how to control their bodies, minds and emotions. The classroom teacher has also begun regularly to implement yoga techniques with all of her students. She also stated that the research intervention has provided her an awareness of the importance of the educator’s role in providing physical activity to help students learn to relax. Educating teachers that movements like yoga are helpful throughout the day may lead teachers to encourage students to take inventory of their own bodies reactions and have thus use yoga techniques to help control stressful situations.

**Practical Implications**

The practical implications of the present study support the need for more physical activity opportunities throughout the school day. School districts looking to increase their state test scores should not be reducing or eliminating physical activity
time, but instead try to make time for more movement related activities. Another practical implication from the results of the present study was that the yoga intervention used no equipment, there was no cost and still produced a positive outcome and learning environment. A program like this intervention can be easily created by collaborating with the physical education teacher (PE) within that schools’ building. The program can enlist the help of the PE teacher to help plan and coordinate simple quick lessons that the classroom teacher can implement. This helps to support that this kind of activity can be done in any school with little to no cost. This study helps to add to the research that physical activity can help to bolster state test scores without sacrificing instruction time while not requiring additional funding.

**Limitations and Future Research**

Despite the strengths of the study, there were a number of limitations. The length of the intervention, timing of the intervention, schedule conflicts, distractions during post testing, and prior knowledge of the students posed some limitations to this study.

Primarily the timing of the study, only a 6-week, 4 days a week, 15 minute per day yoga intervention was conducted. It is believed that if the yoga intervention was conducted for a semester or an entire school year, the outcomes may have been greater.

Next, the researcher was not present to conduct the yoga intervention for every session. There was a conflict between the days and times that the math classes were held and the researcher’s teaching schedule. The researcher demonstrated the lesson and the classroom teacher repeated the same lesson the next day. If the researcher could have
been present for every session, the students may have been able to gain a higher level of ability in yoga and its relaxation breathing.

It is important to note the sample size, since the sample participants are from a school where the researcher was not employed. A lack of knowledge of the student’s initial ability could have slowed the interventions yoga poses progression. Even though the researcher was a physical education professional, prior knowledge of students’ abilities, may have helped progress the yoga sessions to a higher skill level. Additionally, the yoga intervention breathing techniques may have been implemented at other times of the school day to help student’s focus and concentration. The classroom teacher observed the intervention being more effective in the afternoon rather than in the morning with aiding the students focus and ability to relax.

The use of the quasi-experimental design could also be considered a limitation with in this study. This design is very common in educational study setting where the researcher has no control over the assignment of the participants in each classroom (Thomas, Nelson, & Silverman, 2015). The inability to randomize the participants can be viewed as a weakness because it limits the researcher from making cause and effect claims. Since this study found positive effects from pretest to posttest, future research will be needed to assist in supporting the findings in this study. Future research may want to consider using randomized participants to eliminate this limitation.

Finally, unlike the pretest where the classroom teacher was able to arrange a parent volunteer to assist in the administration of the Stroop test, the teacher assisted in the post test. The teacher’s presence during posttesting may have influenced bias or even caused a distraction for the intervention group while taking the test. Even though
the teacher issued an independent assignment, other students steadily came to her for direction while she was administrating the posttest. This distraction may have caused the student to not perform to their highest ability.

Overall, there needs to be more quantified research generated to help support teacher, parent, and student observations that yoga does help to lower anxiety and increase attention. This study has contributed additional subjective findings from the teacher’s observations and the participant reflections on how yoga can be beneficial in a classroom setting. There is a need for more research to provide scientific support that yoga contributes to lowering test anxiety and increased attention levels. Future researchers should consider longitudinal interventions that use different instruments for the measurement of attention.

The results from this study support that the yoga intervention influenced differences among genders with different area/variables examined. The males displayed a larger change in the Stroop testing for attention. The females showed more of a change in the anxiety levels with the yoga intervention. This study adds to the current literature that a yoga intervention could assist male students strengthen their focus and attention on cognitive tasks and female students manage anxiety levels. More research is needed in these areas to help reinforce these arguments. It is not exactly clear why these differences among genders occur. Many different hypotheses may be created to address such questions. Further research is need to fully understand the effects of physical activity and classroom performance.

Future researchers may also want to consider the timing of when the yoga intervention would take place during the school day. The current study posttest timing
for the post test was administered the week the grading quarter ended and a week prior to state testing. The timing could account for the high anxiety levels the control group displayed.

Future research should also evaluate a different grade level or a different school type (urban, suburban and rural, state report card levels, private vs public). Utilizing a school that is under performing with test scores may benefit from such a yoga intervention.

**Summary**

The goal of the present study was to investigate the use of a yoga intervention to help increase academic performance, lower anxiety and help increase attention. It was discovered that a yoga intervention has a positive influence on academic performance. The findings also revealed that the yoga intervention effected the level of anxiety and attention among some of the third-grade students. Gender differences in the sample population existed with both anxiety and attention scores. Further investigation and research is needed to help support these findings.

Previous research has demonstrated that using yoga and relaxation breathing techniques has helped students control anxiety, increase academic performance, and increase attention. The results of the present study support previous research and provide valuable information that can help school districts create positive learning environments to strengthen students’ academic success, and provide students with effective tools that may help enrich their daily lives. Currently, physical activity is being shortened or removed from the curriculum among many school districts. There is a pronounced need to find ways to integrate physical activity into core subjects in
traditional classroom settings. The present study has helped to demonstrate the feasibility of conducting physical activity interventions within the confines of a traditional classroom without having a large open space, without equipment and without disrupting the learning process. The findings of this study provide a practical example of how to use movement woven into the learning of core subjects within the classroom to improve student success.

A school’s primary mission and responsibility is educating children to become functional and healthy citizens. Education administrators are constantly pressuring districts to increase test scores in order to produce a better student. What most administrators do not understand is that approaching the whole child is more beneficial. By eliminating physical education and opportunities for physical activity, the risk of a negative impact on a students’ cognitive abilities may be the result. Increased physical activity has been proven to increase cognitive function. This study has contributed to this valuable research. Therefore, administrators should support districts to integrate more physical activity into the school day, not only to encourage physical fitness but mental fitness as well.
REFERENCES


APPENDICES
APPENDIX A

CHILDREN’S TEST ANXIETY SCALE (CTAS)

TEST ATTITUDE SURVEY
Circle the answers that best describe or tell about you.

1. I am a ... boy, girl.

2. Circle your grade. 3rd 4th 5th 6th

SAMPLE — Please read the following statement and decide if it describes the way you are while you are taking tests. If the statement is almost never or never like you, you should circle 1. If the statement describes the way you are some of the time, circle 2. If the statement describes the way you are most of the—time circle 3. If the statement is almost always or always like you, circle 4.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>While I am taking tests, I think about doing other things.</td>
<td></td>
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</table>

The rest of the items describe how some students may think, feel, or act while they are taking tests.

Please read each statement carefully and decide if the statement describes how you think, feel, or act during a test. Then circle the answer that best describes the way you are while you are taking a test. If you are not sure which answer to circle, read the statement again before circling your answer. Remember that there are no “right” or “wrong” answers on this survey. Please give truthful answers.
<table>
<thead>
<tr>
<th></th>
<th>ALMOST</th>
<th>NEVER</th>
<th>SOME OF THE TIME</th>
<th>MOST OF THE TIME</th>
<th>ALWAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I wonder if I will pass.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>My heart beats fast.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>I look around the room.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>I feel nervous.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>I think I am going to get a bad grade.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>It is hard for me to remember the answers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>I play with my pencil.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>My face feels hot.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>I worry about failing.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>My belly feels funny.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>I worry about doing something wrong.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>I check the time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>I think about what my grade will be.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

15. I wonder if my answers are right.

While I am taking tests . . .

16. I think that I should have studied more.

17. My head hurts.

18. I look at other people.

19. I think most of my answers are wrong.

20. I feel warm.

While I am taking tests . . .

21. I worry about how hard the test is.

22. I try to finish up fast.

23. My hand shakes.

24. I think about what will happen if I fail.

25. I have to go to the bathroom.

While I am taking tests . . .

26. I tap my feet.

27. I think about how poorly I am doing.

28. I feel scared.
29. I worry about what my parents will say.

30. I stare.  Thank you for your help!
APPENDIX B
CHILDRENS VERSION OF THE STROOP TEST

https://faculty.washington.edu/chudler/java/readya.html

Interactive "Animal Stroop" Effect Experiment
In this experiment you are required to look at the picture of an animal and say the name of the animal. Do NOT read the word placed on the picture. For example:

You should say "Cow" because the animal in the picture is a cow.

You should say "Cat" because the animal in the picture is a cat.

As soon as the pictures appear on your screen, identify the animals as fast as you can. When you have finished, click on the "Finish" button. The time it took you to name the animals will appear on the screen. If you want to try the same set of words, click on the "reload" button of your browser. If you want to continue with the experiment, click on "Continue Experiment."

PHASE 1

PHASE 2
APPENDIX C

BREATHEING TECHNIQUES USED DURING INTERVENTION

• Balloon Breath (Flynn, 2013)- This breathing technique was used to as the first warm up for the yoga session or as an alternative to the Count Down to Calm. This help the students get their breathing under their control and it helped to center the students mind in preparation for the yoga poses and/other yoga breathing. Students were instructed to imagine their belly as balloons. To inflate deep breath through the nose filling their belly (balloon) with air. Then exhaling through the nose as they empty their balloon of air, while any negative thoughts just scatter away naturally.

• Count Down to Calm (Flynn, 2013)-This technique was used before every yoga intervention and as a cool down. Students are asked to sit or stand up tall. Holding up a hand the students are instructed to inhale through their nostrils while lifting one finger at a time, counting 1,2,3,4,5. The student pauses. They exhale as the count backwards slowly pulling a finger back in one at a time. Students repeat this breathing technique 5 times or until the feel relaxed and calm.
- Good In/Bad Out Breath (Flynn, 2013)-This breathing technique was used was before a test or quiz. The Good In/Bad Out breathing technique was designed to helps with empowering, encourages perspective change and it aids in dissipating negativity. Students find a comfortable seated position while sitting up and tall with their eyes closed. The students are instructed to think of positive to say about themselves. They breathe in the positive thought, letting that thought grow inside them, enter their hearts and flow throughout their body. The positive thought can be “I can do my best”. In the exhale phase, the student exhales any negative thoughts such as “this is too hard”. Students imagine those negative thoughts being released from their body and disappearing. The final few breathes; students focus on the positive thoughts
APPENDIX D

POSTURES USED DURING INTERVENTION

a. Do My Best
b. Posture Prep
c. Peace Crawl
d. Loosen the Knots
e. When I Feel…
f. Washing Machine
g. Magic Massage
h. Geyser
i. Warrior I
j. Warrior II
k. Warrior III
l. Triangle
m. Tree
n. Half-Sun Salute
o. Eagle
p. Chair
q. Mountain (Standing and sitting)
r.  Star
s.  King Dancer
t.  Rag Doll (Standing and sitting)
u.  Open Heart
v.  Monkey Arms
w.  Sandwich
x.  Boat
y.  Rock the Baby
z.  Sitting Pigeon
aa.  Cat
bb.  Corkscrew
cc.  Desk Rest
Table 1. Overall MAP test results

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest M(sd)</th>
<th>Posttest M(sd)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>202.82 (7.2)</td>
<td>208.5 (7.2)</td>
<td>5.7</td>
</tr>
<tr>
<td>Control</td>
<td>202.3 (6.0)</td>
<td>204.0 (6.5)</td>
<td>1.7</td>
</tr>
</tbody>
</table>

*Note.* Table 1 displays the overall MAP testing results. Both the intervention and control group pretest scores were very similar. The posttesting data shows that the intervention group increased their test scores more than the control group. The intervention more than doubled their increase in score compared to the control group.
APPENDIX F

TABLE 2

Table 2. Overall children’s test anxiety scale result

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest M(sd)</th>
<th>Posttest M(sd)</th>
<th>Difference M(sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>62 (17.1)</td>
<td>58.4 (20.5)</td>
<td>-3.5</td>
</tr>
<tr>
<td>Control</td>
<td>57(19.4)</td>
<td>63.1 (20.0)</td>
<td>6.4</td>
</tr>
</tbody>
</table>

Note. Table 2 depicts the overall results of the Children’s Test Anxiety Scale results for pre- and post-intervention. The graph shows that the intervention began with a higher anxiety level score before the yoga intervention. After the yoga intervention, the result demonstrates how the intervention groups lowered their anxiety while the control group raised their test anxiety levels. Finally, the table displays the difference between the intervention and control group, again showing the deficit in overall score demonstrating a decrease in test anxiety.
Table 3. Difference scores for gender in the children’s test anxiety scale results

<table>
<thead>
<tr>
<th>Group</th>
<th>Females M(sd)</th>
<th>Males M(sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>-6.0 (20)</td>
<td>-0.8 (7.9)</td>
</tr>
<tr>
<td>Control</td>
<td>10.5 (14.8)</td>
<td>2.7 (13.7)</td>
</tr>
</tbody>
</table>

*Note.* Table 3. shows the statistical analysis of the breakdown of differences in scores when looking just at the gender for the Children’s Test Anxiety Scale Result. It shows that the girls differ greatly from between intervention and control group.
### APPENDIX H

#### TABLE 4

Table 4. Overall Stroop test results

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest M(sd)</th>
<th>Posttest M(sd)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>17.2 (7.9)</td>
<td>12.6 (4.3)</td>
<td>-4.6</td>
</tr>
<tr>
<td>Control</td>
<td>17.2 (5.9)</td>
<td>13.3 (5.8)</td>
<td>-4.9</td>
</tr>
</tbody>
</table>

*Note.* Table 4 shows the overall results of the Stroop test. The intervention and control groups scored almost the same in the pre-intervention test. The intervention group improved their scores during the post-intervention stage by decreasing the amount of time it took them to complete the test. The both the intervention and control group improved their scores the same amount.
APPENDIX I

TABLE 5

Table 5. Difference scores in gender for the Stroop Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Females M(sd)</th>
<th>Males M(sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>-3.5 (5.9)</td>
<td>-6.0 (8.1)</td>
</tr>
<tr>
<td>Control</td>
<td>-8.4 (14.8)</td>
<td>-1.8 (6.8)</td>
</tr>
</tbody>
</table>

*Note.* Table 5. shows the score differences in the Genders scores for the Stroop test. Here the table shows that the males in the intervention group improved their Stroop test scores. The females had contrasting scores, while the control group showed improvements.
APPENDIX J

HUMAN SUBJECTS APPROVAL LETTERS/DOCUMENTATION

OFFICE OF RESEARCH ADMINISTRATION
ACKRON, OH 44325-3102

NOTICE OF APPROVAL

Date: January 23, 2017
To: Melissa Drevitch
Sport Science & Wellness Education

From: Sharon McWhorter, IRB Administrator
IRB Number: 20161105-1

Title: The Positive Effects of Yoga on Standardized Test Scores, Test Anxiety and Concentration in Third Grade Students

Your Request for Change in Approved Protocol has been reviewed and approved. Your change does not represent an increase in risk to subjects and qualifies for expedited review.

Approval Category: Expedited 4 & 7
Approval Date: January 20, 2017
Expiration Date: December 6, 2017
Continuation Application Date: November 6, 2017

☑ Research involving children
☑ Research involving prisoners
☐ Waiver of documentation of consent
☐ Waiver or alteration of consent

☐ IRB approval is given for not more than 12 months. If your project will be active for longer than one year, it is your responsibility to submit an Application for Continuation prior to the expiration date.

☐ If changes are made to the protocol before the expiration date you must submit a Request for Change form for review and approval before the change is implemented.

☐ When the project is completed you must submit a Final Report to close the IRB file.

☐ If this research is being conducted for a master’s thesis or doctoral dissertation, you must file a copy of this letter with the thesis or dissertation.

☐ All forms are available on the ORA website at http://www.uakron.edu/research/ors/ors_documents/.

☐ CITI Certification is valid for three years. Any continuation of this protocol or approval of new research is contingent upon maintaining a current CITI certification. It is your responsibility to update your certification as needed. The link to the CITI home login screen is: https://www.citiprogram.org/.

☑ Approved consent form(s) attached

The University of Akron is an Equal Employment and Education Institution
School of Sport Science and Wellness Education
302 E. Buchtel Common
InfoCision Stadium 317
Akron, Oh 44325

January 12, 2017

Dear Parent/Guardian:

Your child is invited to participate in a research study conducted by Melissa Dreisbach who is a Master degree student in the Sport Science, Coaching and Athletic Administration program from the University of Akron School of Sport Science and Wellness Education. Melissa hopes to learn that there is a positive relationship using a yoga intervention and its effects on standardized state math test scores, test anxiety and concentration in elementary students. Your child was selected as a participant in either the control group or experimental group for this study because they are a third-grade student in Mrs. Pepper’s math class.

If you decide to allow your child to participate, the students in the experimental group will be given yoga interventions for 5-10 minutes before their math lessons. The control group will not have the yoga intervention prior to their math lesson. The experimental group will also be guided through a one minute relaxation and breathing exercise before engaging in a math test.

Melissa will lead this intervention two times a week and Mrs. Pepper two times a week for a total of four times weekly. The intervention will last 6 weeks. Data will be collected from both the experimental and control groups. The data used for this research study will be the Measurement of Academic Progress standardized test (MAP test), which is what the students take normally as part of the evaluation process Lake Local schools use, a paper Test Anxiety Inventory, and a computerized Stroop Test.

There is a very small potential risk for the subjects due to the physicality of the intervention. Mild stretching and the use of muscular strength can cause mild soreness due to such physical activity. To help minimize the risk, your child will be instructed how to properly participate in the intervention. The intervention will be grade and skill level appropriate. Potential benefits for the subjects physically can include increase in muscular strength, flexibility, and an appreciation for a new physical activity. Academic potential benefits can include learning relaxation techniques to help increase concentration, decrease test anxiety, and increase academic

APPROVED

The University of Akron

Date: 1/24/17

The University of Akron is an Equal Education and Employment Institution – For Harrier
performance. However, I cannot guarantee that your child personally will receive any benefits from this research.

Any information that is obtained about this study and that can be identified with your child will remain confidential and will be disclosed only with your permission or as required by law. Subject identities will be kept confidential by using a de-identified spreadsheet that will be created with only the subjects number and overall test score result for the MAP data. The Test Anxiety Inventory is a paper Likert scale and the Stroop computerized test will be completed and collected by Melissa which will have a subject number coding system that matches that of the MAP data.

Your child’s participation is voluntary. Your decision whether to allow your child to participate will not affect your or your child’s relationship with Mrs. Pepper or Uniontown Elementary. If you decide to allow your child to participate, you and/or your child are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions about the study, please feel free to contact me at 330.224.4024/mdk24@zips.uakron.edu or my academic advisor Dr. Seungbum Lee at 330.972.6607/se65@uakron.edu.

This research is approved by the University of Akron Institutional Review Board for research with human subjects. If you have any questions about the rights of research participants please contact the IRB at 330-972-6311.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to allow your child to participate and/or release their test scores, that you and/or your child may withdraw your consent at any time and discontinue participation without penalty, that you will receive a copy of this form, and that you are not waiving any legal claims.

Student Name: ____________________________________________

Parent/Guardian
Signature: ____________________________________________

APPROVED

[Signature]

The University of Akron
Research Assent Form
For young children

Hello. My name is Melissa and I am a Master student at the University of Akron. You are invited to participate in a research study that I am conducting.

? What is a research study?
Research studies help us learn new things. We can test new ideas. First we ask a question. Then we try to find the answer.

Important things to know…
- You get to decide if you want to take part
- You can say "No" or you can say "Yes"
- No one will be upset if you say "No"
- Your parents have given permission for you to participate, but even though they say it is ok you can still say no.

? Why are we doing this research?
We are trying to find out if doing yoga can help students do better on math tests, make them think better and if it helps them when they get nervous. We will compare their results with those of students who do not do yoga.

? What would happen if I join this research?
If you decide to be in this research, we would ask you to do the following:
- Answer some questions on a piece of paper about how you feel when taking a test
- Play a computer game with words and animals.

If you want to be in this research after we talk, please write your name below. We will write our name too. This shows that we talked about the research and that you want to take part.

Name of Participant: ____________________________________________
(To be written by child)

Name of Researcher: ____________________________________________

Signature of Researcher: ____________________________________________ Date: ______________

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Thesis permission

Frank Gant <gantfrank@lakelocal.org>
To: Melissa Klein <mdk24@zips.uakron.edu>

Wed, Oct 26, 2016 at 1:00 PM

Mrs. Dreisbach has permission to work on her research project at Uniontown Elementary. She will work closely with the teachers that volunteered to assist her in her project along with myself. No information that particularly identifies students will be shared, and Mrs. Dreisbach’s project will not interfere with the daily requirements of a classroom.

Thank you,

Frank Gant, Principal

From: Melissa Klein [mailto:mdk24@zips.uakron.edu]
Sent: Wednesday, October 26, 2016 11:04 AM
To: Frank Gant <gantfrank@lakelocal.org>
Subject: Thesis permission

[Drafted text hidden]

https://mail.google.com/mail/u/0/?ui=2&ik=d197dc2b76&view=pt&msg=1580f0260a9d4d9&ctf...  4/23/2017