DIFFERENTIAL EFFECTS OF SITTING MEDITATION AND HATHA YOGA ON WORKING MEMORY, STRESS, ANXIETY, AND MINDFULNESS AMONG ADOLESCENTS IN A SCHOOL SETTING

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Abstract

The present study was a randomized controlled trial that explored the feasibility, acceptability, and effectiveness of short-term mindfulness training among adolescents. The primary purpose was to investigate the effectiveness of two main Mindfulness-Based Stress Reduction components—sitting meditation and hatha yoga—on working memory, stress, anxiety and mindfulness. The influence of daily home practice compliance on intervention outcomes was also examined. Participants (N = 198 adolescents) were recruited from a large public middle school in National City, California. Participants were randomly assigned to sitting meditation, hatha yoga, or a waitlist control group. Participants were asked to complete a computerized working memory task (Automated Operational Span Task, AOSPAN), and a battery of self-report measures (Perceived Stress Scale, PSS; Screen for Childhood Anxiety Related Emotional Disorder, SCARED; Child and Adolescent Mindfulness Measure, CAMM) at pre- and post-intervention/waitlist, as well as one-month follow-up. A series of mixed-design analyses of variance (ANOVAs) were used to examine changes in working memory, stress, anxiety, and mindfulness between groups at pre- and post- intervention. As hypothesized, participants in the sitting meditation condition showed significant improvements in working memory, whereas those in the hatha yoga and waitlist control groups did not. However, no significant between-group differences were found for stress, anxiety, and mindfulness. No significant differences were found on any outcome variables between those who were actively compliant with home practice versus those who were not. Results highlight the importance of investigating the components of mindfulness-based interventions among adolescents given that such interventions may improve cognitive function. More broadly, mindfulness interventions have the potential for integration into school settings as well as adding to existing treatment protocols.

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Chapter I

Introduction and Literature Review

Overview of Mindfulness

In the last decade, the field of mindfulness has grown rapidly and has had an international impact on scientific research. Mindfulness originated from Buddhist teachings from over 2,500 years ago as a tool to gain openness and clarity of the mind. The word *mindfulness* is an English translation of terms from the Pali language: *Sati* and *Sampajana*, meaning awareness, circumspection, discernment, and retention (Shapiro, 2009). Jon Kabat-Zinn (1982) provides a more modern-day definition of mindfulness and states that it involves paying attention to the present-moment experience in a nonjudgmental and accepting way. Mindfulness may offer individuals a novel way to relate to their individual self and to the world. This practice helps facilitate a conscious shift from a goal-oriented mindset to one that has no purpose or end goal, but rather to simply observe the experience of "non-doing" or "non-striving" (Kabat-Zinn, 1990). Mindfulness allows the space for practitioners to "just be with their own mind," resulting in "moments of peace and stillness" (Kabat-Zinn, 1994, p. 60). This concept was what Siddhartha Gautama, now known as "The Buddha," found when he reached enlightenment as he sat underneath the Bodhi Tree (Segall, 2003).

Although mindfulness is associated with Buddhism, many religious and spiritual traditions share its philosophy, as does the Western school of psychology (Brown & Cordon, 2009; Walsh, 2000). In 1979, Kabat-Zinn made mindfulness a secular practice by creating the Mindfulness-Based Stress Reduction (MBSR) program at the University of Massachusetts Medical Center. MBSR is an 8-week program originally designed to help patients manage pain symptoms. Due to its effectiveness in treatment, MBSR led the way for many other

contemporary mindfulness interventions such as: Dialectic Behavior Therapy (DBT; Linehan, 1993), which is an effective treatment for borderline personality disorder; Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), which was developed to help people increase their value of living through acceptance of their suffering while staying mindful in the present-moment; and Mindfulness-Based Cognitive Therapy (MBCT; Teasdale et al., 2000), which aims to treat depression by teaching clients to meditate daily and to detach from their negative thoughts.

Mindfulness-based therapies, including those discussed above, have been shown to be effective in treating a wide range of medical and psychological problems (Fletcher, Shoendorff, & Hayes, 2010). A recent meta-analysis of 39 studies indicated that mindfulness-based therapy helps decrease anxiety and depression symptoms (Hofmann, Sawyer, Witt, & Oh, 2010). Furthermore, current evidence suggests that mindfulness can help with medical problems by reducing blood pressure (Chiesa, 2009) and improving quality of life and stress in clinical cancer patients (Ledesma & Kumano, 2009). Overall, there is a considerable body of research that has documented the benefits of mindfulness practice among clinical and nonclinical populations (Baer, 2003; Shapiro & Carlson, 2009).

Given that mindfulness interventions have demonstrated effectiveness in adult samples, researchers have recently begun to explore the use of mindfulness techniques in younger populations. Goodman (2005) suggested that mindfulness practices may be highly suitable for youth because children naturally possess a "beginner's mind." The concept of a "beginner's mind" indicates the qualities of openness and receptiveness to learn new ideas (Goodman, 2005; Kabat Zinn, 1990). Compared to adults, children may be better equipped at seeing the world with a "fresh eye" because they have fewer life experiences, resulting in less judgment.

Therefore, children may be more enthusiastic and less pessimistic when acquiring new skills (Goodman, 2005).

In recent years, mindfulness interventions have been adapted for children and adolescents (Greco, Blackledge, Coyne, & Ehrenreich, 2005; Murrell, Coyne, & Wilson, 2004). However, these adapted versions are still in the early stages of development and have limited research regarding their efficacy. Furthermore, MBSR-based mindfulness interventions typically require a considerable time commitment for both parents and youth. This is likely not feasible for families feeling too overextended to dedicate the amount of time required of a MBSR program (Jastrowski Mano, Salamon, Hainsworth, Anderson Khan, Ladwig, & Weisman, 2013) and such programs would not be suitable for use in school settings. Therefore, it is important to examine whether individual mindfulness components yield beneficial outcomes as well as which components generate the greatest acceptance and compliance among adolescents. The focus of the present study was to: (1) further examine the feasibility and acceptability of mindfulness with adolescents and, (2) examine the different treatment components of MBSR (hatha yoga, sitting meditation) and their effects on stress, anxiety, and working memory. The ultimate purpose of this study was to gain more clarity on the implementation of effective mindfulness interventions for adolescents. In order to fully explore the rationale for offering mindfulness as an intervention for adolescents in school settings, neuroscience research on the benefits of mindfulness are provided in the subsequent sections. This is followed by a more in-depth review of the available outcome studies that examine the effectiveness of mindfulness interventions with youth.

Mindfulness and the Brain

Mindfulness is often recognized as a "practice" or "training," requiring the constant shift from the "automatic pilot" mindset to one that is comprised of "attention" and "awareness"

(Brown & Ryan, 2003). By engaging in this practice, individuals are exercising their mind and consequently, changing the structures of their brains. A growing number of neurological studies are documenting the changing neural pathways of the mindful brain (Davidson et al., 2003; Fletcher, Schoendorff, & Hayes; 2010; Lazar et al., 2005).

Neurological effects. Research has found that mindfulness practice not only reduces psychological distress, but also affects the physiology of the brain (Williams, 2010). Recent neuroimaging studies have used electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) to explore the neural mechanisms underlying mindfulness meditation practice. Davidson and colleagues (2003) used EEG to measure electrical brain activity after four months of mindfulness training and found significant increases in the left prefrontal cortex compared to the right, the former of which is an area associated with positive affect and enhanced mood functioning. Lazar et al. (2005) used high-resolution MRI to investigate 20 long-term meditation practitioners. Their study found that meditation practitioners had increased cortical thickness in middle prefrontal area and the insula, which are brain regions associated with attention, the ability to reflect inner experiences, and process bodily sensations. Furthermore, daily meditation practice slowed down cortical thinning in aging adults, which prevents cognitive decline in older meditators (Lazar et al., 2005; Luders, Toga, Lepore, & Gaser, 2009). Hölzel et al. (2011) found increased gray matter concentration in 16 participants in an 8-week MBSR program. Increased gray matter was found within the left hippocampus, posterior cingulate cortex, temporo-parietal junction, and the cerebellum. These areas are involved with learning, memory, emotion and cognitive regulation, and perspective-taking. These studies suggest that mindfulness practices can promote neural plasticity and changes in the brain structure.

Cognitive effects. The neurological changes in the structure of the brain can affect the cognitive functions associated with them. Studying the changes in functionality involves looking at neural activation patterns (Galvan, 2010). Mindfulness may be used to gain cognitive flexibility, which is the ability to adapt cognitive processes to face new and unexpected conditions (Moore & Malinowski, 2009). Given that mindfulness involves regulated attention, a growing number of studies have found increased attentional skills resulting from mindfulness training (Jha, Krompinger, & Baime, 2007; Lutz, Slagter, Dunne, & Davidson, 2008b; Teasdale, Segal, & Williams, 1995). In 2007, a study used EEG to compare Buddhist monks who had been long-term meditators with novice meditators (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007). The study found Buddhist Monks have less activity in their anterior cingulate cortex, indicating more focus compared to the novice meditators. Also, Lykins, Baer, and Gottlob (2012) found meditators had significant improvement on measures of short-term and long-term memory capacity compared to non-meditators.

Furthermore, research has shown that mindfulness exercises have a direct effect on higher-order cognitive processes, such as executive functioning (Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004; Slagter et al., 2007). Black, Semple, Pokhrel, and Grenard (2011) found positive associations among mindfulness practice and higher cognitive functions such as self-control and working memory. Current research has an increased interest in studying the impact mindfulness has on the working memory since both constructs require moment-to-moment awareness (Dehn, 2008).

Working Memory

Working memory (WM) has been one of the most influential constructs in the study of human cognitive functions (Dehn, 2008). Working memory is described as a mental workbench

that requires moment-to-moment awareness to hold information long enough for reasoning and comprehension to occur. This cognitive function helps the brain shift information from short-term memory to long-term memory. Thus, success in learning largely depends on an individual's working memory capacity. In addition to learning, working memory capacity also impacts performances on other higher-level cognitive tasks such as reasoning, comprehension, and executive functioning (Dehn, 2008; McNamara & Scott, 2001). Increased working memory capacity can be enhanced via mindfulness practices, which can influence overall cognitive functioning (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; Mrazek, Franklin, Phillips, Baird, & Schooler, 2013; Zeidan, Johnson, Diamond, David, & Goolkasian, 2010).

As research is sparse on adolescent working memory, researchers have extrapolated from research on the effects of mindfulness practice on adults. In the adult literature, studies have shown that mindfulness training may be used as a tool to enhance working memory (Chambers, Lo, & Allen, 2008; Jha et al., 2010; Mrazek et al., 2013, Zeidan et al., 2010). One study trained 20 novice meditators for 10 intensive days of meditation and found that participants showed improvement in depression symptoms, rumination, working memory, and sustained attention (Chambers et al., 2008). Jha et al. (2010) used Mindfulness-Based Mind Fitness Training (MMFT™) with a high-stress military group that was preparing to be deployed to Iraq. They found that those who received a large amount of mindfulness practice maintained their working memory and positive mood upon returning from deployment. Conversely, those who engaged in limited mindfulness exercises showed a decline in working memory capacity and an increase in negative mood. The authors suggested that mindfulness training serves a protective function against cognitive impairments for high stress samples. Therefore, those who engaged in

minimal practice did not receive the same protective benefit as those who had meditation training (Jha et al., 2010).

Not all populations, however, appear to require extensive mindfulness training to see beneficial results. A recent study found that brief 4-day mindfulness training was effective in improving cognitive processes such as executive functioning, visuo-spatial processing, and working memory in a nonclinical sample (Zeidan et al., 2010). Mrazek, Franklin, Phillips, Baird, and Schooler (2013) found that a 2-week mindfulness-training course improved mind wandering, Graduate Record Examination (GRE) scores, and working memory capacity in college and graduate-school samples. Taken together, these studies suggest that clinical samples—such as high stress military population—may need a more extensive intervention to offset the impact of deployment, whereas nonclinical samples may not need as lengthy of an intervention to show some benefit. Nonetheless, these studies indicate that mindfulness training may help to improve cognitive abilities and flexibility in adults.

Stress

Stress may also "reshape" the brain; however, its effects are deleterious (Liston, McEwen, & Casey, 2008; McEwen & Sapolsky, 1995). The improvement of cognitive flexibility through mindfulness training may positively impact individuals' perceived stress. Stress is considered a normal part of the human experience, however individuals' perception of stress could impact their ability to respond to the challenges of these stressors (Lazarus, 1993). Recent research has shown that mindfulness practices improve cognitive appraisals and coping with stressful situations. For example, with a sample of 141 college students, Weinstein, Brown, and Ryan (2009) investigated the effects of MBSR on the appraisal of stress, coping with stress, and the effects of emotional well-being. Results indicated that students who reported higher

mindfulness levels after training were more likely to perceive stressful situations (e.g. tests), as being less stressful or threatening. Thus, mindfulness training may alter cognitive appraisals of events allowing individuals to better handle their stressful situation.

Another study by Rosenzweig, Reibel, Greeson, Brainard, and Hojat (2003) examined the effectiveness of a 10-week MBSR intervention to help medical students improve their coping skills and reduce their stress levels. Three hundred and two medical students participated in either the MBSR intervention or a complementary medicine class. The results indicated that students in the MBSR course had higher baseline mood disturbances as compared to the control group, however by the end of the 10-week course, MBSR participants reported significant improvement in moods and lower psychological stress than did the control group. Thus, this study demonstrated that mindfulness practices could be an effective stress management tool for medical students. While these research studies have been primarily focused on college and graduate students, findings suggest the potential for similar benefits for adolescents.

Anxiety

Just as mindfulness is thought to decrease stress, a growing body of scientific research has suggested that mindfulness training is also useful in reducing anxiety (Miller, Fletcher, & Kabat-Zinn, 1995; Orsillo, Roemer, & Barlow, 2002). Anxiety is a common response; however, chronically elevated levels of anxiety may negatively affect normal functioning and lead to overactive cognitive appraisals of threat or danger (Beck, Emery, & Greenberg, 2005). Mindfulness-based approaches may be effective in helping restructure one's experience of anxiety. For example, Kabat-Zinn et al. (1992) investigated 22 participants diagnosed with generalized anxiety disorder (GAD) and/or panic attacks. Results showed group mindfulness meditation to be effective in reducing symptoms of anxiety and panic. Furthermore, Semple et

al. (2010) conducted a study with 25 children, ages nine to thirteen from low-income communities using the mindfulness program Mindfulness-Based Cognitive Therapy. Their results showed a statistically significant reduction in anxiety and behavior problems. Beauchemin, Hutchins, and Patterson (2012) also investigated the effects of mindfulness in a youth sample, specifically students with an emotional disability or learning disability, and found significant decreases in state and trait anxiety. As researchers are emphasizing these positive outcomes, it is imperative to investigate the underlying components of effectiveness. The widespread use of the term mindfulness is applied to numerous interventions such as sitting meditation and hatha yoga, and separating those that are effective from those that are not is a logical extension of the question of the efficacy of mindfulness overall.

Components of Mindfulness Interventions

The majority of current studies examine mindfulness through contemporary interventions such as MBSR (Kabat-Zinn, 1982) and MBCT (Teasdale et al., 2000). These mindfulness interventions offer multiple techniques (e.g., body scan, sitting meditation, hatha yoga, self-compassion, meditation, etc.) to increase awareness and attention. Moreover, the MBSR program is an 8-week course that includes 2.5 hours of weekly sessions and 45 minutes of daily home practice. MBSR participants are also required to partake in a silent weekend retreat to deepen their practice. Such a lengthy intervention may not be feasible in settings where time is limited. Thus, separately examining the two central components of MBSR in terms of their feasibility, acceptability, and effectiveness may allow for the distillation of the most essential parts of the intervention.

The two formal practices used in most mindfulness psychological interventions are sitting meditation and hatha yoga. Research indicated that these two components aim to cultivate a

present-moment experience with a heightened level of awareness. Though theoretically similar in terms of their intended therapeutic purpose, recent research proposes that sitting meditation and hatha yoga may differ in potentially important ways. For example, theoretical and experimental research suggests that sitting meditation improves working memory; whereas this has yet to be demonstrated in hatha yoga (Chambers et al., 2008; Zeidan et al., 2010). These two practices are described in detail in the following section.

Sitting meditation. Sitting meditation is one of the key practices in mindfulness interventions, especially in the MBSR program. Jon Kabat-Zinn (1990) described sitting meditation as "the heart of formal meditation practice" (p. 61). This type of meditation has been used for centuries to quiet the mind through keeping the body still. Sitting meditation comes in various forms, from mindfulness to concentration meditation. Each type of meditation uses a different technique to train the mind. For example, mindfulness meditation requires individuals to objectively observe one's thoughts in order to gain insight. Concentration meditation uses a single object such as a sound or an image to help the mind focus. Since each technique is significant and varies in its method of delivery, they may consequently produce differing effects.

Sitting meditation has been the subject of more extensive scientific research, in terms of the potential impact on brain functioning, compared to the hatha yoga literature. Sitting meditation has many health benefits ranging from decreased anxiety to increased relaxation (Miller, Fletcher, & Kabat-Zinn, 1995). Furthermore, recent research found that meditation is associated with neuroplasticity, referring to the brain's structural and functional changes (Begley, 2007; Davidson & Lutz, 2008). This particular mindfulness technique has also been shown to be effective in strengthening the brain structure and improving cognitive abilities (Davidson & Lutz, 2008). Research has found that with repeated practice of sitting meditation,

individuals improve their attention, working memory, visual perception, and performance in other cognitive tasks (MacLean, et al., 2010). These benefits have yet to be studied in hatha yoga, though similar results have been hypothesized.

Hatha yoga. Western interest in yoga has been on the rise due to its natural healing effects. Yoga is a combination of both physical and meditative components. Patanjali (2003, p. 3), a famous yogi, stated that yoga "is a technique to still the patterning of consciousness." Therefore, the ultimate goal of yoga is similar to that of sitting meditation. Yoga is another form of meditation that incorporates the components of stretching, relaxing, and opening the body. Hatha yoga involves physical forms (*asanas*), breathing techniques (*pranayama*), and meditation (*dhanya*).

Yoga research is still evolving. Past research has indicated the practice of yoga allows one to reap many health benefits including psychological and physiological wellness (Baer, 2003; Birdee et al., 2009; Galantino, Galbavy, & Quinn, 2008). Recently, there has been an increased interest in using yoga as an alternative intervention (Khalsa, 2004). Yoga practices are often associated with decreased anxiety, depression, and stress, as well as improved mood (Baldwin, 1999; Lavey et al., 2005; Michalsen et al., 2005). Yoga has also been associated with improved sleep among patients undergoing treatment for lymphoma (Cohen, Warneke, Fouladi, Rodriguez, & Chaoul-Reich, 2004). Other studies have shown yoga to be an effective method for managing pain symptoms including chronic low back pain and migraine (John, Sharma, Sharma, & Kankane, 2007; Sherman, Cherkin, Erro, Miglioretti, & Devo, 2005; Williams et al., 2005). Through these studies, it is apparent that yoga has a variety of health advantages in adults. Existing research on the beneficial nature of mindfulness interventions for adults

highlights the importance of extending such research to youth samples. A more comprehensive discussion of mindfulness research with adolescents is presented in the next section.

Mindfulness Interventions in Youth

Cognitive flexibility is important throughout the lifespan, though it may be especially important in the developing adolescent brain. Adolescence is the time between childhood and adulthood. Giedd et al. (1999) stated that during this time, numerous internal changes in the brain chemistry are occurring. "Brain plasticity" is a phenomenon that becomes especially apparent in adolescence (Giedd et al., 1999). Plasticity is vital so adolescents can adapt and learn new skills to help pave the way for independence during this period (Giedd et al., 1999). Preventive interventions may be particularly beneficial during adolescence, given that during this developmental phase adolescents are acquiring new skills, maturing, and exhibit a higher degree of plasticity relative to adults.

The interventions used with adults can be modified for developing youth mindfulness programs. Several mindfulness-based interventions have been adapted for youth, including Mindfulness-Based Stress Reduction for Teens (MBSR-T; Biegal, Brown, Shapiro, & Schubert, 2009), Mindfulness-Based Cognitive Therapy for Children (MBCT-C), and Dialectic Behavioral Therapy for Adolescents (DBT-A). These programs modified their wording and exercises to be more appropriate for youth. For example, in Saltzman's Still Quiet Place she uses "Seaweed Practice" to help calm children's restless state. Hayes, Strosahl, and Wilson (1999) also use metaphors such as "Mule in the Well" and "Leaves on a Stream" in exercises to help children and adolescents learn acceptance and mindfulness. Recently, mindfulness interventions with youth have demonstrated beneficial effects on well-being and physical health (Biegel et al., 2009; Black, Milam, & Sussman, 2009; Burke, 2009; Semple, Lee, Rosa, & Miller, 2009). The

potential benefits of modified mindfulness interventions for youth are described in the subsequent section.

Preliminary research has found mindfulness training to be feasibly adapted for use with clinical and non-clinical adolescent samples. For instance, DBT has been successfully tailored for adolescents with bipolar disorder (Goldstein, Axelson, Birmaher, & Brent, 2007), self-injurious behaviors (Miller, Rathus, & Linehan, 2007), and binge eating (Salbach-Andrae, Bohnekamp, Pfeiffer, Lehmkuhl, & Miller, 2008). Furthermore, Zylowska and colleagues (2007) found mindfulness training to be a feasible intervention for adolescents with Attention Deficit Hyperactivity Disorder (ADHD). The participants with ADHD reported high levels of satisfaction after completing an 8-week mindfulness program. Sibinga and colleagues (2008) assessed the effects of a MBSR program in a sample of 33 HIV-infected, at-risk urban youth and found positive effects related to hostility, interpersonal relationships, school achievement, and physical health.

In nonclinical samples, Saltzman and Goldin (2008) conducted an 8-week modified version of the MBSR program with 31 children and their parents. Based on self- and parent-report, results indicated improvement in attention, reactivity and some areas of meta-cognition. These studies support the beneficial effects of mindfulness in youth. In spite of the work put into adapting these interventions for children and adolescents, they are still in their incipient stage. These adapted mindfulness interventions are still lengthy in time and duration, ranging from eight to twelve weeks with each session lasting 40 to 90 minutes. Researchers and educators are recognizing that practicing the full MBSR program may not be feasible in all settings (e.g., schools) due to time restraints and thus the importance of finding the "active ingredients" or most effective components of these programs is further highlighted.

Mindfulness in School Settings

As mindfulness interventions are on the rise, research is required to look at the modifications needed to successfully incorporate these programs into school systems. The inherent value of incorporating mindfulness practices in school settings rests in the view that mindfulness practices may function in a preventative capacity to strengthen attention, focus, and non-judgmental acceptance in youth who require such skills to succeed in academia (Greenberg & Harris, 2012; Mendelson, Greenberg, Gould, Rhoades, & Leaf, 2010; Wall, 2005). Thus, many researchers have begun programs incorporating mindfulness practices into existing school curricula. The existing mindfulness research conducted in school settings suggests positive effects on adolescent stress, anxiety and emotional regulation (Potek, 2012). Wall (2005) conducted a study with MBSR and Tai Chi with middle school children and found that these techniques helped enhance overall students' well-being. After 5-weeks of MBSR and Tai Chi, the students experience relaxation, increased self-care, and improved sleep. Furthermore, ACT interventions have been linked with a reduction in adolescents dropping out of school (Moore et al., 2003) and decreased high-risk sexual behaviors among adolescent girls (Metzler, Biglan, Noell, Ary, & Ochs, 2000).

Mindfulness training has also been used as a treatment method for clinical populations in schools, such as reducing attentional problems (Rani & Rao, 1996; Semple, 2005). Gordon, Staples, Blyta, and Bytyqi (2004) used MBSR in school settings to treat 139 adolescents with post-traumatic stress symptoms. The mindfulness program was delivered in six, three hour sessions. Participants were offered multiple mindfulness techniques such as relaxation training, meditation, guided imagery and biofeedback. The researchers found a significant reduction in post-traumatic stress disorder symptoms for students who participated in this intervention. These

studies suggest that mindfulness training may be an effective intervention to use in school settings to help adolescents' functioning in a myriad of arenas.

Although many of these studies have suggested that MBSR and related interventions are effective with children and adolescents, these findings should be interpreted with caution. Baer (2003) discussed that most mindfulness-based intervention studies contain methodological problems such as small sample sizes and lack of control groups, thus limiting the value of their results. Moreover, many mindfulness studies struggled with high rates of attrition. For example, Black, Milam, and Sussman (2009) conducted a meta-analysis of 16 research studies looking at mindfulness with children and adolescents, and found that some mindfulness studies had retention rates as low as 64%. Some researchers have suggested that this may be due to the extensive nature of mindfulness programs, resulting in few participants actually completing the entire training (e.g., Jastrowski et al., 2013). Zylowska et al. (2007) also suggested the importance of flexible scheduling when working with adolescent samples. Given the concerns regarding attrition, there is a need to examine the feasibility, acceptability, and effectiveness of briefer interventions.

The Present Study

Based on the literature review, mindfulness has been shown to be effective in producing beneficial effects on physical and psychological functioning, especially in adult samples. However, adolescent research remains preliminary. The few available studies have poor methodological quality, such as small sample size, lack of a control group and concerns about treatment fidelity (Baer, 2003; Black et al., 2009; Sibinga et al., 2011). Furthermore, current mindfulness interventions for youth have been adapted from adult curricula that include multiple mindfulness components (e.g., sitting meditation, hatha yoga, body scan, etc.). MBSR and

related mindfulness interventions, when practiced in full, are time intensive, which likely increase participant burden and attrition. Further, lengthy interventions are not feasible in all settings (e.g., school) and for all youth. To date, there have been no published studies directly examining the differential acceptability and effectiveness of the core components of mindfulness interventions in youth. Therefore, it is important to determine whether single components typically included as part of MBSR may be effective in and of themselves. Such information would be clinically useful in general, and particularly so when implementing mindfulness interventions with adolescents in settings where lengthy treatment protocols are not feasible.

Therefore, a randomized control trial of sitting meditation and hatha yoga was conducted in order to: (a) explore the feasibility and acceptability of two main MBSR components—sitting meditation and hatha yoga—and (b) investigate the effectiveness of meditation and yoga on outcomes such as working memory, stress, and anxiety in an adolescent sample. The overall purpose of this study was to help advance our understanding of mindfulness techniques, their benefits, and their future use as effective interventions among youth.

Conceptual Hypotheses

The primary purpose of this study was to examine the feasibility, acceptability, and effectiveness of mindfulness training on adolescents' working memory, stress, anxiety, and mindfulness. Based on previous research, we hypothesized:

Hypothesis 1. Adolescents who receive a sitting meditation intervention would show significantly greater improvement in working memory relative to adolescents who receive a hatha yoga intervention or no intervention (waitlist control group).

Hypothesis 2. Adolescents who receive a sitting meditation or hatha yoga intervention would report significantly lower levels of stress and anxiety at post-intervention relative to

adolescents assigned to a waitlist control group.

Hypothesis 3. Adolescents who receive a sitting meditation or hatha yoga intervention would report significantly greater mindfulness at post-intervention relative to adolescents in a waitlist control group.

Hypothesis 4. Adolescents participating in a sitting meditation or hatha yoga intervention who are actively compliant with daily home practice would exhibit the greatest improvements in working memory, stress, anxiety, and mindfulness.

Chapter II

Method

Overview

The specific aims of the study were to (a) assess the feasibility, acceptability, and effectiveness of short-term mindfulness training for adolescents, (b) examine the effects of hatha yoga versus sitting meditation on working memory, stress, anxiety, and mindfulness, and (c) explore daily home practice compliance. Using an experimental design, participants were randomly assigned to one of three conditions: sitting meditation, hatha yoga, or a waitlist control group. This study employed a series of mixed factorial Analyses of Variance (ANOVAs) to compare the three groups on each of the outcome measures at pre-intervention and post-intervention. The feasibility and acceptability component of the study were determined by recruitment, attendance, and retention rates. This chapter reviews this study's participants, setting, measures, procedures, and data analysis plan.

Participants

The inclusion criteria consisted of students who were: (a) currently enrolled in school between the ages of 12 – 17 years old, (b) English speaking—to understand and complete the questionnaires and the working memory tasks, (c) able to attend the weekly hatha yoga or sitting meditation sessions, and (d) not reporting any injuries or health condition(s) that might limit their physical activity. Exclusion criteria included individuals who have hearing impairments, injuries, or physical disabilities that would hinder them from fully participating in intervention.

Approximately four hundred and twenty students received information regarding the mindfulness research study in their mandatory physical education classes. The majority of students indicated their interest in participating by raising their hands. However, the mindfulness

program was only able to accommodate approximately half of the students due to limited availability of mindfulness facilitators for this study. Thus, the first thirty students in each of the six classes who turned in their student assent and parent consent forms were able to participate in the study. One hundred and ninety-eight adolescents initially participated in this study. Twelve participants decided to withdraw before the randomization process. Within each physical education class period, participants were randomly assigned to one of the three group conditions resulting in 61 (32%) participants in the sitting meditation group, 68 (37%) in the hatha yoga group, and 57 (31%) in the waitlist control group.

Setting

The study was conducted at a large public junior high school in National City, California that serves approximately 1,079 students from 7th to 9th grade. The school consisted of students who were predominantly from low-income minority households. About 80 percent of the students were eligible for a free or reduced lunch. The school has an expressed interest in intervention programs to improve students' well-being and performance.

Measures

Demographic data. A brief demographic questionnaire completed by the participants was used to obtain background information including age, gender, grade level, race/ethnicity, and extracurricular activities. Previous experience with mindfulness, meditation and/or yoga was also assessed. Furthermore, the researcher sent home a separate demographic questionnaire for the parent/legal guardian to complete. Spanish and English forms were made available for parents. This form addressed information such as socioeconomic status and diagnosis of any learning disabilities and/or developmental disorders (e.g., Asperger's Syndrome and ADHD) (see Appendices E and F).

Intervention expectations, acceptability, and experiences. Intervention acceptability was measured in two ways. One way acceptability was assessed was through retention rates (i.e., number of dropouts from each group). Another way acceptability was measured was through treatment expectation questionnaires. Participants' expectations regarding the likely benefit of the intervention (hatha yoga or sitting meditation) (Jastrowski Mano et al., 2013) were assessed prior to beginning the intervention with a 6-item questionnaire. For example, participants in the sitting meditation group were asked, "How helpful do you think sitting meditation (the whole 4 week session-overall) will be to you?" A 5-point Likert scale was used, ranging from 1 (*Not at all*) to 5 (*completely*). Furthermore, after completion of the intervention (hatha yoga or sitting meditation), participants were given an intervention experiences measure. For example, participants were asked, "Did you find the practice relaxing?" The experiences questionnaire also used a 5-point Likert scale, ranging from 1 (*Not at all*) to 5 (*completely*), to assess participants' satisfaction with the techniques learned as part of the intervention (refer to Appendix H).

Automated Operation Span Task. The Automated Operation Span Task (AOSPAN; Unsworth, Heitz, Schrock, & Engle, 2005) was used to measure working memory capacity. The AOSPAN measures the capacity to learn and retain information in the active state of memory while in the presence of distractors (Engle, 2002). This computerized task is created using E-prime or Inquisit software that is delivered on a computer, only requiring participants to click on the mouse button. Participants can complete the task independently without the experimenter because instructions are provided through the program. This cognitive task comprised of 15 sets of trials, each containing two tasks the participants completed simultaneously. These two tasks involve actively performing a memory task while answering simple mathematic equations. In

the memory section, participants were presented a series of letters that appear one at a time for 800 milliseconds. Participants were asked to recall letters in the same order they were presented by clicking the box next to the appropriate letters in correct order. In the math portion of the task, the mathematics equations was presented in sets of simple questions such as "(1*2)+1=?)." After solving the problem, participants were then asked to click to the next screen where a potential answer, such as "3" was presented. Participants would either click on the "true" or "false" box, depending on their answer. The task allowed participants to work at their own pace, but the program would calculate an average time limit for each participant (i.e., their average response time to solve the math equations plus 2.5 *SD*). There are a total of 75 letters to recall and 75 math equations to solve. The total time to complete the entire task is approximately 20 minutes. At the end of the task, five scores were generated: OSPAN score, total number correct, math errors, speed errors, and accuracy score.

The AOSPAN has shown acceptable internal consistency ($\alpha = 0.78$) and good test-re-test reliability (.83) in nonclinical samples. Furthermore, factor analyses have shown that the AOSPAN load on the same factor as two popular working memory measures (the OSPAN and RSPAN) in both a confirmatory and exploratory factor analysis (Unsworth et al., 2005). This task has been used extensively in working memory research, and it has been shown to be appropriate for use with children and adolescents (Gradisar, Terrill, Johnston, & Douglas, 2008; Kaufman, DeYoung, Gray, Brown, & Mackintosh, 2009).

Perceived Stress Scale. The Perceived Stress Scale-10 (PSS-10; Cohen & Williamson, 1988; see Appendix L) is a 10-item measure that explores perceived stressful situations that may occur in daily life. All questions are rated on a 5-point Likert scale, ranging from 0 (*never*) to 4 (*very often*) to assess how respondents felt during the past month. Some items are reverse-scored

and an overall score is calculated. Overall scores range from 0 to 40, with higher scores indicating greater perceived stress. The PSS-10 is designed for use in community samples with individuals with at least a junior high school education. The previous version of the PSS was a 14-item self-report measure (Cohen, Kamarck, & Mermelstein, 1983). The psychometric data for the PSS were collected in both college and community samples with internal consistency coefficients ranging from 0.84 to 0.86. Test-retest reliability ranged from 0.55 (community sample) to 0.85 (college sample). Cohen and Williamson (1988) developed the PSS-10. Roberti, Harrington, and Storch (2006) found that the PSS-10 was internally consistent (Cronbach's alpha = 0.89), in a nonclinical sample of college students. The study also found the PSS-10 to be highly correlated with similar measures, such as the Spielberger State-Trait Anxiety Inventory (1983). In addition, the PSS-10 has been used with diverse adolescent samples to examine perceptions of stress (Carlozzi et al., 2010; Kohn & Milrose, 1993; Magaya, Asner-Self, & Schreiber, 2005; Siqueira, Diab, Bodian, & Rolnitzky, 2001). For example, Carlozzi et al. (2010) examined adolescents' spirituality, anger and stress, and found the PSS-10 to exhibit good internal consistency (Cronbach's alpha = 0.82). In the current study, the internal consistency of the PSS-10 (Cronbach's alpha = 0.63) was lower than what has been previously reported. The researcher carefully reviewed the dataset and omitted PSS-10 scores for 23 participants who endorsed the same response option throughout the entire measure (Huang, Curran, Keeney, Poposki, & Deshon). Scores from the remaining participants (n = 149) who were included in the analyses yielded an acceptable internal consistency (Cronbach's alpha = 0.71).

Screen for Child Anxiety and Related Emotional Disorder. The Screen for Child Anxiety and Related Emotional Disorders (SCARED; Birmaher et al., 1997; see Appendix J) is a

self-report anxiety measure designed for use with youth ages 8-18 years. The SCARED also has a parent-proxy report form, the Screen for Child Anxiety and Related Emotional Disorders-Parent Form (SCARED-P; Birmaher et al., 1997). The SCARED/SCARED-P are 41-item measures that parallel the five types of anxiety disorders described in the DSM-IV: generalized anxiety, social phobia, separation anxiety, panic disorder, and school phobia. Higher total scores indicate higher levels of anxiety and worry. This is a brief measure that can be completed in 10 minutes. Respondents uses a 3-point Likert scale: 0 (*not true*), 1 (*sometimes true*) and, 2 (*often true*) after reading statements such as, "I worry about other people liking me" and "When I get frightened, my heart beats fast".

The SCARED has been shown to possess good psychometric properties in a variety of clinical and nonclinical samples of children and adolescents (Crocetti, Hale, Fermani, Raaijmakers, & Meeus, 2009; Jastrowski et al., 2012). Birmaher et al. (1997) conducted a study of the 38-item version of the SCARED inventory with an outpatient youth sample and their parents. They found good internal consistency with reported alpha coefficients ranging from 0.74 to 0.93 and test-retest reliability ranging from 0.70 to 0.90. The SCARED has also demonstrated good psychometric properties in nonclinical samples. For example, the SCARED was examined in a community sample of 111 African-American high school students (Boyd, Ginsburg, Lambert, Cooley, & Campbell, 2003). SCARED total scores were statistically significantly positively correlated with other measures of anxiety symptoms, and showed good internal consistency (alpha = 0.89). Based on current studies, the SCARED demonstrated to be a reliable instrument in assessing anxiety symptoms in children and adolescents. The SCARED-P showed similarly acceptable validity (Cronbach's alpha = 0.93). In the current study, both the SCARED and the SCARED-P Cronbach's coefficient alpha was 0.93. The SCARED-P was

available in both Spanish and English for parents.

Child Acceptance and Mindfulness Measure. The Child Acceptance and Mindfulness Measure (CAMM; Greco, Dew, & Ball, 2005; see Appendix I) was administered to assess the degree to which children and adolescents observe internal experiences, act with awareness, and accept internal experiences in a non-judgmental manner. The CAMM is a 25-item measure created on a 5-point Likert scale ranging from 0 (*never true*) to 4 (*always true*). Total scores range from 0-100, with higher scores indicating higher levels of acceptance and mindfulness. The questions on the CAMM include, "I notice small changes in my body, like when my breathing slows down or speeds up" and "I try only to think about things that makes me feel happy." The wording and construction of the CAMM make it more appropriate for younger respondents over the age of nine years old (Greco, Baer, & Smith, 2011). The CAMM has demonstrated good concurrent validity and internal consistency (Cronbach's alpha = 0.87; Ciarrochi & Bilich, 2006). Greco et al. (2011) indicated that the CAMM may be a useful measure of mindfulness skills for school-aged children and adolescents. In the current study, the internal consistency of the CAMM was substantially lower (Cronbach's alpha = 0.33). Due to the low Cronbach's alpha, the researcher reviewed the dataset and found 19 participants who endorsed the same response option repeatedly throughout the entire measure. The remaining participants (n = 150) who were included in analyses yielded a low internal consistency (Cronbach's alpha = 0.41).

Home practice compliance. Participants were asked to complete a daily home practice log by recording whether or not they practiced for the day, the number of minutes spent practicing (either hatha yoga or sitting meditation), and whether or not they used a compact disc (CD) or digital versatile disc (DVD). Participants were encouraged to engage in approximately

15 to 30 minutes of home practice for seven days per week for four weeks. The researcher was unable to obtain practice logs after the final week of the intervention due to the end of the academic school year. Thus, home practice logs were requested for weeks one through three in their stead, yielding a maximum total number of 21 expected practice days. Participants were also given a space to write down their home practice experiences in the "comments" section of the log. During the study intervention sessions, if they chose to, participants were given the opportunity to share their home practice experiences. The home practice forms were turned in to the principal investigator on a weekly basis (see Appendix M). Ninety-four percent of participants turned in at least one weekly home practice log.

Procedure

The study was held in a public middle school in National City, California. The interventions were delivered during the students' Physical Education (PE) class periods. Pre- and post-intervention assessments were held throughout the school day, from 2nd period to 7th period. Study measures were administered by trained graduate research assistants to a group of approximately 30 students in the school's computer lab. Each participant sat at one of the computer stations in the school computer lab to complete the Automated OSPAN task. In contrast, all self-report measures (PSS-10, SCARED, CAMM) were completed via paper-and-pencil. The majority of participants completed their assessment measures during their assigned PE period, and those who did not finish were able to complete their assessment measures during lunch period, which was also held in the computer lab. The sitting meditation intervention was held in a quiet room in the school's library, while the hatha yoga intervention was held in the school's gym. The wait-list control group participated in their mandatory regular physical education classes. Participants were treated according to the ethical standards of the American

Psychological Association (APA, 2002). All methods and procedures used in this study were approved by the Institutional Review Board of Alliant International University, San Diego. Participation was entirely voluntary and participants were free to discontinue their participation at any time. Additionally, participants were given assurances that all information they provided would be kept confidential.

A number of recruitment strategies were employed, including: (a) making announcements in PE classes; (b) placing fliers around the school campus; (c) making campus-wide announcements through the school's telecom. In attempting to capture the general adolescent population, this study did not have many exclusion criteria. The students determined if they were interested, but the Principal Investigator determined if they were eligible through a simple questionnaire completed by the parents and adolescents prior to the intervention (see Appendix G). If the students were eligible, adolescent assent and parent consent forms were signed and collected from each participant. A demographic questionnaire was then given to all participants to gather background information at pre-intervention. Parent forms were additionally made available in Spanish. Teachers, parents, and adolescents were fully informed in writing about the nature of the study. They were given opportunities to contact the primary investigator to ask questions or express concerns. Participants were assigned identification numbers to preserve their personally identifiable information (e.g., name, grade, sex, age, and ethnicity). The list of participants and identification numbers were kept in a computer file with a secured password accessible only to the researcher. All participants were also asked to complete a battery of self-report measures (PSS-10, SCARED and CAMM) and a computerized working memory task (AOSPAN) before the brief 4-week mindfulness course as part of the pretest indices. SCARED-P forms were sent home for parents to fill out in either Spanish or English

based on parent preference. It took participants approximately forty-five minutes to an hour to complete all intervention measures. Participants in the waitlist control group completed all measures at the same time points as the participants in the intervention groups.

After completing the initial assessment measures, participants were then randomly assigned to either the waitlist control condition or one of the two intervention groups (sitting meditation or hatha yoga). Prior to the start of intervention, intervention group participants were asked to complete the expectations questionnaires to assess how they felt about the intervention (sitting meditation or hatha yoga) and whether they thought the intervention would be helpful. Participants in both intervention groups met a total of eight times: two times a week (i.e., Tuesday, Thursday) for four weeks. Each intervention session lasted 45 minutes with approximately twenty to thirty minutes spent practicing hatha yoga or sitting meditation. The remainder of the time was used to introduce and explain the practice and collect daily home practice logs. A segment of the time was also allotted to discussing the participants' experiences, as well as answering any questions they had. Each intervention class size was approximately ten to thirteen students with one sitting meditation or hatha yoga instructor.

Participants assigned to hatha yoga learned a new set of yoga poses each week, whereas the sitting meditation participants learned new types of sitting meditation each week (see Interventions section below). The participants in both groups received approximately forty-five minutes of sitting meditation or hatha yoga each session, with a total of approximately six hours of intervention time. Following the 4-week intervention condition, all participants (waitlist and intervention groups) completed the post-treatment/post-waitlist measures. Intervention groups (sitting meditation or hatha yoga) were also given the treatment experience questionnaire at post-intervention to assess how positive their experiences were with the intervention. Furthermore,

daily home practice was monitored through a written home practice log that was collected once a week during the intervention. Following the 4-week waitlist period, the participants in the waitlist control condition were randomized to either the hatha yoga or sitting meditation condition. The researcher contacted the participants in the hatha yoga, sitting meditation, and waitlist control conditions via email to complete the follow-up study measures one month after the completion of the intervention phase. In the email, the researcher provided a link for participants to gain access to a website in order to complete the follow-up measures. Participants were asked to complete all self-report measures (PSS-10, SCARED, CAMM) and the Automated OSPAN task online, utilizing Qualtrics Survey and Inquisit software for security and storage of data obtained from participants. The data collected through Qualtrics and Inquisit were directly downloaded into Statistical Package for Social Sciences (SPSS) Version 20, reducing the probability of data entry errors.

Table 1

Intervention Study Timeline

Week 1	*Completion of pre-intervention study measures*
Week 2	*First week of sitting meditation or hatha yoga or waitlist*
Week 3	*Second week of sitting meditation or hatha yoga or waitlist*
Week 4	*Third week of sitting meditation or hatha yoga or waitlist*
Week 5	*Fourth week of sitting meditation or hatha yoga or waitlist*
Week 6	*Completion of post-intervention (intervention groups)/ post-waitlist (waitlist control group) measures; Randomization of waitlist control participants to either sitting meditation or hatha yoga*
Week 7	*First week of intervention (sitting meditation or hatha yoga) for waitlist*
Week 8	*Second week of intervention (sitting meditation or hatha yoga) for waitlist*
Week 9	*Third week of intervention (sitting meditation or hatha yoga) for waitlist*
Week 10	*Fourth week of intervention (sitting meditation or hatha yoga) for waitlist*
Week 11	*Completion of post-intervention (hatha yoga or meditation) study measures for waitlist control group and one-month follow-up measures for intervention groups (sitting meditation or hatha yoga)*
Week 15	*Completion of one-month follow-up measures for waitlist control group after participation in an intervention (sitting meditation or hatha yoga)*

Note. Waitlist participants were randomly assigned into either sitting meditation or hatha yoga in week seven.

Throughout the data collection period, participants received raffle tickets for their participation. They each received one raffle ticket for turning in their parent packet and assent form. Participants also received one raffle ticket for every study measure packet they completed, one for every class in which they participated, and one for every daily home practice log they completed. Each participant could receive up to a total of 22 raffle tickets. These raffle tickets were entered into a drawing for a grand prize (Galaxy 2 Tablet) at the completion of post-intervention/waitlist assessments. These raffle tickets also gave participants the opportunity to win $5 gift cards each week (e.g., iTunes or Target gift cards). The weekly raffle occurred at the end of intervention sessions every period on Thursdays for each condition (i.e., sitting meditation or hatha yoga).

Interventions

Sitting meditation sessions. The sitting meditation groups were facilitated by two different female instructors trained in facilitating mindfulness sitting meditation. Both instructors have completed weeklong mindfulness-based programs (i.e., MBCT, MBSR) at various workshops and retreats, while maintaining their own personal practices. The sitting meditation intervention was held in a quiet room in the library, where participants were arranged in circular seating, facing the instructor. The researcher was also available to assist instructors as a non-participating observer. The curriculum was based on the MBSR program developed by Jon Kabat-Zinn (1990), and was modified to suit the interests and developmental level of the adolescent population. Modifications included minor changes such as adjusting the wording to accommodate their reading level, shortening the timeframe to adjust to an academic school schedule, and incorporating incentives for participation as well as mindfulness games (e.g., mirror game, conveyor belt). To monitor fidelity of intervention, each instructor was given a binder consisting of the sitting meditation curriculum, schedule of each session; and breathing exercise, meditation, and mindfulness activity scripts. The researcher periodically attended sessions to observe if the intervention was being implemented as described, and generally found the instructors following the written script with minimal variability.

The sitting meditation condition consisted of three parts: (a) breathing techniques, (b) meditation, and (c) discussion. Participants in the sitting meditation group learned new types of sitting meditation each week (i.e., **Week 1** Breathing Meditation, **Week 2** Being in the Body Meditation and Feelings Meditation, **Week 3** Awareness Meditation and Leaves on a Stream Meditation, **Week 4** Sitting meditation and Loving Kindness Meditation). Both meditation cushions and chairs were prepared and arranged to facilitate proper posture. Instructions on

sitting posture, breathing method, and how to deal with wandering thoughts were given and repeated at each session. Participants in the sitting meditation group received a CD that consisted of audio meditations that they could follow along at home. The sitting meditation participants were encouraged to practice formal sitting meditation for 15 to 30 minutes every day and asked to record details of their practice on their daily home practice logs.

Hatha yoga sessions. The hatha yoga groups were facilitated by two different certified female yoga instructors trained in teaching child and adolescent yoga. The hatha yoga intervention, which required a larger space for students to move, was held in the school's gym. Yoga mats were provided for each participant, and were arranged in three staggered lines facing the instructor. The researcher was also available to assist instructors as a non-participating observer. The adolescent hatha yoga curriculum was used with permission from Shanti Generation Yoga © (2009) created by Abby Wills. The hatha yoga sessions consisted of three parts: (a) breathing techniques, (b) yoga poses, and (c) discussion. Participants in the hatha yoga group learned a series of new yoga poses each week, as well as reviewed old poses (i.e., **Week 1** Creating Happiness: Forward bends for flexibility, **Week 2** Energy Amplified: Balancing and core strengthening postures, **Week 3** Choosing Peace: Standing poses, backbends, and forward bends, **Week 4** Being Sound: Twist, bend, and relax; and Voice Choice Possibility: Breathe, visualize, and move). Yoga poses included a series of movements that required bending, stretching, and holding to help increase muscle tone and flexibility. Students were also taught the health benefits for each poses. At the end of each yoga session, participants lay on their backs with their eyes closed for 2 to 3 minutes of relaxation. During the first session, participants in the hatha yoga group received a DVD that contained five yoga lessons corresponding to the yoga poses being taught in the intervention. Participants were encouraged

to practice the series of yoga poses at home for 15 to 30 minutes each day and record their home practice in their daily home practice logs.

Table 2

Structure of Intervention Sessions

Sitting Meditation Condition		Hatha Yoga Condition	
Roll Call	3 min.	Roll Call	3 min.
Opening Instructions	5 min.	Opening Instructions	5 min.
Sitting Meditation	30 min.	Hatha Yoga	30 min.
Questions/Discussion	5 min.	Questions/Discussion	5 min.
Raffle Tickets	2 min.	Raffle Tickets	2 min.

Study Hypotheses

The primary purpose of this study was to examine the feasibility, acceptability, and effectiveness of mindfulness training on adolescents' working memory, anxiety, stress, and mindfulness. Based on previous research, we hypothesized:

Hypothesis 1. Adolescents in the sitting meditation group would show significantly greater improvement in working memory (Automated OSPAN) compared to the hatha yoga and waitlist control conditions.

Hypothesis 2. Adolescents in the sitting meditation and hatha yoga groups would report significantly lower levels of stress (PSS-10) and anxiety (SCARED) at post-intervention compared to the waitlist control group.

Hypothesis 3. Sitting meditation and hatha yoga groups would report significantly greater mindfulness (CAMM) at post-intervention compared to the waitlist control group.

Hypothesis 4. Participants in the sitting meditation and hatha yoga groups who are actively compliant with daily home practice would exhibit the greatest improvements in working memory (Automated OSPAN), stress (PSS-10), anxiety (SCARED), and mindfulness (CAMM).

Data Analysis Plan and Power Analysis

The Statistical Package for Social Sciences (SPSS) Version 20 software was used for analysis of the data collected in the present study. The data for each participant consisted of their demographic information, computerized scores from the OSPAN task, multi-informant data from the PSS-10, SCARED (youth self- and parent proxy report), and the CAMM that were collected prior to the start of intervention, at post-intervention / waitlist, and at one month follow-up. Mixed factorial analyses of variance (ANOVA) were employed to explore differences between the three conditions (sitting meditation, hatha yoga, waitlist control) across three time points (pre-treatment, post treatment, and one-month follow-up). For the independent variables, group condition (three levels) was the between-subjects factor and time (three levels) was the within-subjects factor. The dependent variables were working memory, stress, anxiety, and mindfulness. Statistical significance was set at the $p < .05$ level. Due to limited research, it was difficult to estimate expected effect sizes. However, a power analysis (using G-Power) indicated that an estimated total sample size of 120 participants was needed to achieve 80 percent power and a medium effect size of .05 (Cohen, 1992).

Furthermore, a Bonferroni correction was applied to reduce the chance of a type 1 error, or finding a relationship between variables when one does not exist (Pallant, 2013). A Bonferroni correction involves dividing the critical p value ($\alpha = .05$) by the number of tests performed (Pallant, 2013). In this study, the number of hypothesized comparisons was 4, thus the alpha level was adjusted to .01 (α/n).

Chapter III

Results

In this chapter, the results of the data analyses are presented. Participant characteristics, descriptive statistics, preliminary analyses, and the results of analyses related to each research hypothesis are provided. Finally, post-hoc analyses are presented in the last section of this chapter.

Participant Characteristics

One hundred and ninety-eight adolescents participated in this study. The adolescents ranged in age from 12 to 15 years with a mean age of 13.18 (*SD* = 0.72). There were 123 girls and 75 boys who participated in the study. Eighty-six adolescents were 7th graders (43%), 110 adolescents were 8th graders (56%), and two participants were 9th graders (1%). A majority of adolescents identified themselves as Hispanic (66.7%), followed by Asian (18.2%), "mixed race" (8.6%), African American (2.0%), Native American (2.5%), Caucasian (1%), or "other" (1%). The majority of the participants' parents reported being currently married (69%). Hollingshead socioeconomic status total scores ranged from 8 to 58 (*M* = 32.96, *SD* = 12.50) indicating variability within the sample with 15.9% (*n* = 18) of participants having low SES (*n* = 18, 15.9%), 76.1% (*n* = 86) of participants having middle SES, and 8% (*n* = 9) of participants reporting high SES. The majority of parents reported that their adolescents were not receiving any special services at school (*n* = 92.7%) and did not have any behavior problems (*n* = 93.9%).

Participant Attrition. Of the 198 participants, twelve (4.7%) dropped out after completing initial baseline/pre-intervention measures. Of the twelve who dropped out, eleven participants elected to return to their regular physical education class and did not indicate any particular reason for their decision to withdraw from the study. One participant dropped out due

to a reported injury. This attrition rate is relatively low compared to other studies of mindfulness interventions with youth (Jastrowski et al., 2013; Malboeuf-Hurtubise, Achille, Sultan, & Vadanis, 2013). Fourteen participants (5.5%) attended fewer than six out of eight sessions. Of those non-completers, one student was suspended from school and therefore was not able to complete mindfulness sessions. Two participants were removed from the study because their teachers decided that they were not a good fit (i.e., disruptive behavior). Three students dropped out of the study due to the randomization outcome not meeting their personal preferences. Eight participants attended most sessions, but were not able to complete the intervention due to intermittent school absences (e.g., illness, field trip). Those who dropped out or completed fewer than six sessions were not included in the final analyses. Thus, a total of 172 participants completed both pre- and post- intervention measures, and attended six or more mindfulness sessions. Completers received at least 75% of the intervention. At baseline, no significant differences were found between those who dropped out after completing initial baseline/pre-intervention measures, those who attended fewer than six sessions, and those who completed six or more sessions (OSPAN, $F(2,197) = 2.7$, $p = .07$; PSS, $F(2,192) = 0.4$, $p = .70$; SCARED, $F(2,185) = 2.39$, $p = .10$; CAMM, $F(2,195) = 0.1$, $p = .89$).

Only participants who completed both the baseline/pre-intervention and post-intervention measures were included in the statistical analyses. The final sample size was $N = 172$. Participants were randomly assigned to one of three group conditions, resulting in 54 (31%) participants in the sitting meditation group, 65 (38%) in the hatha yoga group, and 53 (31%) in the waitlist control group. Descriptive statistics by group condition are presented in Table 3.

Excluded data. Of the 172 participants with complete data, 27 demonstrated inconsistent or invalid response patterns on one or more self-report measures by providing the

same response option throughout the entire measure. These 27 participants were excluded only on analyses that involved evidence of inconsistent or invalid response patterns on a particular measure. Seven of the 27 participants demonstrated inconsistent or invalid response patterns on more than one measure. Thus, those participants were excluded from all analyses involving self-report measures (stress, anxiety, or mindfulness) given that those participants who answered inconsistently on more than one measure would likely have been inconsistent on all self-report measures. However, these participants were not excluded from analyses involving the performance-based working memory measure, as it was not subject to self-report response biases. An independent *t*-test was conducted and found no significant differences on the Automated OSPAN task between the inconsistent responders and those who appeared to respond more carefully on the self-report measures ($p = .86$). In other words, those who responded inconsistently on the self-report measures did not score differently on the OSPAN task compared to those who did not evidence a response pattern on the self-report measures. Consequently, their data was not excluded from this analysis.

Figure 1. Participant Flow Chart

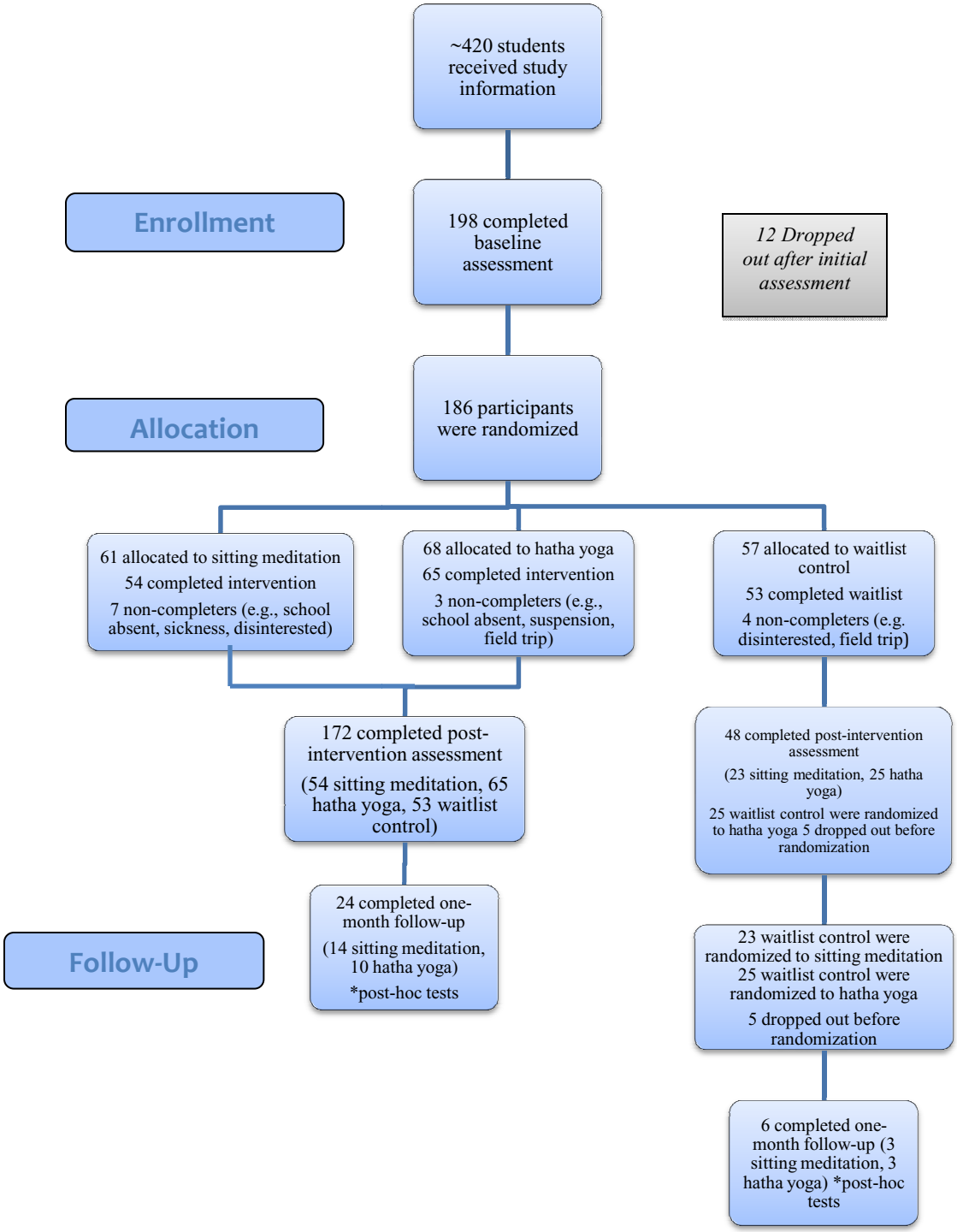

Figure 1. Participant flow chart across the time points

Table 3.

Adolescents Demographic Characteristics

Characteristic	Sitting Meditation Group *n* = 54	Hatha Yoga Group *n* = 65	Waitlist Group *n* = 53
Gender			
Female	83.3 (*n* =45)	63.1 (*n* = 41)	52.8 (*n* = 28)
Male	16.7 (*n* = 9)	36.9 (*n* = 24)	47.2 (*n* = 25)
Race/Ethnicity			
Spanish/Hispanic/Latino	72.2 (*n* = 39)	67.7 (*n* = 44)	56.5 (*n* = 30)
Asian or Pacific Islander	14.8 (*n* = 8)	21.5 (*n* = 14)	24.5 (*n* = 13)
Biracial	3.7 (*n* = 2)	7.7 (*n* = 5)	11.3 (*n* = 6)
Caucasian	0.0 (*n*=0)	1.5 (*n*=1)	1.9 (*n*=1)
African American	1.9 (*n*=1)	1.5 (*n*=1)	0.0 (*n*=0)
Native American	5.6 (*n* = 3)	0.0 (*n* = 0)	3.8 (*n* = 2)
Other	1.9 (*n* = 1)	0.0 (*n* = 0)	1.9 (*n* = 1)
Grade			
7th grade	38.9 (*n* = 21)	44.6 (*n* = 29)	49.1 (*n* = 26)
8th grade	61.1 (*n* = 33)	53.8 (*n* = 35)	50.9 (*n* = 27)
9th grade	0.0 (*n* =0)	1.5 (*n* = 1)	0.0 (*n* = 0)
Period			
2nd period	11.1 (*n*=6)	23.1 (*n*=15)	0.0 (*n*=0)
3rd period	16.7 (*n*=9)	12.3 (*n*=8)	28.3 (*n*=15)
4th period	14.8 (*n*=8)	13.8 (*n*=9)	26.4 (*n*=14)
5th period	13.0 (*n*=7)	20.0 (*n*=13)	20.8 (*n*=11)
6th period	22.2 (*n*=12)	9.2 (*n*=6)	24.5 (*n*=13)
7th period	22.2 (*n*=12)	21.5 (*n*=14)	0.0 (*n*=0)
Previous Meditation Experience			
Never tried	44.4 (*n*=24)	49.2(*n*=32)	34.0 (*n*=18)
Tried once or twice	44.4 (*n*=24)	38.5(*n*=25)	52.8 (*n*=28)
Practice a few times a year	5.6 (*n*=3)	4.6 (*n*=3)	7.5 (*n*=4)
Practice a few times a month	1.9 (*n*=1)	1.5 (*n*=1)	0.0 (*n*=0)
Practice once a week	1.9 (*n*=1)	1.5 (*n*=1)	3.8 (*n*=2)
Practice few times a week	1.9 (*n*=1)	3.1 (*n*=2)	1.9 (*n*=1)
Practice daily	0.0 (*n*=0)	1.5 (*n*=1)	0.0 (*n*=0)
Previous Yoga Experience			
Never tried	55.6 (*n*=30)	53.8(*n*=35)	47.2 (*n*=25)
Tried once or twice	40.7 (*n*=22)	36.9(*n*=24)	45.3 (*n*=24)
Practice a few times a year	1.9 (*n*=1)	4.6 (*n*=3)	3.8 (*n*=2)
Practice a few times a month	1.9 (*n*=1)	3.1 (*n*=2)	1.9 (*n*=1)
Practice once a week	0.0 (*n*=0)	0.0 (*n*=0)	1.9 (*n*=1)
Practice a few times a week	0.0 (*n*=0)	1.5 (*n*=1)	0.0 (*n*=0)
Practice daily	0.0 (*n*=0)	0.0 (*n*=0)	0.0 (*n*=0)
Extracurricular Activities			
No activities	57.4 (*n* = 31)	33.8 (*n* =22)	30.2 (*n* = 16)
1-2 activities	40.8 (*n*=22)	53.9 (*n*=35)	56.6 (*n*=30)
3-4 activities	1.9 (*n*=1)	12.3 (*n*=8)	13.2 (*n*=7)

Note. Data is reported as percentages.

A series of one-way ANOVAs and chi-squared analyses were conducted to determine if randomization produced three equivalent groups with regard to demographic information. There were no significant between-group differences in age, $F(2,171) = 0.81$, $p = .45$; grade $F(2,171) = 0.54$, $p = .59$; class period, $F(2,171) = 0.30$, $p = .29$; or race, $F(2,171) = 2.0$, $p = .15$. Similarly, no significant between group differences were found with regard to previous yoga experience ($p = .54$), or previous sitting meditation experience ($p = .79$). However, there was a significant between-group difference in the number of reported extracurricular activities, $F(2,171) = 4.40$, $p = .02$. The sitting meditation group reported less participation in extracurricular activities compared to the hatha yoga and waitlist control groups. No statistically significant differences were found on any outcome variables when using a series of ANOVAs, suggesting that involvement in extracurricular activities was unlikely to be a confound in this study.

Additionally, there was a significant between-group difference in gender, ($p = .003$). There were significantly fewer male participants in the sitting meditation group ($n = 9$ out of 54, 16.7%) as compared to the hatha yoga group ($n = 24$ out of 65, 36.9%). However, the number of males in the hatha yoga group was similar to the number of males in the waitlist control group ($n = 25$ out of 53, 47.2%). In order to assess the relationship between gender and the outcome variables, independent samples *t*-tests were conducted to see if there were statistically significant differences between males and females on the dependent variables. Upon review, statistically significant differences were found on the CAMM, $F(1,176) = 7.32$, $p = .007$, for males and females. However, given the poor internal consistency of the CAMM, these results should be interpreted with caution.

Feasibility and Acceptability

One primary aim of this study was to evaluate the feasibility, acceptability, and effectiveness of short-term mindfulness training with adolescents in school settings. Intervention feasibility and acceptability was determined by recruitment, attendance, and retention rates. In addition, participants completed brief questionnaires (expectations and experiences forms) to evaluate the intervention they participated in (sitting meditation or hatha yoga).

Feasibility. Participant attendance, recruitment and retention rates, and home practice compliance data were used to assess intervention feasibility. Intervention feasibility partially determines the appropriateness of future efficacy testing (Bowen et. al, 2009). Both sitting meditation and hatha yoga lasted 45 minutes per a session, and the entire intervention lasted six hours for each participant. Mindfulness instructors and physical education teachers reported that this amount of time was feasible given their school schedule and regular workload. Of those who enrolled and were randomized into an intervention group, only 8% dropped out or completed fewer than six sessions. Of those non-completers, seven participants (11%) were from the sitting meditation group and three participants (4%) were from the hatha yoga group, while four (7%) participants were part of the waitlist control group, with each percentage reflecting the total number dropped with respect to their assigned group. Those who missed study sessions predominantly did so due to school absences. This study has a retention rate of 86%. Of those who completed the entire study, 94% of participants reported engaging in some form of home practice in their daily home practice log. The high recruitment and retention rates, session attendance, and home compliance support the feasibility of mindfulness-based interventions among students and teachers in school settings.

Acceptability. Overall, adolescents reported considerable enthusiasm about the program, and the study did not have difficulty recruiting participants. The mindfulness program was able to accommodate approximately half of the sixty students per physical education period. There were numerous students who had shown interest, but were unable to participate due to the limited availability of mindfulness facilitators within the scope of this study. Teachers and school administrators verbally reported their support of student training in mindfulness-based techniques in informal conversation with the researcher. Several teachers noted that they had observed improvements in their students' management of themselves and others. One teacher shared an anecdote about a student who cried often in class, but was able to better manage her strong emotions after several sessions of yoga. Another teacher discussed finding one of her students, who was part of the sitting meditation group, walking away from a conflict when another student provoked him. Additionally, teachers expressed interest in knowing the intervention curriculum so that they could reinforce the skills students learned.

All participants (i.e., those who were initially assigned to one of the two intervention groups and those from the waitlist control group who were later randomized) were asked to complete the expectations questionnaire (n = 169) at pre-intervention and experiences questionnaire (n = 157) at post-intervention. Independent samples t-tests were used to compared those that were initially assigned (n = 107) and those in the waitlist control group that were later assigned (n = 46) to either intervention group. Participants reported similar intervention expectations and experiences, with the exception of helpfulness and relaxation. Participants who were first assigned one of the two interventions experienced significantly greater helpfulness, $t(153) = 2.31$, $p = .02$, and relaxation, $t(154) = 2.15$, $p = .02$, at post-intervention compared to those from the waitlist control group at post-intervention.

Furthermore, independent samples *t*-tests were utilized in comparing participants in the sitting meditation intervention versus those in the hatha yoga intervention. These participants included those who were initially assigned to either intervention, as well as those who were initially waitlisted and then later assigned. Participants from both interventions reported similar values on expected helpfulness, $t(151) = 1.75$, $p = .08$, expected relaxation, $t(151) = 0.29$, $p = .78$, expected usefulness with CD or DVD instructions, $t(151) = 1.15$, $p = .25$, expected improvements in concentration and attention, $t(151) = 0.83$, $p = .41$, and expected enjoyableness $t(151) = 0.54$, $p = .59$. Participants from both interventions also reported similar values on their experienced helpfulness, $t(152) = 0.40$, $p = .69$, experienced relaxation, $t(152) = 0.77$, $p = .45$, experienced usefulness with CD or DVD instruction, $t(152) = 0.26$, $p = .80$, experienced enjoyableness, $t(152) = 0.62$, $p = .53$. Only the post-intervention experience of concentration and attention was found to be statistically significant, with participants in the hatha yoga group reporting greater improvement in their concentration and attention than those in the sitting meditation group, $t(152) = 2.05$, $p = .04$.

Overall, one hundred and forty-one participants completed both expectations and experiences questionnaires. Using a paired *t*-test to compare the responses on the expectations and experiences questionnaires, results indicated a significant increase in the participants' perceptions of helpfulness, $t(140) = 5.61$, $p < .001$, usefulness of CD or DVD instruction, $t(140) = 3.03$, $p = .003$, improvements in concentration and attention, $t(140) = 5.19$, $p < .001$, and enjoyableness, $t(140) = 4.35$, $p < .001$ of the mindfulness interventions. However, no significant differences were found between their perceptions of relaxation at pre-intervention and post-intervention, $t(140) = 1.69$, $p = .09$. Of those who completed the experiences questionnaire,

100% (*N* = 157) of the participants reported that they would like to continue practicing sitting meditation and hatha yoga.

Table 4

Intervention Expectations and Experiences

	N	*M*	*SD*	*SE*
Helpfulness				
Expectation	141	3.77	.743	.063
Experience	141	4.18	.710	.060
Relaxation				
Expectation	141	4.25	.785	.066
Experience	141	4.39	.782	.066
Usefulness of CD/DVD				
Expectation	141	3.50	.968	.082
Experience	141	3.81	.902	.076
Concentration/Attention				
Expectation	141	3.82	.875	.074
Experience	141	3.22	1.109	.093
Enjoyableness				
Expectation	141	4.16	.936	.079
Experience	141	4.50	.639	.054

Note. *M* = mean, *N* = number, *SD* = standard deviation, *SE* = standard error.

Participants in the sitting meditation and hatha yoga conditions reported that they were satisfied overall with the intervention. They also reported that the intervention was helpful and relatively interesting. The participants' comments on the experiences questionnaire reflected a positive experience with the program:

- *"I liked that we got to relax and talk about our true feelings without anyone judging. The whole class was very open. I didn't like leaving."*
- *"I was able to connect with myself and concentrate on myself."*
- *"This will help me in high school when I'll have a lot of stress."*
- *"This meditation group has helped me get over my sad and bad thoughts so thank you for everything."*
- *"I think this class was an amazing opportunity for me and I will continue practicing sitting meditation in the future."*
- *"In some days I felt like I was falling into water and felt the wet warmth surround me and being aware I could breathe underwater in a cool blue."*
- *"Meditation has helped me relax and think more positive in life. It has helped me become much more patient with others."*
- *"We should have a good yoga program in our school."*

- *"I liked how it was very relaxing and helped me calm down. There is nothing that I didn't like about it. The experience was very enjoyable."*

Descriptive Statistics: Dependent Variables

This study had four dependent variables: (a) working memory, measured using the OSPAN (Unsworth, Heitz, Schrock, & Engle, 2005); (b) perceived stress, measured by the PSS (Cohen & Williamson, 1988); (c) anxiety, measured using the SCARED (Birmaher et al., 1997); (d) and mindfulness, as measured by the CAMM (Greco, Dew, & Ball, 2005). Baseline descriptive statistics of these measures are presented in Table 5.

Table 5.

Baseline Descriptive Statistics of Dependent Variables by Group Conditions

Group	*Variable*	*N*	*M*	*SD*	*Min*	*Max*	*Sk*[a]	*K*[a]
Sitting Meditation	OSPAN	54	34.15	18.74	0.00	75.00	0.32	-0.81
	PSS	48	20.13	5.30	9.00	33.00	1.08	-0.57
	SCARED	53	22.96	14.11	2.00	69.00	2.87	1.28
	CAMM	46	47.89	8.43	28.00	65.00	-1.45	-0.59
Hatha Yoga	OSPAN	65	35.92	19.62	0.00	75.00	0.24	-1.33
	PSS	58	19.22	5.36	10.00	31.00	0.08	-1.30
	SCARED	62	23.80	15.03	0.00	53.00	0.65	-1.79
	CAMM	58	50.88	6.78	33.00	66.00	-0.78	0.23
Waitlist Control	OSPAN	53	39.64	20.77	0.00	75.00	-0.51	-1.64
	PSS	43	18.88	6.35	7.00	33.00	0.66	-0.51
	SCARED	50	23.70	14.56	0.00	64.00	0.52	-0.45
	CAMM	49	51.39	8.06	24.00	69.00	-2.10	2.60

Note. *N* = number, *M* = mean, *SD* = standard deviation, *Min* = minimum score, *Max* = maximum score, *Sk* = skewness, *K* = kurtosis. [a]Obtained by dividing values with their respective standard error.

Preliminary Analyses

Prior to conducting the mixed-method ANOVAs for hypothesis testing, preliminary analyses were conducted with the dependent variables. First, the dependent variables were examined for missing data. Second, statistical calculations were performed to determine if the dependent variables met the assumptions for ANOVA. Third, Pearson bivariate correlations were conducted to examine the relationships among dependent variables.

Missing data. There were a number of participants who did not complete all study measures. Nine participants skipped the computerized task at post-intervention. Three participants did not complete the entire measure at post-intervention. One participant did not complete the anxiety measure (SCARED), and three participants did not complete the SCARED at post-intervention. For the mindfulness measure (CAMM), two participants skipped the entire measure at pre-intervention, and another two participants skipped the measure at post-intervention. Descriptive statistics are reported in the following table. In addressing measures that were not completed in their entirety (i.e., whole measure), sample size was sufficient to use case pairwise deletion. This option excluded cases only if they were missing the data required for the specific analysis. The cases were still included in the analysis for which they had the necessary information; thus, there are different sample sizes (*n*) among the various analyses.

Of the completed measures, there were no missing values for three of the four dependent variables (i.e., OSPAN, PSS-10, and CAMM). Less than 5% of cases were missing data on the SCARED measure. Missing data across questionnaire items ranged from one to three items per a measure. Missing data were examined using listwise deletion methods in SPSS to determine if data were missing at random (MAR) or not missing at random (NMAR). The data were shown to be missing at random and therefore mean imputation was used to replace single missing items. Scale means were computed using the mean of available items for each participant.

Testing statistical assumptions. There are three major assumptions that need to be met for a mixed-design ANOVA. The first assumption is that there is normality in the distribution of dependent variable scores (Keppel & Wickens, 2004). The second assumption is that there is homogeneity of variances in the dependent variable data across the independent variable groups (Keppel & Wickens, 2004). The third assumption is that there is homogeneity of covariances,

that is, the covariance matrices of the dependent variables are equal across groups (Keppel & Wickens, 2004).

Normality in the dependent variables was examined via (a) histograms, (b) boxplots, which identified restricted range of scores and outliers, and (c) calculation of the skewness and kurtosis values, with the requirement that values must be less than +/- 2.00 to demonstrate normality (Keppel & Wickens, 2004). Skewness and kurtosis statistics were computed for all variables by dividing the skewness and kurtosis values by their respective standard errors. Most skewness and kurtosis variables were within the acceptable range (-2 to 2), with the exception of the SCARED (skewness = 2.87), which was positively skewed, and the CAMM (skewness = -2.10; kurtosis = 2.60), which was negatively skewed. However, an inspection of the shape of the histograms for these two variables indicated that the scores were only slightly skewed and therefore a transformation was not required. Through visual inspection of the boxplot, a few outliers were found. However, an inspection of 5% trimmed means indicated that these outliers had no impact on the overall mean (Keppel & Wickens, 2004).

Homogeneity of variance, the assumption that the dependent variable scores showed equivalent variances across the three group conditions, was tested by performing the Levene's test of equality of error variances (Keppel & Wickens, 2004). The non-significance of the Levene's test for the four dependent variables showed that all variables met the assumption of homogeneity of variances; that is, variability of scores across group conditions was similar. The homogeneity of covariance assumption was tested using Box's *M* test of equality of covariance matrices (Keppel & Wickens, 2004). Results from the Box's *M* tests showed that the covariance matrices of the dependent variables were equal across three group conditions. These results

showed that the four dependent variables met all assumptions for conducting an analysis of variance (ANOVA).

Pearson bivariate correlations among the dependent variables suggest that the only statistically significant relationship among dependent variables at baseline was between perceived stress (PSS-10) and anxiety (SCARED) scores ($r = .56$, $p < .00$).

See Table 6.

Table 6.

Pearson Bivariate Correlations: Baseline OSPAN, PSS, SCARED, and CAMM Scores (N = 172)

	OSPAN	PSS-10	SCARED	CAMM
OSPAN	1.00			
PSS	-.07	1.00		
SCARED	-.00	.56**	1.00	
CAMM	.00	-.15	-.10	1.00

Note. **Correlation is significant at the 0.01 level (2-tailed).

Hypothesis Testing

This section provides the pre- to post-intervention results across the three study conditions (sitting meditation, hatha yoga, waitlist control). First, the analyses for working memory are presented. Second, the analyses for stress, anxiety and mindfulness are provided. Lastly, the home compliance data are presented.

Hypothesis 1. The first study hypothesis was that adolescents in the sitting meditation group ($n = 51$) would show significantly greater improvement in working memory compared to adolescents participating in the hatha yoga ($n = 60$) and waitlist control conditions ($n = 52$) at post-intervention. A mixed-design analysis of variance (ANOVA) was used to examine changes in working memory functioning, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle, 2005) between three condition groups from pre- to post-intervention. As hypothesized, there was a significant time (pre- and post-intervention) by group (sitting meditation, hatha yoga,

waitlist) interaction, F (2,160) = 4.77, p = .01, η^2_p = .04. A simple effects procedure was then conducted to determine the specific interaction effect and to test the separate group conditions for significance. Results indicated that participants in the sitting meditation group reported significant improvements in working memory from pre- to post-intervention, F(1,50) = 15.71, p < .001, η^2_p =.24, whereas participants in the hatha yoga and waitlist control groups did not (hatha yoga: F(1,59) = 3.85, p =.11, η^2_p = .04, waitlist: F(1, 51) = 0.50, p = .46, η^2_p = .01). These results indicated that sitting meditation is associated with improvements in working memory among the adolescent population. Thus, hypothesis 1 was supported. See Figure 2.

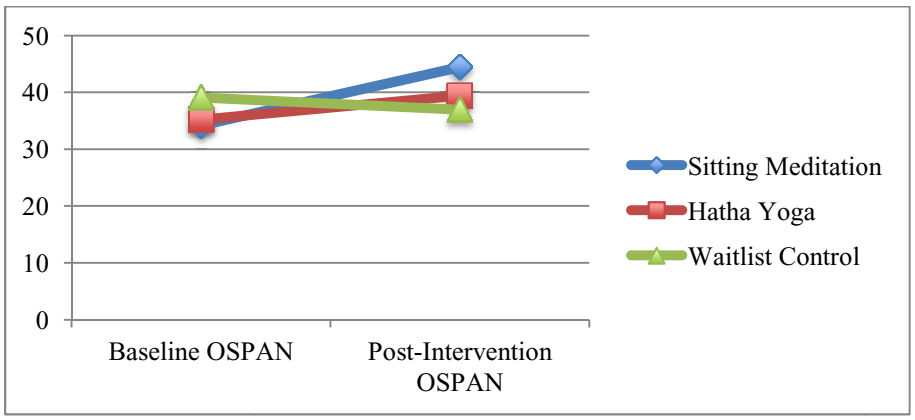

Figure 2. OSPAN scores: Differences across three groups.

Hypothesis 2. The second hypothesis was that adolescents in the sitting meditation (n = 46) and hatha yoga groups (n = 57) would report significantly lower levels of stress and anxiety at post-intervention compared to the waitlist control group (n = 43). A mixed-design analysis of variance (ANOVA) was employed to compare perceived stress scores, as measured by the PSS-10 (Cohen & Williamson, 1988), between the three group conditions from pre- to post-intervention. Results showed no significant condition by time interaction effect, F(2,143) = 1.53, p = .22, η^2_p = .02. There was a significant main effect for time, F(1,143) = 7.10, p = .01, η^2_p=.05, with all three groups showing a reduction in perceived stress from pre- to post-

intervention. The main effect of group conditions was not significant, $F(2,143) = 0.01$, $p = .99$, $\eta^2_p = .00$, suggesting no difference in the effectiveness of the three group conditions. See Figure 3.

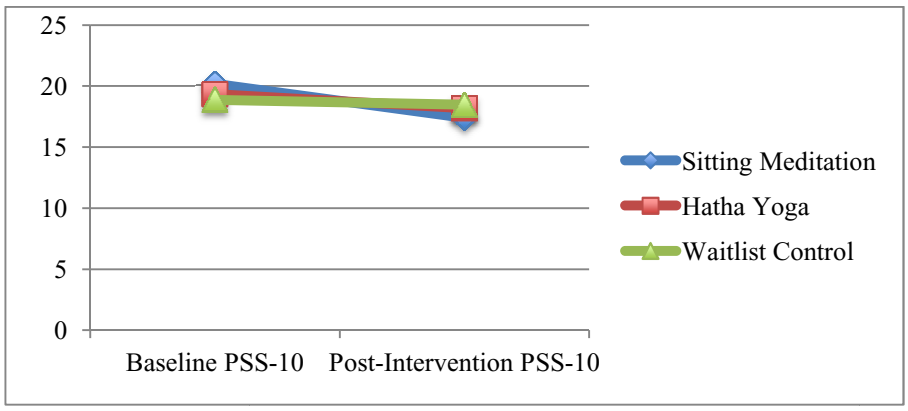

Figure 3. PSS-10 scores: Differences across three groups.

A mixed-design analysis of variance (ANOVA) was employed to examine differences in anxiety, as measured by the SCARED (Birmaher et al., 1999) between the three condition groups (sitting meditation, $n = 51$; hatha yoga, $n = 61$; waitlist control, $n = 50$) from pre- to post-intervention. Results showed no significant condition by time interaction effect, $F(2,159) = 0.22$, $p = .80$, $\eta^2_p = .00$. There was a significant main effect for time, $F(1,159) = 15.73$, $p < .001$, $\eta^2_p = .09$), with all three groups showing a reduction in anxiety from pre- to post-intervention. The main effect of condition was not significant, $F(2,159) = 0.18$, $p = .84$, $\eta^2_p = .00$. Consequently, hypothesis 2 was not supported, suggesting that there were no significant differences in mindfulness techniques in decreasing perceived stress and anxiety among adolescents. See Figure 4.

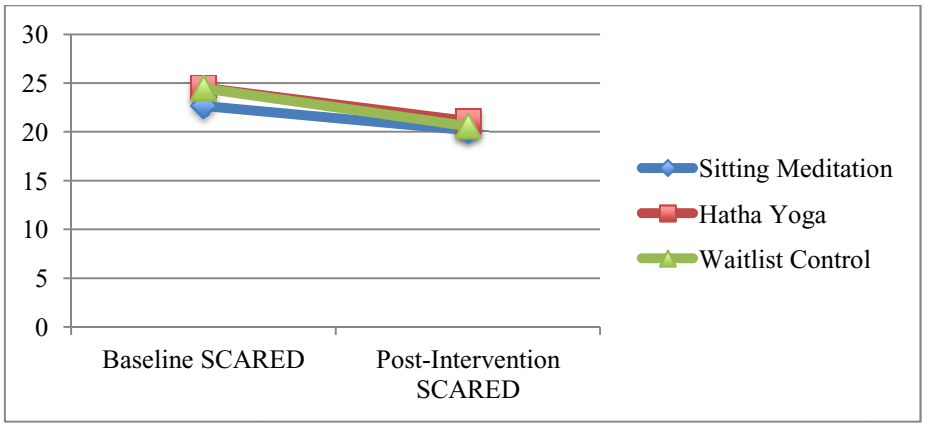

Figure 4. SCARED scores: Differences across three groups.

Hypothesis 3. The third hypothesis was that adolescents in the sitting meditation (n = 44) and hatha yoga groups (n = 57) compared to participants in the waitlist control group (n = 49) would report significantly greater mindfulness at post-intervention. A mixed between-within subjects analysis of variance was conducted to examined pre-to post-intervention differences on mindfulness, as measured by the CAMM (Greco, Dew, & Ball; 2005) between participants in the three group conditions (i.e., sitting meditation, hatha yoga, waitlist control). According to the analysis, there was a significant condition by time interaction effect, $F(2,147) = 3.30$, $p = .04$, $\eta^2_p = .04$. A simple effects procedure was employed to determine the significant interaction effect and to test the separate group conditions for significance. No significant differences in pre- to post- mindfulness scores were found for the sitting meditation group, $F(1,43) = 3.35$, $p = .07$, $\eta^2_p = .07$, the hatha yoga group, $F(1,56) = 0.32$, $p = .58$, $\eta^2_p = .01$, and the waitlist control group, $F(1,48) = 3.35$, $p = .07$, $\eta^2_p = .07$. These results indicated no significant differences among the three group conditions in mindfulness scores, and therefore hypothesis 3 was not supported. However, given the low internal consistency of the CAMM, these results should be interpreted with caution. See Figure 5.

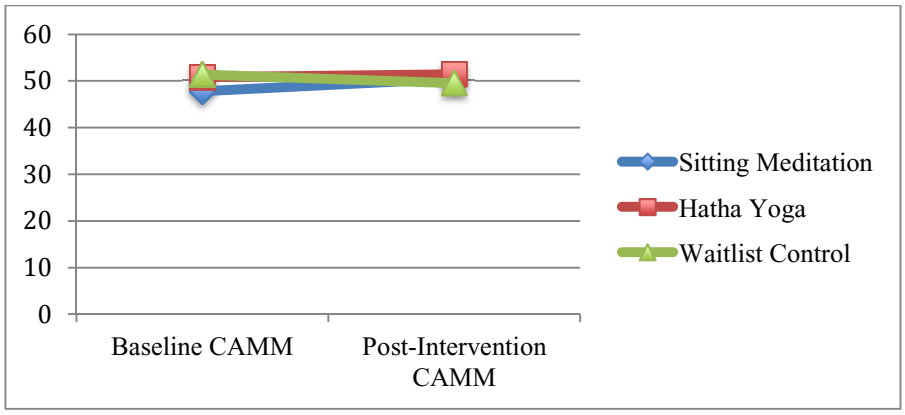

Figure 5. CAMM scores: Differences across three groups.

Hypothesis 4. The fourth hypothesis was that participants in the sitting meditation and hatha yoga groups who were actively compliant with daily home practice would exhibit the greatest improvements in working memory, stress, anxiety, and mindfulness. The home practice data included both intervention and waitlist participants' data after completing the intervention. Of the 172 participants who provided both pre- and post-intervention assessment data, 162 (94%) adolescents provided some or all of their mindfulness home practice data. For these 162 participants, 142 participants turned in week one home practice logs, 135 participants turned in week two home practice logs, and 142 participants turned in week three practice logs. For those who failed to provide any documented home practice or turned in only partial home practice data that did not include their minutes and days of practice, values of zero were entered and treated as "0 minutes of home practice." Thus, practice times may be underestimated, as participants may have engaged in mindfulness intervention practice, which they did not completely document or turn in to the researcher.

On average, participants reported practicing sitting meditation for a total of 5.66 out of the 21 days (SD = 4.24), for approximately 83.77 out of a possible 630 minutes (SD = 117.46). Participants practiced hatha yoga on average 7.22 out of the 21 days, for approximately 142.82

out of a possible 630 minutes (*SD* = 148.52). Independent samples t-tests were conducted and found statistically significant differences in the total practice days and minutes between the two intervention groups (days: $p = .037$; minutes: $p = .007$), with the hatha yoga group reporting greater home practice than the sitting meditation group.

In order to examine the hypothesis that active compliance with daily mindfulness home practice would result in greater improvements in working memory, stress, anxiety, and mindfulness, daily home practice times for each individual were summed yielding a total reported practice time for the first three weeks (21 days) of the intervention. Differences were first examined between participants who, based on their total reported practice times, were in the bottom third and upper third. As such, participants who practiced 30 minutes or less were considered the Low Mindfulness Practice group. Participants who practiced 120 minutes or more were considered the High Mindfulness Practice group.

Effect of home practice compliance on working memory. A mixed-design analysis of variance (ANOVA) was used to examine pre- to post-intervention differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005), between the High Mindfulness Practice group ($n = 56$) and Low Mindfulness Practice group ($n = 51$). Results indicated that there was no significant practice by time interaction effect, $F(1,105) = 0.00$, $p = 1.00$, $\eta^2_p = .00$. There was not a statistically significant main effect of time, $F(1,105) = 3.27$, $p = .07$, $\eta^2_p = .03$, or significant main effect of practice, $F(1,105) = 0.98$, $p = .32$, $\eta^2_p = .01$. See Figure 6.

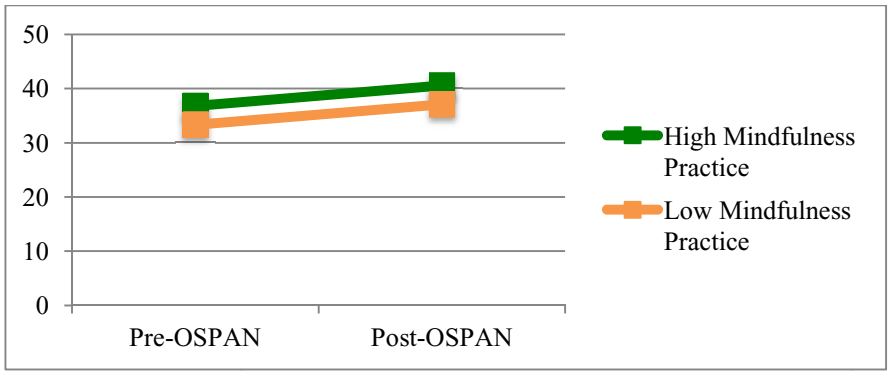

Figure 6. OSPAN scores across high versus low home mindfulness practice groups.

Effect of home practice compliance on perceived stress. A mixed-design analysis of variance (ANOVA) was used to examine differences in perceived stress, as measured by the PSS (Cohen & Williamson, 1988), between the High Mindfulness Practice group (n = 47) and Low Mindfulness Practice group (n = 47). Results indicated that there was not a significant practice by time interaction effect, F (1,92) = 1.15, p = .29, η^2_p =.01. There was not a statistically significant main effect for time, F(1,92) = 3.39, p = .07, η^2_p = .04, or main effect of practice, F(1,92) = 0.22, p =.64, η^2_p = .00. See Figure 7.

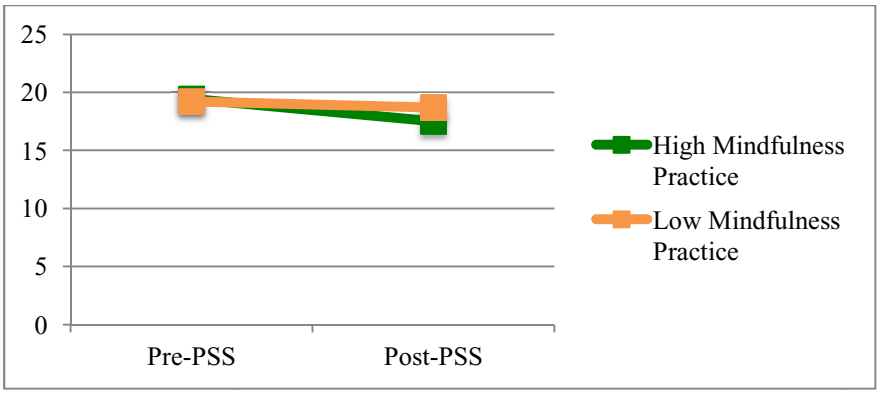

Figure 7. PSS-10 scores across high versus low home mindfulness practice groups.

Effect of home practice compliance on anxiety. A mixed-design analysis of variance (ANOVA) was used to investigate differences in levels of anxiety, as measured by the SCARED (Birmaher et al., 1997) between the High Mindfulness Practice group (n = 53) and Low

Mindfulness Practice group (n = 54). Results indicated that there was no significant practice by time interaction effect, $F(1,105) = 0.00$, $p = .99$, $\eta^2_p = .00$. There was a statistically significant main effect of time, $F(1,105) = 7.93$, $p = .01$, $\eta^2_p = .07$, but no significant main effect of practice, $F(1,105) = 0.18$, $p = .68$, $\eta^2_p = .002$. See Figure 8.

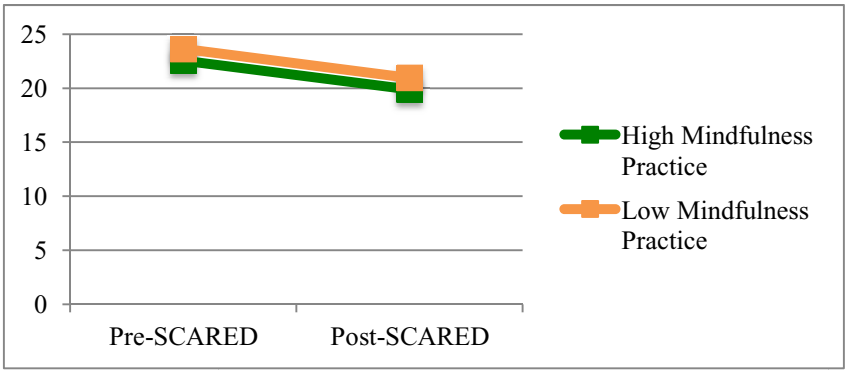

Figure 8. SCARED scores across high versus low home mindfulness practice groups.

Effect of home practice compliance on mindfulness. A mixed-design analysis of variance (ANOVA) was used to examine differences in mindfulness scores, as measured by the CAMM (Greco, Dew, & Ball, 2005) High Mindfulness Practice group (n = 48) and Low Mindfulness Practice group (n = 49) on their CAMM scores between pre-and post-intervention/waitlist. Results indicated that there was no significant practice by time interaction effect, $F(1,95) = 0.03$, $p = .87$, $\eta^2_p = .00$. There was not a statistically significant main effect of time, $F(1,95) = 0.003$, $p = .96$, $\eta^2_p = .00$. The main effect comparing the two group practices was also not significant, $F(1,95) = 0.10$, $p = .75$, $\eta^2_p = .00$. See Figure 9.

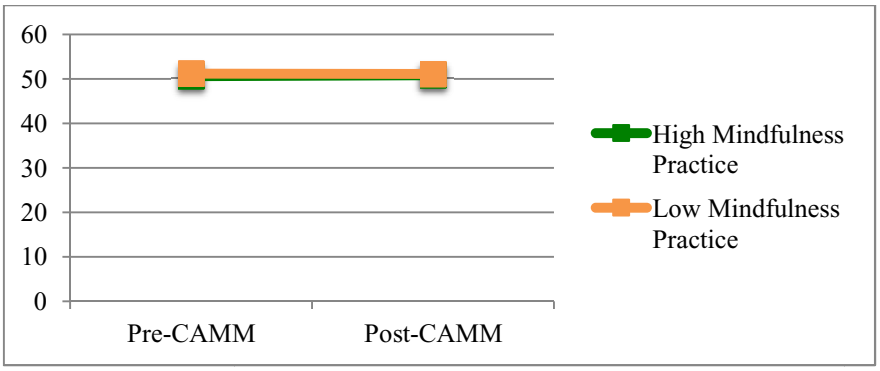

Figure 9. CAMM scores across high versus low home mindfulness practice groups.

Home practice data was then further analyzed by distinguishing practice between the two different intervention groups. Differences were examined comparing the top third to the bottom third of both sitting meditation and hatha yoga groups. For the sitting meditation analyses, participants who practiced 20 minutes or less of total home practice were considered the bottom third and was categorized as Low Sitting Meditation Practice group. Participants who practiced 80 minutes or more were considered the top third and were categorized as the High Sitting Meditation Practice group. For the hatha yoga group analyses, participants who practiced 60 minutes or less of total home practice were considered the Low Hatha Yoga Practice group (bottom third). Participants who practiced 155 minutes or more were considered the High Hatha Yoga Practice group (top third).

Effect of home practice compliance on working memory. A series of mixed-design analysis of variance (ANOVA) analyses were used to further investigate pre- to post-intervention differences in working memory between the High Practice (sitting meditation: $n = 23$; hatha yoga: $n = 30$) and Low Practice (sitting meditation: $n = 25$; hatha yoga: $n = 28$) groups. Results were similar for both interventions, showing no significant practice by time interaction effect (sitting meditation: $F(1,46) = .042$, $p = .84$, $\eta^2_p = .001$; hatha yoga: $F(1,56) = 1.09$, $p = .30$, $\eta^2_p = .02$). There was not a statistically significant main effect for time (sitting meditation: $F(1,46) =$

1.73, $p = .20$, $\eta^2_p = .04$; hatha yoga: $F(1,56) = 0.60$, $p = .44$, $\eta^2_p = .01$) or intervention practice (sitting meditation: $F(1,46) = .17$, $p = .69$, $\eta^2_p = .004$; hatha yoga: $F(1,56) = 0.96$, $p = .33$, $\eta^2_p = .02$). These results suggested that home practice compliance had no significant effect on working memory. See Figure 10 and 11.

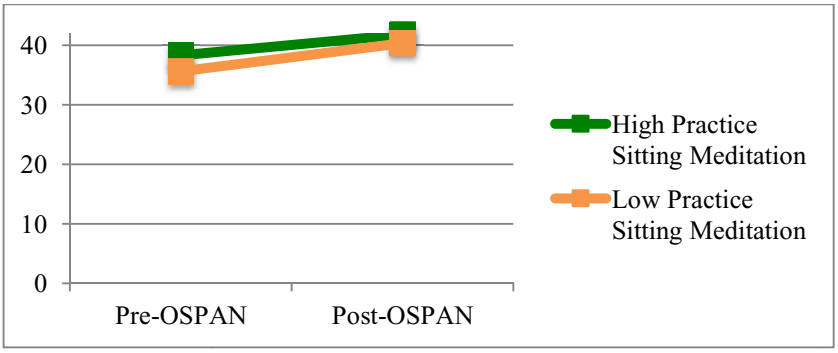

Figure 10. OSPAN scores across high versus low sitting meditation home practice.

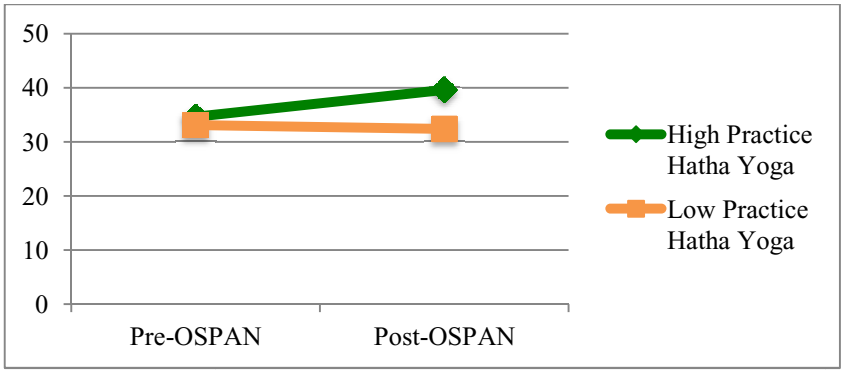

Figure 11. OSPAN scores across high versus low hatha yoga home practice.

Effect of home practice compliance on perceived stress. A series of mixed-design analysis of variance (ANOVA) analyses were used to further investigate pre- to post-intervention differences in perceived stress between High Practice (sitting meditation: $n = 21$; hatha yoga: $n = 25$) and Low Practice (sitting meditation: $n = 20$; hatha yoga: $n = 27$) participants. Results indicated that there were no significant practice by time interaction effect for sitting meditation, $F(1,39) = 1.10$, $p = .30$, $\eta^2_p = .03$, but there was a significant interaction for the hatha yoga condition, $F(1,50) = 12.72$, $p = .001$, $\eta^2_p = .20$. Simple effects procedures were employed to

determine the specific interaction effect and to test the separate group practices for significance. Results indicated that the High Hatha Yoga Practice group reported significantly decreased perceived stress levels, $F(1,24) = 8.52$, $p = .008$, $\eta^2_p = .26$, whereas the Low Hatha Yoga Practice group showed significantly increased perceived stress, $F(1,26) = 4.61$, $p = .04$, $\eta^2_p = .15$. There was not a statistically significant main effect for time (sitting meditation: $F(1,39) = 3.03$, $p = .09$, $\eta^2_p = .07$; hatha yoga: $F(1,50) = 0.25$, $p = .62$, $\eta^2_p = .01$) or main effect for practice (sitting meditation: $F(1,39) = 1.05$, $p = .31$, $\eta^2_p = .03$; hatha yoga: $F(1,50) = 0.06$, $p = .81$, $\eta^2_p = .001$). These results indicated that home compliance had no significant impact on perceived stress. See Figure 12 and 13.

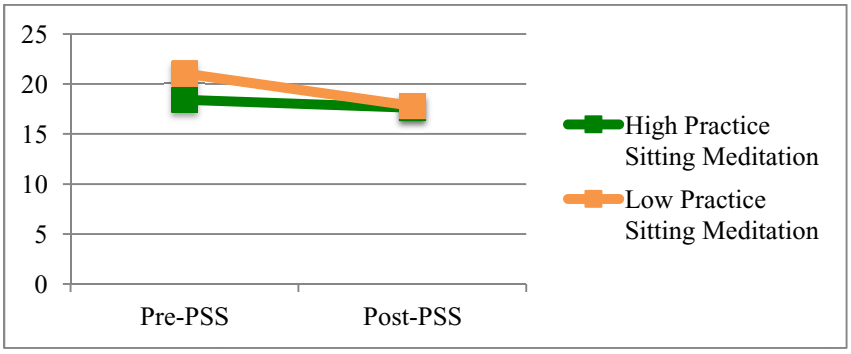

Figure 12. PSS-10 scores across high versus low sitting meditation home practice.

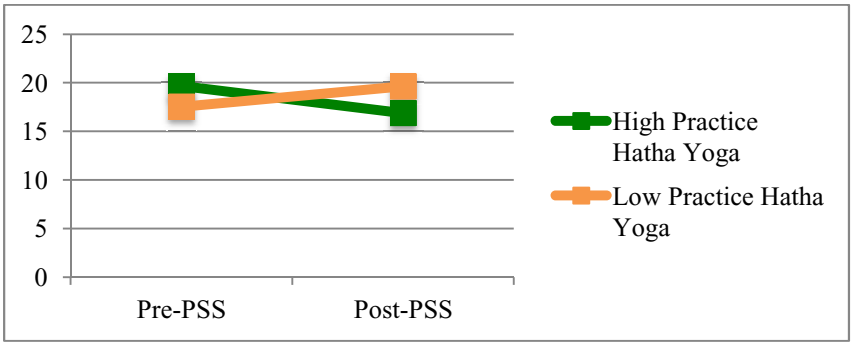

Figure 13. PSS-10 scores across high versus low hatha yoga home practice.

Effect of home practice compliance on anxiety. A series of mixed-design analysis of variance (ANOVA) analyses were used to further investigate pre- to post-intervention

differences in anxiety between High Practice (sitting meditation: $n = 24$; hatha yoga: $n = 27$) and Low Practice (sitting meditation: $n = 25$; hatha yoga: $n = 30$) participants. Results showed no significant practice by time interaction effect, (sitting meditation: $F(1,47) = 1.22$, $p = .28$, $\eta^2_p = .03$; hatha yoga: $F(1,55) = 0.02$, $p = .89$, $\eta^2_p = .00$). There was a statistically significant main effect of time for sitting meditation: $F(1,47) = 2.65$, $p = .11$, $\eta^2_p = .05$, but not for hatha yoga, $F(1,55) = 10.04$, $p = .002$, $\eta^2_p = .16$). The main effect of practice was not statistically significant (sitting meditation: $F(1,47) = 2.06$, $p = .16$, $\eta^2_p = .04$; hatha yoga: $F(1,53) = .61$, $p = .44$, $\eta^2_p = .01$). These results demonstrated that home practice compliance did not produce significant changes in anxiety scores. See Figure 14 and 15.

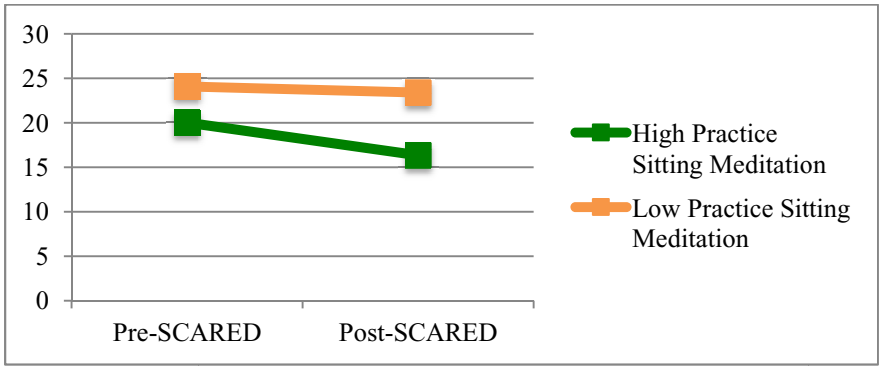

Figure 14. SCARED scores across high versus low sitting meditation home practice groups.

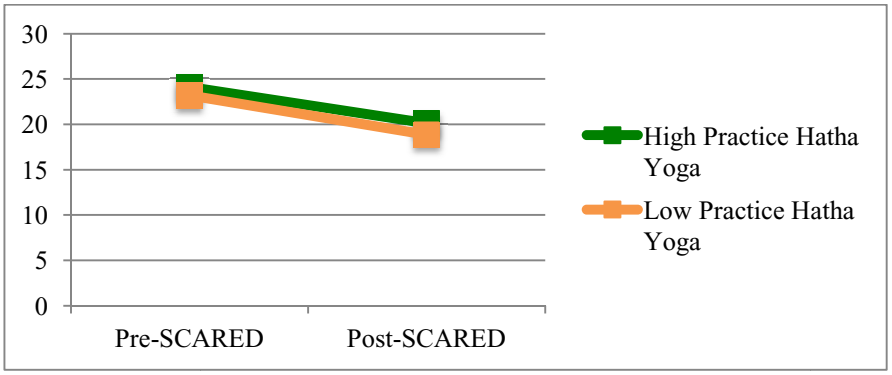

Figure 15. SCARED scores across high versus low hatha yoga home practice groups.

Effect of home practice compliance on mindfulness. A series of mixed-design analysis of variance (ANOVA) analyses were used to further investigate pre- to post-intervention differences in mindfulness between the High Practice group (sitting meditation: $n = 20$; hatha yoga: $n = 25$) and Low Practice group (sitting meditation: $n = 23$; hatha yoga: $n = 28$). Results were similar for both interventions showing no significant condition by time interaction effect, (sitting meditation: $F(1,41) = 1.82$, $p = .19$, $\eta^2_p = .04$; hatha yoga: $F(1,51) = 0.15$, $p = .70$, $\eta^2_p = .003$). There was not a statistically significant main effect of time (sitting meditation: $F(1,41) = 1.43$, $p = .24$, $\eta^2_p = .03$; hatha yoga: $F(1,51) = 0.01$, $p = .95$, $\eta^2_p = .00$). The main effect of practice was not significant for sitting meditation, $F(1,41) = 3.93$, $p = .05$, $\eta^2_p = .09$, or for hatha yoga, $F(1,51) = 0.15$, $p = .70$, $\eta^2_p = .003$. These results suggested that home compliance did not significantly impact mindfulness scores. See Figure 16 and 17.

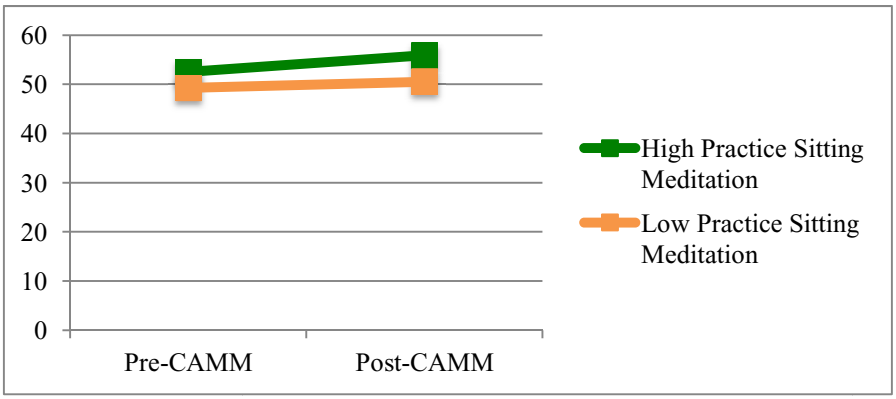

Figure 16. CAMM scores across high versus low sitting meditation home practice groups.

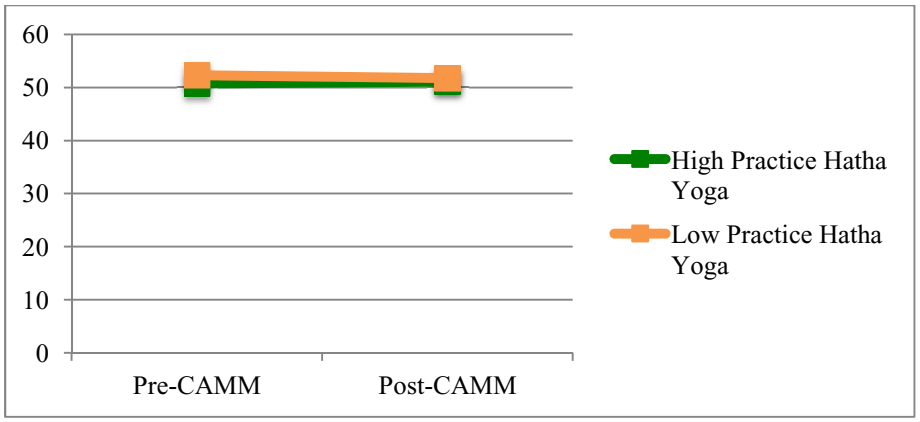

Figure 17. CAMM scores across high versus low hatha yoga home practice groups.

Exploratory Analyses

This section presents the data from post-hoc analyses. First, the data from the parent-proxy reports of youth anxiety was examined from pre- to post-intervention. Second, the post-hoc analyses data were collapsed across intervention conditions to compare intervention versus no intervention (waitlist control). Third, the outcome data pertaining to all participants who were in the one-month follow-up data are provided. Finally, this section describes the findings pertaining to the waitlist control after completion of an intervention. All four dependent variables (OSPAN, PSS-10, SCARED, and CAMM) are examined for all post-hoc analyses.

Parent-proxy reports of youth anxiety. One hundred and seventeen out of 172 parents completed the SCARED-P at pre-intervention. Out of those, one-fourth of the parents (25%) parents chose to complete the Spanish version of the SCARED-P form. Of the 117 parents who completed pre-intervention measures, 51 (44%) parents completed the SCARED-P at post-intervention.

Thus, 51 SCARED-P scores were analyzed at pre- and post- intervention/waitlist. A mixed-design analysis of variance (ANOVA) was employed to compare SCARED-P scores among the three condition groups (sitting meditation, $n = 14$; hatha yoga, $n = 11$; waitlist control,

n = 14) at pre- and post-intervention/waitlist. Results showed no significant group by time interaction, $F(2,36) = 0.95$, $p = .39$, $\eta^2_p = .05$. There was also no significant main effect for time $F(1,36) = 0.30$, $p = .59$ $\eta^2_p = .01$, and no main effect for group condition, $F(2,36) = 0.16$, $p = .85$, $\eta^2_p = .01$. See Figure 18.

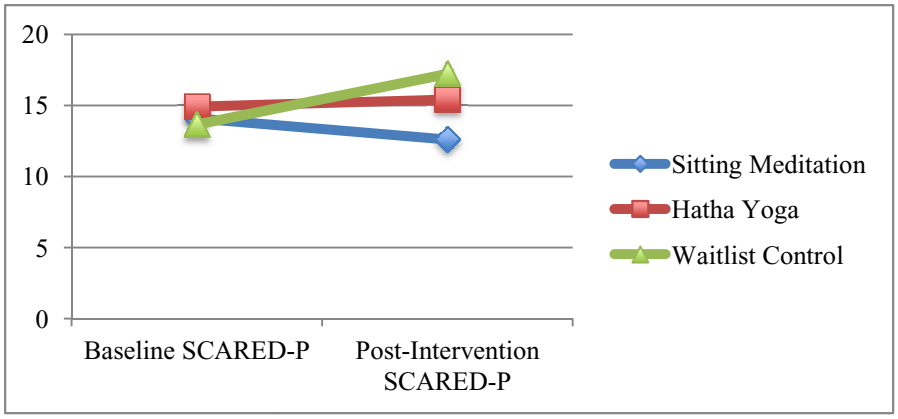

Figure 18. Parent SCARED scores: Differences across three groups.

Intervention Versus Waitlist Control Group Results

Working memory. A mixed-design analysis of variance (ANOVA) was used to examine pre- to post-intervention differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005) between participants who received an intervention (sitting meditation or hatha yoga; *n* = 111) versus those who did not receive any intervention (waitlist control; *n* = 52). Results indicated that there was a significant condition by time interaction effect, $F(1,161) = 7.05$, $p = .01$, $\eta^2_p = .04$. The simple effects procedure demonstrated significant pre- to post-intervention increases in working memory scores for the intervention group, but not for the waitlist control group (intervention: $F(1,110) = 14.45$, $p < .001$, $\eta^2_p = .12$, waitlist: $F(1,51) = 0.46$, $p = .50$, $\eta^2_p = .01$). See Figure 19.

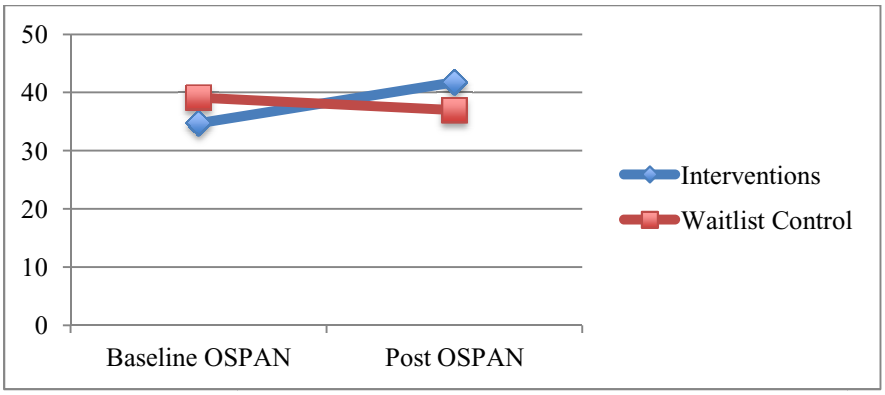

Figure 19. OSPAN scores: Intervention versus waitlist control.

Perceived stress. A mixed-design analysis of variance (ANOVA) was used to examine pre- to post-intervention differences in perceived stress, as measured by the PSS (Cohen & Williamson, 1988), between adolescents who received an intervention (sitting meditation or hatha yoga; $n = 103$) versus those who did not receive an intervention (waitlist control; $n = 43$). Results indicated that there was no significant condition by time interaction effect, $F(1,144) = 1.51$, $p = .22$, $\eta^2_p = .01$. Results indicated that there was no significant condition by time interaction effect, $F(1,144) = 1.5$, $p = .22$, $\eta^2_p = .01$. There was no significant main effect for time, $F(1,144) = 3.75$, $p = .06$, $\eta^2_p = .03$ or condition, $F(1,144) = 0.02$, $p = .90$, $\eta^2_p = .00$. See Figure 20.

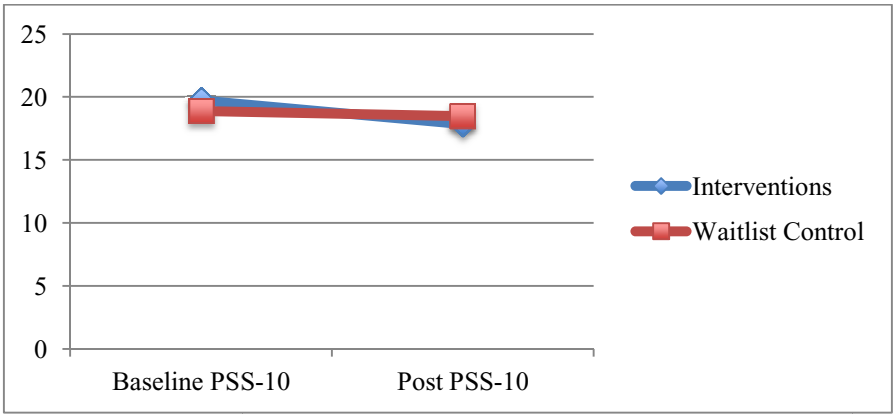

Figure 20. PSS-10 scores: Intervention versus waitlist control.

Anxiety. A mixed-design analysis of variance (ANOVA) was used to examine pre- to post-intervention differences in anxiety, as measured by the SCARED (Birmaher et al., 1999), between participants who received an intervention (sitting meditation or hatha yoga; $n = 112$) versus participants who did not receive an intervention (waitlist control; $n = 50$). Results indicated that there was no significant condition by time interaction effect, $F(1,160) = .24$, $p = .63$, $\eta^2_p = .001$. The main effect for time was significant, $F(2,160) = 15.05$, $p < .001$, $\eta^2_p = .09$, with both the intervention and waitlist control groups showing decreases in anxiety from pre- to post-intervention. The main effect of condition was not significant, $F(1,160) = 0.03$, $p = .87$, $\eta^2_p = .00$. See Figure 21.

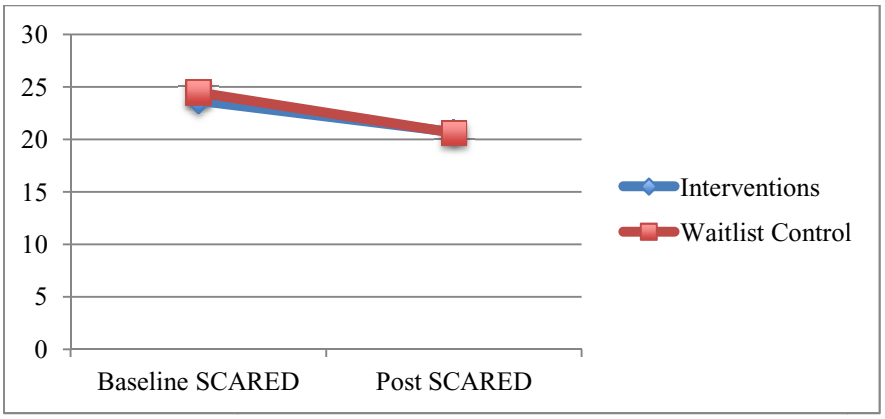

Figure 21. SCARED scores: Intervention versus waitlist control.

Mindfulness. A mixed-design analysis of variance (ANOVA) was used to examine pre- to post-intervention differences in mindfulness, as measured by the CAMM (Greco, Dew, & Ball, 2005), between participants who received an intervention (sitting meditation or hatha yoga; $n = 101$) versus participants who did not receive an intervention (waitlist control; $n = 49$). Results indicated that there was a significant condition by time interaction effect, $F(1,148) = 5.15$, $p = .03$, $\eta^2_p = .03$. The simple effects procedure demonstrated that no significant differences between the pre- to post-intervention time periods for either the intervention or

waitlist control group (intervention: $F(1,100) = 2.88$, $p = .09$, $\eta^2_p = .03$, waitlist: $F(1,48) = 3.35$, $p = .07$, $\eta^2_p = .07$). See Figure 22.

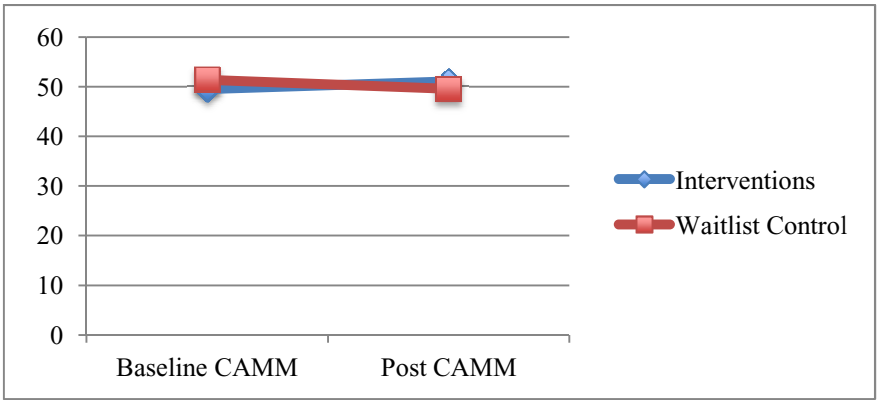

Figure 22. CAMM scores: Intervention versus waitlist control groups.

Parent-proxy reports of youth anxiety. A mixed-design analysis of variance (ANOVA) was used to compare participants who received either intervention (sitting meditation or hatha yoga; $n = 25$) to participants who did not receive any intervention (waitlist control; $n = 14$) on the SCARED-P scores between pre-and post-intervention/waitlist. Results indicated that there was not a significant condition by time interaction effect, $F(1,37) = 1.68$, $p = .20$, $\eta^2_p = .04$. There was not a significant main effect of time, $F(1,37) = 0.84$, $p = .37$, $\eta^2_p = .02$, nor was there a main effect of condition, $F(1,37) = 0.14$, $p = .71$, $\eta^2_p = .00$. See Figure 23.

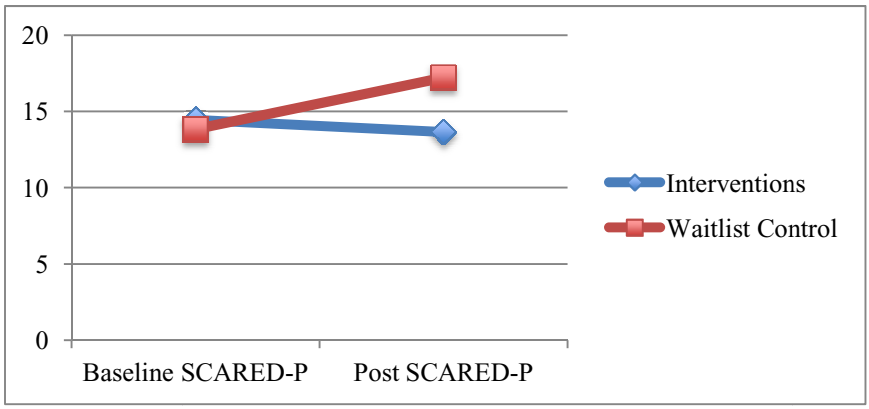

Figure 23. SCARED-P scores: Interventions versus waitlist control.

Follow-Up Results

Though the main purpose of the study was to compare groups pre- to post-intervention, the study also explored the follow-up data post-hoc. Data was collected from all participants one-month after the completion of their respective interventions (i.e., sitting meditation and yoga). Of the 172 participants who completed the entire study, approximately 30 participants (17.4% of the total sample) were able to participate in the one-month follow-up data collection. Of the 30 participants, 87% (n = 26) reported continued sitting meditation and hatha yoga practice at least once a month. Approximately 50% (n = 15) of the participants reported practicing meditation/yoga once a week or more. Due to the nature of the small follow-up data sample size, the two intervention conditions (sitting meditation and hatha yoga) were collapsed across the three time points (pre-intervention, post-intervention, one-month follow-up).

Working memory: Follow-up results. A repeated-measures design analysis of variance (ANOVA) was used to examine differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005), across three time points for participants (n = 14) who were assigned to either intervention group. Results indicated no statistically significant differences across the three time points, $F(2,12) = 1.71$, $p = .22$, $\eta^2_p = .22$; however, the effect size was large. See Figure 24.

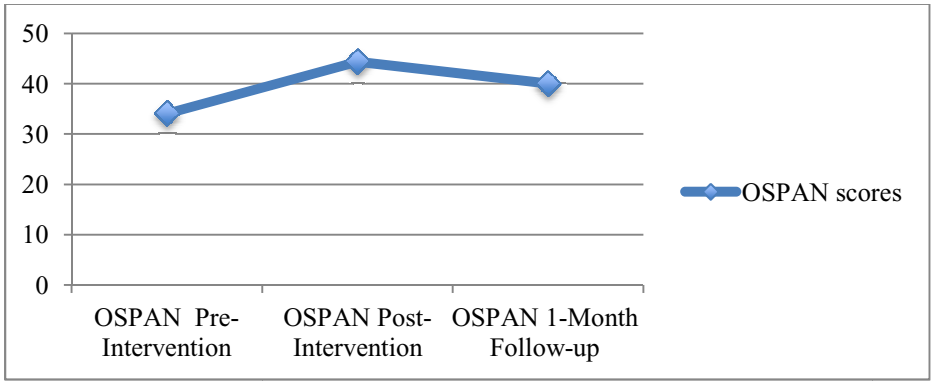

Figure 24. One-month follow-up OSPAN scores.

Perceived stress: Follow-up results. A repeated-measures design analysis of variance (ANOVA) was used to examine differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005), across three time points for participants (n = 24) who were assigned to either intervention group. Results indicated no statistically significant differences across the three time points, $F(2,22) = 3.14$, $p = .06$, $\eta^2_p = .22$; however, the effect size was large. See Figure 25.

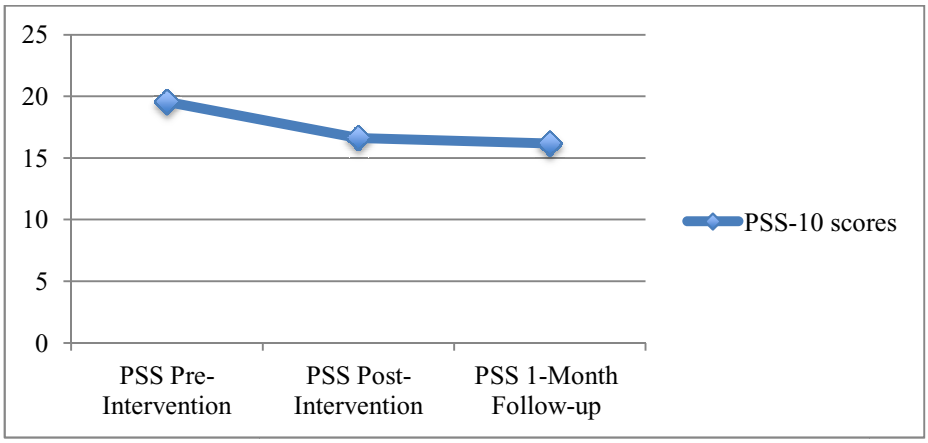

Figure 25. One-month follow-up PSS-10 scores.

Anxiety: Follow-up results. A repeated-measures design analysis of variance (ANOVA) was used to examine differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005), across three time points for participants (n = 24) who were assigned to either intervention group. Results showed a statistically significant difference across the three time points, $F(2,22) = 6.21$, $p = .007$, $\eta^2_{pm} = .36$, with a large effect size. See Figure 26.

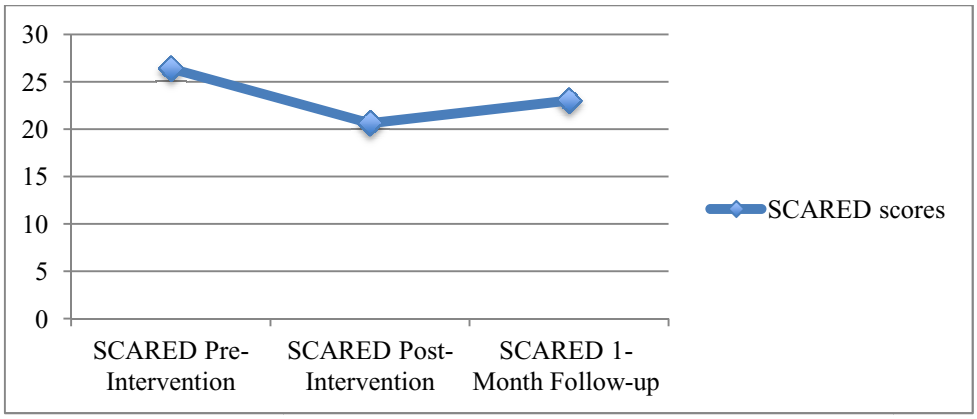

Figure 26. One-month follow-up SCARED scores.

Mindfulness: Follow-up results. A repeated-measures design analysis of variance (ANOVA) was used to examine differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005), across three time points for participants (n = 24) who were assigned to either intervention group. Results indicated no statistically significant differences across the three time points, $F(2,22) = 2.36$, $p = .12$, $\eta^2_p = .18$; however the effect size was large. See Figure 27.

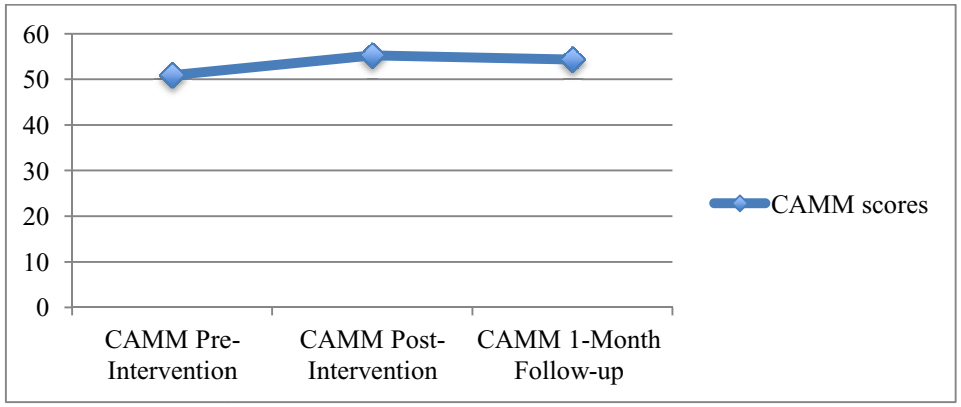

Figure 27. One-month follow-up CAMM scores.

Waitlist Randomization

Primary analyses involving the waitlist control participants were those pertaining to pre- to post-intervention group differences. This study, however, was able to collect additional post-

intervention and one-month follow-up data after the waitlist control participants completed their assigned intervention. After completion of the waitlist period, participants in the waitlist control group (n = 53) were randomly assigned to either a sitting meditation or hatha yoga group. Of the 53 participants, five dropped out after completing the post-waitlist/pre-intervention measures. Therefore, 48 waitlist participants completed an intervention condition and were included in the analyses described below. Waitlist control data was collected and analyzed at two different time points (post-waitlist/pre-intervention, and post-intervention). This section of analyses is focused on the results from post-waitlist/pre-intervention (Time 2) to post-intervention (Time 3) as no differences were shown between Baseline and Time 2.

Working memory: Waitlist randomization. A mixed-design analysis of variance (ANOVA) was used to examine differences in working memory, as measured by the OSPAN (Unsworth, Heitz, Schrock, & Engle; 2005), between waitlist control participants who were randomized into the sitting meditation group (n = 14) and into the hatha yoga group (n = 25). Results indicated that there was no significant interaction effect between condition and time, $F(1,37) = 0.19$, $p = .89$, $\eta^2_p = .001$. There was not a statistically significant effect of time, $F(1,37) = 0.64$, $p = .80$, $\eta^2_p = .002$, or condition, $F(1,37) = 0.002$, $p = .964$, $\eta^2_p = .00$.

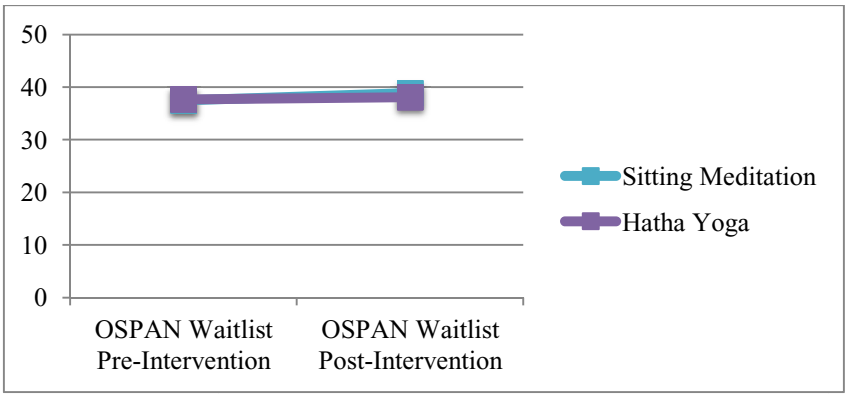

Figure 28. Waitlist Randomization OSPAN scores across time points.

Perceived stress: Waitlist randomization. A mixed-design analysis of variance (ANOVA) was used to examine differences in perceived stress, as measured by the PSS (Cohen & Williamson, 1988), between the waitlist control participants who were randomized into the sitting meditation condition (n = 19) versus into the hatha yoga condition (n = 22). Results indicated no significant condition by time interaction effect, $F(1,39) = 2.19$, $p = .15$, $\eta^2_p = .05$. There was not a statistically significant main effect of time, $F(1,39) = 1.96$, $p = .17$, $\eta^2_p = .05$, nor was there a significant main effect of condition, $F(1,39) = 0.38$, $p = .54$, $\eta^2_p = .01$. See Figure 29.

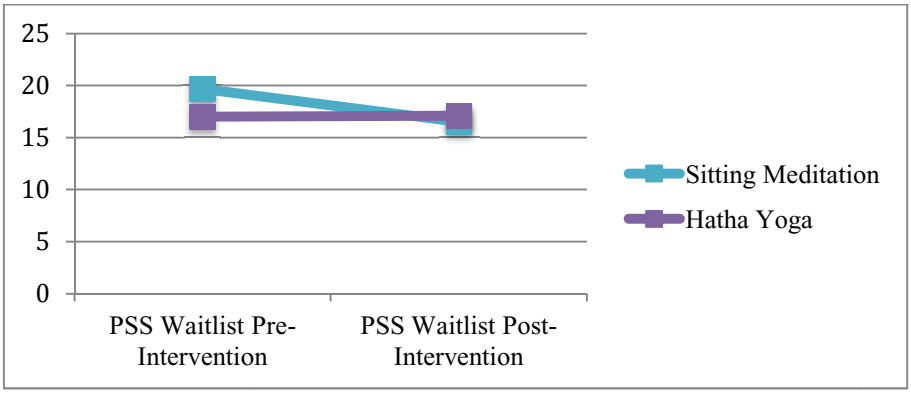

Figure 29. Waitlist randomization PSS-10 scores across time points.

Anxiety: Waitlist randomization. A mixed-design analysis of variance (ANOVA) was used to examine differences in anxiety, as measured by the SCARED (Birmaher et al., 1999), between waitlist control participants who were randomized into the sitting meditation condition (n = 22) and into the hatha yoga condition (n = 24). Results displayed no significant condition by time interaction effects, $F(1,44) = 1.15$, $p = .29$, $\eta^2_p = .03$. There was a statistically significant main effect of time, $F(1,44) = 8.12$, $p = .01$, $\eta^2_p = .16$: participants in both the sitting meditation and hatha yoga groups showed a reduction of anxiety across two time points. The main effect of condition was not significant, $F(1,44) = 0.88$, $p = .35$, $\eta^2_p = .02$. See Figure 30.

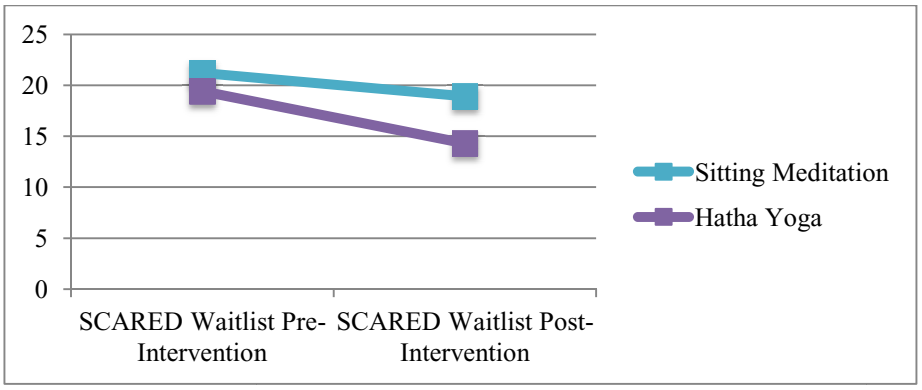

Figure 30. Waitlist randomization SCARED scores across time points.

Mindfulness: Waitlist randomization. A mixed-design analysis of variance (ANOVA) was used to examine differences in mindfulness, as measured by the CAMM (Greco, Dew, & Ball, 2005), between waitlist control participants who were randomized into the sitting meditation group (n = 21) and into the hatha yoga group (n = 24). Results indicated no significant condition by time interaction effect, $F(1,43) = 0.14$, $p = .71$, $\eta^2_p = .003$. There was a statistically significant main effect of time, $F(1,43) = 4.79$, $p = .03$, $\eta^2_p = .10$, with both sitting meditation and hatha yoga group participants showing an increase in mindfulness. There was no significant main effect of condition, $F(1,43) = .71$, $p = .40$, $\eta^2_p = .02$. See Figure 31.

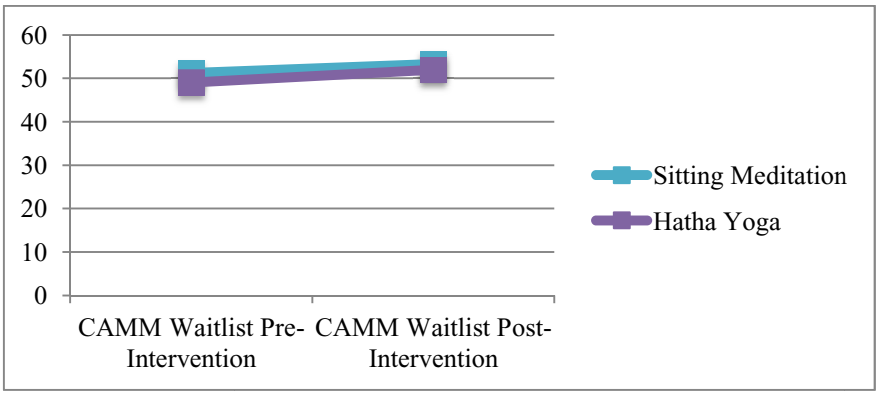

Figure 31. Waitlist randomization CAMM scores across time points.

Chapter IV

Discussion

The purpose of this randomized controlled trial was to evaluate the following, with regard to Mindfulness-Based Stress Reduction (MBSR): (a) the feasibility and acceptability of mindfulness interventions in a school setting; and (b) the relative effectiveness of two core components of MBSR (sitting meditation and hatha yoga) on working memory, stress, anxiety, and mindfulness in an adolescent community sample. The broader goal of this study was to advance our understanding of different mindfulness techniques, their unique benefits, and their potential effectiveness among youth.

Hypothesis Testing

Mindfulness interventions and working memory. Our first hypothesis was that adolescents in the sitting meditation group would show significantly greater improvement in working memory capacity compared with those in the hatha yoga and waitlist control conditions. This hypothesis was supported by the data. The results revealed a significant increase in working memory capacity for participants in the sitting meditation practice, whereas those in hatha yoga and the waitlist control groups did not display significant changes. This finding is in line with past research supporting the effectiveness of meditation training on working memory (Jha et al., 2010; Mrazek et al., 2013). Previous studies have attributed this finding to the mechanism of meditation training, which requires sustained attention on a single point of focus (e.g., the sensation of the breath, a particular sound, etc.), while, at the same time, redirecting that particular attention to the present-moment. This practice of holding information in the mind, while redirecting the information, is similar to the function of working memory (Baddeley & Hitch, 1974). While the majority of prior research regarding meditation and its impact on

working memory capacity has been focused on adult populations in various community settings, this present study demonstrates that meditation shows similar benefits in a younger, adolescent population within a school setting. One issue in need of addressing is the meaning behind the changes on the AOSPAN scores. Though there is not a clinical cut-off for the AOSPAN, it is notable that in the present study, the pre-post change in scores ($\Delta y = \sim 10$) in the sitting meditation group was larger relative to previous studies with adolescent samples ($\Delta y = \sim 4\text{-}6$; Glass, Maddox, & Love, 2013; Padilla, Pérez, & Andrés, 2014).

Furthermore, the present finding suggests that sitting meditation may be effective in strengthening students' cognitive abilities; however, participation in hatha yoga did not show the same effects. Previous findings have suggested that the different practices commonly included in mindfulness-based interventions may target different aspects of psychological health (Sauer-Zavala, Walsh, Eisenlohr-Moul, & Lykins, 2012). Hatha yoga, for example, places an emphasis on postures and breathing, which requires different physical and mental involvements than sitting meditation. As with sitting meditation, current research has found hatha yoga to have physiological and psychological benefits, such as improvement in mood, decreased stress, lessening of somatic complaints and depression, and improved quality of life (Jenson & Kenny, 2004; Oken et al., 2004; Uebelacker et al., 2010). However, few studies have investigated its impact on brain functioning, and thus, interpreting comparative results is difficult. Overall, differences in mechanisms between hatha yoga and sitting meditation may explain why the participants in the hatha yoga group did not show significant improvements in their working memory capacity post-intervention.

Mindfulness interventions and youth-reported stress and anxiety. The second hypothesis was that adolescents in the sitting meditation and hatha yoga groups would report

significantly lower levels of stress and anxiety at post-intervention, compared to the waitlist control group. This hypothesis was not supported: all three group conditions (sitting meditation, hatha yoga, and waitlist control group) showed a reduction in stress and anxiety post-intervention. Despite the non-significant finding in between-group differences, this study did discover significant decrease in stress and anxiety from pre- to post-intervention with all three conditions. This finding complements the results from several related studies examining the usage of mindfulness techniques to decrease stress and anxiety (Biegel et al., 2009, Hofmann et al., 2010, Mendelson et al. 2010). However, our study cannot entirely attribute these findings to mindfulness interventions, as the waitlist control condition also demonstrated a significant decrease in stress and anxiety.

One potential explanation may be the low internal consistency on the PSS-10 measure due to inconsistent response pattern. This finding was not in line with previous research estimating coefficient alpha reliability to be 0.72 (Cohen, Kamarck & Mermelstein, 1983). However, in previous research, the majority of studies assessing the PSS-10 used general adult and college student samples (Hewitt, Flett, & Mosher, 1992; Mimura & Griffiths, 2004; Remor, 2006). In the present study, ninety-six percent of adolescents were of ethnic minority backgrounds living in a middle to lower SES neighborhoods. In addition, patterns of inconsistent responding were primarily (74%) found among the Hispanic participants. Perhaps the combination of living in a middle to lower SES neighborhood and the increased likelihood of language barriers inhibited a portion of participants from fully comprehending self-report items. Though participants who were found to be responding inconsistently were excluded from analyses, results from the PSS-10 should be interpreted with caution.

Another possible reason why significant between-group differences were not found may be using a community, rather than clinical sample. Past research has found significant improvements in levels of perceived stress and anxiety with clinical samples, such as breast cancer patients, sufferers of fibromyalgia, and psychiatric outpatients (Weissbecker et al., 2002; Biegal et al., 2009; Lengacher et al., 2009). However, the current study included adolescents who scored similarly on the PSS (M = 19.28) relative to other community samples of adolescents (M = 19; Augustine, Rao, Rao, Laxmaiah, & Nair, 2011; Lemon & Watson, 2011). Likewise, approximately half (53%) of participants in this study scored within the normal range on the SCARED. Approximately 12% scored in the at-risk range and 35% in the clinical range. It is possible that moderate or high levels of stress and anxiety can be reduced through mindfulness training, but those within the normal range would have limited room for improvement (Lee, Semple, Rosa, & Miller, 2008). If true, this would explain the lack of significant differences between those who participated in an intervention and those who did not.

From the results of our current study, along with the knowledge acquired from previous research, it can be deduced that different sample populations react differently to mindfulness interventions. This result suggests that while participation in sitting meditation and hatha yoga may lead to a decrease in stress and anxiety, other factors likely played a role that caused the waitlist control group to demonstrate the same decrease in stress and anxiety. Non-experimental factors may include the timing of the intervention, which was near the end of the academic school year, or even a possible diffusion of intervention effects into the control group. These are some possible interpretations of why our study did not find a significant difference between the three group conditions in addition to the low reliability, problems with inconsistent responding, and possible comprehension issues described above.

Mindfulness interventions and youth-reported mindfulness. The third hypothesis was that participants in the sitting meditation and hatha yoga groups would report significantly greater levels of mindfulness post-intervention compared to the waitlist control group. This hypothesis was not supported. No significant changes in mindfulness were found in any of the three conditions (sitting meditation, hatha yoga, and waitlist control). However, it should be noted that the CAMM measure used in the study was found to have extremely low internal consistency (Cronbach's alpha = .41), and thus, results pertaining to this measure should be interpreted with caution. We can possibly attribute the low internal consistency to inconsistent responding as some participants may not have been as interested or invested in the study. Participants may have volunteered in the study to opt out of their mandatory physical education classes in school, and thus they were not truly interested in learning the mindfulness techniques. Another possibility may be confusion as a result of reverse wording of items (Sonderen, Sanderman, & Coyne, 2013). Lastly, mindfulness involves a variety of theories and conceptualizations, which may be difficult to capture in a single self-report measure (Brown, West, Loverich, & Biegel, 2011). Mindfulness is an abstract concept that may be difficult for even adults to fully grasp (Bishop, 2002; Brown & Ryan, 2003) and thus, adolescents may have a challenging time comprehending the questions on mindfulness measures in general, which may have resulted in low internal consistency on the CAMM.

The validity evidence for the CAMM is inconsistent in the current literature. Studies have generally found CAMM to display adequate internal consistency, and thus it is considered a developmentally appropriate measure for school-aged children and adolescents (Greco et. al, 2011; Greco, Murrell, & Coyne, 2005). However, those studies were validated with school-aged children and adolescents who were predominately Caucasian and living in higher SES

neighborhoods (Greco, Baer, & Smith, 2006). Thus, the CAMM measure may not be as sensitive for use with ethnic minorities from predominantly low to middle class SES.

Home practice and mindfulness intervention outcomes. The fourth hypothesis was that participants in the sitting meditation and hatha yoga groups who were actively compliant with daily home practice would exhibit the greatest improvements in working memory, stress, anxiety, and mindfulness. This hypothesis was not supported with regard to working memory, anxiety, and mindfulness levels post-intervention. These findings imply that home practice compliance did not contribute to the benefits seen in this study. However, when the data was further explored to separately evaluate by intervention type (sitting meditation or hatha yoga), it was found that high-frequency hatha yoga practitioners showed a significant decrease in stress, whereas low-frequency hatha yoga practitioners showed a significant increase in perceived stress. This finding is consistent with the current hatha yoga literature indicating psychological benefits, especially with regards to perceived stress (Brisbon & Lowery, 2009; West, Otte, Geher, Johnson, & Mohr, 2004).

These ambiguous results demonstrating a lack of connection between home practice compliance and program benefits are consistent with some of the current research (Carmody & Baer, 2009; Jensen, Vangkilde, Frokjaer, & Hasselbalch, 2012). For example, Vettese et al. (2009) investigated 98 studies that included mindfulness compliance reports. Of the 98, only 24 looked at the relationship between home practice compliance and program outcome, and nearly half of those failed to identify a connection between home practice and program benefits. Such findings may be explained by the limitations in monitoring home practice, including levels of engagement (Gaynor, Lawrence, & Nelson-Gray, 2006), quality of home practice (Burns & Spangler, 2001), as well as personality variables (e.g., motivation, interest) that cannot be

controlled. These findings demonstrated a substantial disparity between what is advocated clinically and what is known empirically about the benefits of mindfulness practice.

Additional Findings

Parent-proxy reports of youth anxiety. Results showed no significant differences in parents' reports of their children's anxiety among the three group conditions. Parents' reports are consistent with adolescents' self-reports of anxiety, indicating no significant between-group differences among those who participated in the intervention and those who did not. However, the adolescents' self-reports demonstrated significant within-group differences with all three conditions showing decreases of anxiety from pre- to post- that was not demonstrated in the parent-proxy reports. The inconsistent reports of within-group differences may be due to the lack of parent-child agreement. A number of studies have found that agreement between parent and adolescents on the SCARED measure is moderate at best (Achenbach, Krukowski, Dumenci, & Ivanaova, 2005; Des Los Reyes & Kazdin, 2004; Weitkamp, Romer, Rosenthal, Wiegand-Grefe, & Daniels, 2010; Wigham & McConachie, 2014). For example, Weitkamp et al. (2010) found only moderate associations between parent and adolescent reports of anxiety as measured by the SCARED, with adolescents reporting higher levels of anxiety than parents. This may be a reason for the discrepancy between the adolescents' and parents' ratings of anxiety in this study.

Waitlist randomization. Post-intervention data was analyzed for the waitlist group after participants completed the intervention (sitting meditation or hatha yoga). In the waitlist randomization, no significant between-group differences were found for working memory, stress, anxiety, and mindfulness levels from pre- to post-intervention. However, the participants in both the sitting meditation and hatha yoga conditions reported significant decreases in anxiety from post-waitlist/pre-intervention to post-intervention. This finding was expected, as this study

demonstrated a pattern of stress and anxiety naturally decreasing over time, even without intervention. Thus, we are not able to attribute such changes to the interventions. Furthermore, only tentative conclusions should be drawn from this data, as the limited sample size precluded any statistically significant findings.

One-month follow-up. Seventeen percent of participants (n = 30) completed the one-month follow-up, which was held during the students' summer break. No significant differences were found across the three time points (pre-intervention, post-intervention, and one-month follow-up) with the exception of anxiety, which decreased from pre- to post-intervention. However, anxiety levels increased again at the one-month follow-up. As for the other outcome variables, the lack of statistical significance may be explained by the small sample sizes involved in the follow-up analyses. Statistical significance is often regarded as the benchmark of a successful study; however, evaluation research must also take into account the clinical significance of results. Effect size estimates are one way to determine the impact of an intervention. In the follow-up section, results obtained partial eta-squared values ranged from .18-.36 (Cohen, 1988), which are considered large by social scientific research standards. These values indicate that mindfulness interventions have a substantial impact on adolescents' working memory, stress, anxiety, and mindfulness.

Clinical Implications

The primary findings from this study help add to the growing body of mindfulness research in adolescents. Prior research has demonstrated a decrease in stress and anxiety, and an increase in mindfulness. The present research, however, indicates that this may not be the case for all participants of mindfulness practices. Thus, the benefits of mindfulness practices should not be overstated, as it may lead to skepticism in those who are seeking specific benefits. It

would behoove mindfulness advocates to become more familiar with–and more realistic about–the specific benefits that can be expected from brief interventions. The lack of demonstrated, significant differences in stress, anxiety, and mindfulness levels in this study may be an artifact of the brief duration of the intervention. Longer interventions may very well provide the psychological benefits in question (Beauchemin et al., 2008; Biegal et. al, 2009; Napoli, Krecj, Holley, 2005); however, further research is needed to confirm this assertion.

Despite the apparent lack of effect with regards to stress, anxiety, and mindfulness, the present study was, in fact, able to demonstrate that a 4-week sitting meditation program could elicit significant improvement in working memory. This key finding indicates that positive benefits are still attainable in a condensed intervention period. Working memory is implicated in processes such as reasoning ability, mathematical problem solving, language, and reading comprehension, as well as many other aspects of learning (Daneman & Carpenter, 1980; Kyllonen & Christal, 1990; Swanson & Beebe-Frankenberger, 2004). Thus, it would follow that strengthening working memory capacity would be especially valuable during the developmental stage of adolescence, where the majority of the day is spent in an educational setting. As the current study was conducted with an adolescent sample attending a public school in a lower SES neighborhood, the effects of the interventions may not generalize to other samples in various settings (e.g., high SES, rural, primarily Caucasian). Research has shown that lower SES students score significantly lower than their higher SES counterparts on tests of language, working memory, and executive functioning (Noble, Norman, & Farah, 2005). Thus, as working memory is part of the executive function integral to learning, improvement in this area will highly benefit adolescents from disadvantaged backgrounds, who may need the most help in their academic work and can benefit the most from greater working memory capacity.

Another noteworthy finding is the suggestion that mindfulness training can be distilled into an abridged format, requiring less time while still delivering important benefits such as gains in working memory. This is important, since it would allow schools to design programs that are more cost-effective, less time-consuming, and that require fewer staff, while still maintaining maximal effectiveness. The finding may be especially beneficial for lower income, urban school settings, such as the one in this study, where resources are less readily available.

One final note of importance is that students, teachers, and school administrators all showed enthusiasm toward the use of mindfulness techniques and verbally reported emotional, psychological, and academic improvements. The positive response of all involved, given during informal conversations, suggests an openness toward the use of mindfulness interventions; however, other school settings may not be as receptive. Overall, the likelihood of incorporating short-term mindfulness practices into formalized school settings and achieving beneficial results is promising.

Limitations and Directions for Future Research

Generalizability. As with all research, our current study has limitations that must be considered when interpreting the results. One limitation is that data was collected from adolescents from one urban public middle school in southern California, and as such, the results may not generalize to adolescents in different regions, or to other adolescents who are not attending an urban public school. Furthermore, the majority of participants were the between the ages of 12 to 15 years, members of low-to-middle-income families, and from a minority background. As such, results from this study cannot be generalized to children and adolescents who are older or younger than the participants in this sample, nor can results be generalized to student populations that are not predominantly low-to-middle income or holding a minority

status. To address this limitation, it is suggested that future research in other types of school settings (e.g., public, private, charter) is needed to evaluate the generalizability of the current findings. Samples should include more diverse populations and span majority and minority ethnic status, age, socioeconomic status, geographic location, and other demographic variables.

Lastly, the participant pool was comprised of adolescents who volunteered for the study. Students' motivation to have an alternative to their traditional gym class might explain the positive reception to the intervention. It may be beneficial to examine in future studies whether volunteering versus being mandated (e.g., as part of a requirement for a class) to participate in an intervention would result in a different outcome. Possible groups to be further investigated would include students who complete a mindfulness intervention as part of an afterschool program, either in lieu of their regularly scheduled PE classes, or an addition to them. Previous exposure to sitting meditation or yoga may also play a role, as different groups may be more or less receptive to certain interventions based on their personal history with mindfulness practices.

Self-reports. Another area of concern is the current study's primary use of self-report measures. Self-report data rely on participants' understanding of the survey questions, as well as their willingness and ability to candidly and accurately disclose their thoughts, feelings, and behaviors. Due to the sensitive nature of some of the self-report questions–for example, those related to stress and anxiety–some adolescents may have been reluctant to disclose information related to their psychological experiences. Self-report measures are also affected by the emotional state of a participant; thus, self-report measures are known to have issues with response bias and inaccuracy of responses (Dunning, Heath, & Suls, 2005; Paulhus & Vazire, 2007).

Another area of question with regard to self-reports is their developmental validity, that is, the actual ability of the child or adolescent to "read, comprehend, and answer" self-report surveys (Woolley, Bowen, & Bowen, 2004, p. 2). The developmental validity of a self-report survey is especially important for adolescents, as their ability to understand and respond to abstract questions may vary across time, setting, and context (Woolley et al., 2004; Woolley, Bowen, & Bowen, 2006). In addition, adolescents may have difficulties understanding particular words and meanings. All of these reasons may have contributed to the low consistency on the CAMM measure, as items on mindfulness scales "can be easily misinterpreted, in particular by respondents who are not familiar with the mindfulness concept" (Bergomi, Tschacher, & Kupper, 2014, p. 5).

An additional consideration unique to this study's sample population was the presence of language barriers and their resulting effect on reading comprehension levels. Many of the students reported that their native language was not English, and additionally, their parents were given Spanish language versions of the Demographic questionnaire and SCARED. As a result, the non-native-English speakers in this study may have had a more difficult time reading and comprehending the questionnaires. Thus, the results involving self-report measures in this study should be interpreted with some caution.

Due to the disadvantages of self-report questionnaires, future studies would benefit from the use of parent and teacher reports of students' cognitive and emotional states to corroborate students' experiences of the benefits of these interventions. Furthermore, these studies can also make forms available in different languages to accommodate diversity. The incorporation of objective assessments and multiple methods of assessing a singular construct may also strengthen findings.

Measurement error. In this study, the CAMM yielded low internal consistency (Cronbach's alpha = 0.41). This may reflect difficulties in accurately capturing an internal, complex construct such as mindfulness in adolescents. Mindfulness is an abstract concept that may be difficult to operationally define, and thus for respondents to fully understand. In the adult literature there are varying theories and conceptualizations of mindfulness that differ considerably from one another (Brown, Ryan, & Creswell, 2007). Furthermore, the question of whether mindfulness is a fleeting state of mind or a dispositional mental trait is still being considered (Brown & Ryan, 2003). Current research has uncovered inconsistent findings with the CAMM. As discussed previously, the CAMM was normed with a sample of adolescents, primarily Caucasians. The current study suggests that the CAMM may not generalize well with other adolescent samples, such as ethnic minorities. Furthermore, other research has uncovered interesting patterns using the CAMM measure. Bruin, Zijlstra, and Bögels (2013), for example, found that adolescents who had meditation experience showed a significantly *lower* score on the CAMM than those without experience. Given the potential difficulty measuring the mindfulness construct among adolescents, it may be necessary for future research to spend time improving methods for measuring the concept of mindfulness.

In addition to the CAMM, the PSS-10 was also initially found to exhibit low internal consistency (Cronbach's alpha = 0.63). However, after visual inspection of the data, inconsistent responders were excluded from the sample, which resulted in improved internal consistency (Cronbach's alpha = 0.71). Though not all self-report measures in the current study included reverse scored items, given the pattern of responding on the CAMM and PSS-10, one possibility is that the measurement error evidenced in CAMM and PSS-10 scores was largely related to reverse wording. Though the majority of previous research has found the PSS-10 to have good

psychometric properties, there are varied findings on the effects of reverse wording of questionnaires (Sonderen, Sanderman, & Coyne, 2013). Sonderen et al. (2013) found that reverse scoring did not prevent response bias, and often confused respondents. Specifically, they found that reversed items that involved changing words to their opposite meanings or adding negative articles to sentences caused confusion for respondents. For example, on the CAMM, the item "I push away thoughts I don't like" represents the opposite of mindfulness (e.g., "push away" rather than "accept"). It is possible that reversed items such as these were confusing for participants in the current study. Thus, future studies may benefit from using instruments that have items posed in the same direction (e.g., MAAS-A), rather than reversed. This may be especially helpful when attempting to capture an abstract concept such as mindfulness.

Intervention timing. This study took place near the end of the academic school year when teachers and students had more availability and time for participation. Students at the end of the school year may have experienced a general decrease in stress and anxiety levels as they prepared to leave for summer break. Thus, the timing of the intervention may have been a factor contributing to the improvement in stress and anxiety level seen in the waitlist participants. It may be useful for future studies to investigate which time of the academic school year would be most beneficial for adolescents to participate in mindfulness exercises. This could be achieved by conducting mindfulness interventions throughout the school year. Groups could then be assessed to see whether participating at a certain time (e.g., beginning of school year versus the end) has any effect on the outcomes of mindfulness practice. In addition, since the assessments were completed during class time, time constraints might have caused students to rush through their computerized task (OSPAN) and self-report measures (PSS-10, SCARED, CAMM), thus

impacting the results. Future studies could look into different avenues of administrating assessments to obtain the most accurate results.

The timing of the intervention also prevented the majority of adolescents from participating in the one-month follow-up. Because the academic school year had ended, the one-month follow-up was conducted during summer vacation, a time when adolescents are less inclined to participate or are unable to do so (i.e., out of town or without access to Internet). Thus, future studies might consider beginning the intervention earlier in the school year, leaving sufficient time for the participants to complete the one-month follow-ups while still in school.

Academic functioning. Lastly, since this study was able to detect statistically significant changes in working memory, it may be beneficial for future studies to further investigate whether enhancements in working memory are associated with improvements in overall academic performance (e.g., GPA or standardized test scores) to further evidence improvements in cognitive functioning. Investigations of a broader range of school-related outcomes may be helpful in understanding whether the gains from mindfulness techniques translate into improvements in academic performance or school functioning more broadly.

Moreover, this study did not evaluate other AOSPAN scores, including: total number correct, math errors, speed errors, and accuracy errors. The "total number correct" is the total number of letters participants recalled in the correct position. The "math error" is the total number of task errors, which is broken down to "speed errors" looking at when participant ran out of time when solving a math equation, and "accuracy errors" observing the number of incorrect math equation responses (Unsworth et al., 2005). Additional examination of these scores may provide more detailed information regarding which aspects of cognitive improvement may be related to mindfulness interventions. This may inform future utilization of

mindfulness techniques aimed at improving specific areas of academic performance. Future research may also benefit from administering additional performance-based tasks, such as the N-back or Stroop task, in order to more fully evaluate the impact of mindfulness interventions on working memory and other neuropsychological functions.

Conclusion

Throughout the last decade, research on mindfulness practices has grown rapidly, and mindfulness has been shown to be effective in treating a wide range of medical and psychological problems in adult samples (Baer, 2003; Chiesa, 2009; Fletcher, Shoendorff, & Hayes, 2010; Hofmann, Ledesman, & Kumano, 2009; Sawyer, Witt & Oh, 2010; Shapiro & Carlson, 2009). Researchers have recently begun to explore their use in younger populations. Although the body of literature for children and adolescents is still in its initial stages, it has already suggested potential cognitive, psychological, and behavioral benefits (Biegal et al., 2009; Goodman, 2005; Mendelson, 2010; Saltzman & Goldin, 2008; Wall, 2005). Despite the growing amount of literature on mindfulness practice in adolescents, this is the first study to directly investigate the feasibility and acceptability of the two primary components of the Mindfulness-Based Stress Reduction (MBSR) program among adolescents in a school setting. Such information will hopefully prove clinically useful when implementing mindfulness interventions with youth, particularly in school settings where time is limited.

Overall, this study provided support for the benefits of short-term mindfulness practice, specifically sitting meditation, in improving working memory in adolescents. This finding is particularly salient during adolescence, as this developmental phase is characterized by heightened brain plasticity. Acquiring mindfulness skills may prove beneficial in enhancing adolescents' cognitive abilities, which may translate into improved school functioning more

broadly. Furthermore, the finding that a brief mindfulness intervention appeared to produce effective results is important for researchers and educators when deciding which mindfulness components to implement in school settings.

On the other hand, inconsistent with previous literature, this study did not detect any significant between-group differences in stress, anxiety, and mindfulness. This suggests that the psychological benefits of mindfulness training may not be easily attained in a condensed mindfulness intervention. Also, comparing the current study to previous research indicates that mindfulness practices may differ in effectiveness depending on the sample studied. In other words, the benefits gained by one sample population likely do not generalize to other groups with different ethnic, socioeconomic, or other demographic backgrounds. Nonetheless, this study was able to elicit strong interest from students, teachers, and school administers toward learning both sitting meditation and hatha yoga, indicating that these mindfulness techniques may be feasibly implemented into school settings.

The results of the current study are promising; nevertheless, mindfulness-based research among adolescents is still in its early stages. Researchers are still in the process of operationalizing the construct of mindfulness, while simultaneously attempting to study its effects on human behavior, brain functioning, psychophysiology, and physiology. It is essential to continue the improvement, implementation, and empirical examination of the different mindfulness components of the MBSR program, in order to improve our understanding of their usage and to determine their clinical utility.

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Appendix A
School Flyer

Sitting Meditation and Hatha Yoga Research Study

-Time to Relax and Stretch-

Brief Description:
I am a doctoral student in the clinical psychology Ph.D. program at Alliant International University. As an avid yoga practitioner, I noticed how this practice has enriched my life. I believe that yoga and meditation can benefit all people, including adolescents. This is why I am conducting a research study on yoga and sitting meditation with students. This study will help us understand the impact of mindfulness practice on adolescents.

The entire study will be completed in 15 weeks. Participation from students is voluntary. Each participant is placed in one of the three groups: sitting meditation, hatha yoga, or waitlist. Instructors will come twice a week for 4 weeks. Additionally, participants are encouraged to practice at home with a free yoga and meditation DVD/CD. Participants will take a pre-study, post-study, and one-month follow-up survey.

Eligibility of Participants: Students, ages 12-17

Surveys Will Measure: Mindfulness, Stress, Anxiety, and Memory Skills

Raffle Prizes:

- Galaxy 2 Tablet
- $5 gift cards every week (iTunes, Target, Subway, Starbucks…etc.)

I look forward to sharing the practice of sitting meditation and hatha yoga with your community. Please feel free to contact me with any questions.

Kind regards,
Dianna Quach M.A.
Alliant International University
Clinical Psychology Student
dquach@alliant.edu

Appendix B
Student Flyer

Learn Yoga and Sitting Meditation

Who?

Students age 12 to 17

What?

Participate in 8 sessions of yoga or meditation

Complete surveys on mindfulness, stress, anxiety, and memory skills

When and Where?

Sessions are twice a week, for 4 weeks

during school free periods or afterschool hours

@ your school or afterschool program

Why?

Learn Cool Yoga Poses

Strengthen Your Body and Mind

Feel Calm and Relaxed

Build Self-Confidence

Win Prizes:

A Galaxy 2 Tablet

Free yoga classes

$5 gift cards to your favorite stores

Please Contact:

Dianna Quach Phone #: (626) 215-5419 Email: Dquach@alliant.edu

Come Join Us!

Appendix C

PARENT CONSENT

Title of Project: Teaching Adolescents Sitting Meditation and Yoga Project

Researcher: Dianna Quach, M.A. phone: (626) 215-5419 email: dquach@alliant.edu

Introduction

I would like to invite your adolescent to participate in a research study that will involve 8 sessions of either yoga or sitting meditation. In recent years, mindfulness programs have shown positive effects, such as increased relaxation, concentration, awareness, and attention. Being "mindful" means being aware of the present moment in a non-judging way. Teaching adolescents these mindfulness skills through sitting meditation and yoga may be helpful for managing stress and anxiety.

Purpose of the Study

The purpose of this study is to learn more about the effect of two kinds of mindfulness practice—**yoga** and **sitting meditation**—on adolescents' memory skills, mindfulness, anxiety and stress. The data collected is intended to help further our knowledge of how yoga and sitting meditation work and what implications this may have for young adults. Your adolescent's participation will help to contribute to an important body of research.

Number of Participants in this Study

Approximately 140-150 adolescents are being asked to participate in this study. The study will involve students able to participate in 8 sessions of yoga or sitting meditation, with an additional 3 sessions to complete pre- and post-study surveys, and follow-up surveys.

What Will Happen During the Study

If you agree to have your adolescent participate, and if your adolescent wants to participate, he or she will be randomly assigned to one of three groups: yoga, sitting meditation, or waitlist. Specifically, each participant will be assigned a random number so that everyone has the same chance of being assigned to any given group.

Pre-study: You and your adolescent will be asked to sign consent and assent forms regarding willingness to participant in this study. You and your adolescent will then be asked to fill out a short 5-minute questionnaire regarding basic background information and a 5-10 minute questionnaire about how your adolescents handle his or her stress and worries.

Week 1: All participants will be asked to complete initial Time 1 surveys, which will take approximately an hour to complete. The Time 1 surveys will include a 20-25 minute computerized memory task at the school/after school program's computer lab. They will also be given hand written surveys to assess their level of mindfulness, anxiety, and stress.

Week 2-5: Those assigned to the sitting meditation and yoga groups will be asked to attend either yoga or sitting meditation sessions twice a week for four weeks. Participants placed in the waitlist group will wait 4 weeks after completing Time 1 surveys before they begin their participation. The sessions will be held at their school or after-school program either during school free periods or afterschool hours. They will also be given CD/DVDs as an option to practice on their own (approximately 10-20 minutes) on days the sessions do not take place.

Your adolescent will be asked to record his/her daily home practice on a log sheet that will be collected each week.

Week 6: After the completion of the 4-week intervention or waitlist period, all participants will be asked to complete the computerized memory task and surveys for a second time (Time 2). The waitlist group will then be randomly assigned to begin either the 4-week yoga or sitting meditation group.

One-Month Follow-up: One month after his/her completion of the 4-week (8 sessions) intervention of either yoga or sitting meditation, your adolescent will be asked to complete the study surveys once more. This will occur during **Week 11** or **Week 15**, depending on which group your adolescent participated in.

Length of the Study

All adolescents will participate in 4 weeks of either yoga or sitting meditation (total of 8 sessions, two per week). The entire study, including the follow-up survey-taking session that will take place one month after completing either yoga or sitting meditation, will be complete in **15 weeks or less**.

Possible Risks

The exercises that your adolescent will be doing have very minimal risk. The surveys used are not expected to evoke any psychological stress. Participants' survey answers will not be revealed to anyone. However, your adolescent will have the opportunity to discuss his/her yoga or sitting mediation experiences with other participants, if they so choose. If you or your adolescent feels uncomfortable at any time during the study, you may choose to discontinue participation. There will be no penalty for choosing not to participate, declining to answer questions, or withdrawing from this study. Your adolescent may feel slightly uneasy learning new yoga poses or learning to sit quietly with their thoughts. Students do not have to participate in poses they feel uncomfortable doing. Instructors will provide modifications and variations of each pose to adapt to each adolescent's individual needs.

If there are any injuries related to the study, the researcher will be available to provide assistance immediately. If the adolescent requires more advanced care, which goes beyond the expertise of the research assistants and facility staff, parents/guardians will be notified immediately, and the adolescent will be provided a list of recommended facilities that he/she can go to on his/her own time. Alliant International University does not take responsibility in the case of injury. If a participant sustains a physical injury, the cost of all medical care will be the responsibility of the participant and his or her parents.

Possible Benefits

Participants in this study may benefit from receiving up to 90 minutes a week of hatha yoga or sitting meditation instructions. Participants will have the opportunity to learn mindfulness techniques that may help them manage stress and anxiety. Each week, participants will also have the opportunity to discuss their experiences and may ask any questions about their practice. Although not guaranteed, participants may also have positive experiences of increased relaxation, awareness, and calmness.

Compensation

Throughout the study, participants will be receiving raffle tickets by completing surveys, attending study sessions, and turning in their weekly home practice log. These raffle tickets will give participants the opportunity to win one of two raffle prizes (***1 Galaxy 2 Tablet***) at the end of the study. These raffle

tickets will also give participants the opportunity to win $5 gift cards each week (e.g. iTunes, Target, Starbucks, etc.) during study sessions.

Confidentiality

The only persons who will know that your adolescent has participated in this study will be the research team members, Dianna Quach M.A., Kristen Jastrowski Mano, Ph.D., yoga and meditation instructors, and research assistants. Your adolescent's records will be confidential, except when mandated by California law. California law mandates the filing and reporting of reasonable suspicions of child, dependent adult, and elder abuse. Each child's responses will be coded with numbers so they cannot be identified by name. Your adolescent will not be identified in any reports or publication resulting from the study.

Additional Information

Your cooperation is much appreciated. As parent or guardian, you are encouraged to ask questions about the study and/or the methods that are being used at any time. Your suggestions and concerns are important, and I ask you to please contact me, Dianna Quach at 626-215-5419 or dquach@alliant.edu. My supervisor, Dr. Kristen Jastrowski Mano can be reached at 858-635-4721 or kmano@alliant.edu. The Institutional Review Board of Alliant International University can answer questions about participant rights and may be contacted at 858-635-4752. Participants, if they wish, may request a summary of the results once the study has been completed.

Signature

By signing this form, I affirm that I have read the information contained in the form, that the study has been explained to me, that my questions have been answered, and that I agree to have my adolescent take part in this study. I do not give up any of my adolescent's rights by signing this form.

_____

Printed Student's Name Printed Parent Name

_____ _____

Parent Signature Date

Please send this form back to your adolescent's school or after-school program as soon as possible. Thank you!

Appendix D

STUDENT CONSENT

I invite you to join my sitting meditation and yoga research project. Before you decide to participate, here is some information about the project.

WHO I AM:

My name is Dianna Quach, and I am a student at Alliant International University. I am working on my doctoral degree in clinical psychology.

ABOUT THE PROJECT:

This project is about **sitting meditation** and **yoga** for adolescents your age**. Sitting meditation** involves sitting quietly and paying attention to your thoughts. **Yoga** involves balancing and gentle stretching. We want to find out if practicing sitting meditation or yoga helps adolescents with how they concentrate, and how they handle stress and worries.

WHAT WILL HAPPEN IN THE STUDY:

If you agree to participate, you will be randomly assigned (which is like picking a number out of a hat) to one of three groups: yoga, sitting meditation, or waitlist group. Also, you will be asked to:

1) Answer questions about yourself, including things that make you worry or things that you find stressful or difficult.
2) Complete a memory activity on the computer that will take about 20 to 25 minutes.
3) Participate in sitting meditation or yoga group meetings twice a week for 4 weeks. Meetings will take place at your school or afterschool program during free periods or afterschool hours.
4) Practice what you are learning in your sitting meditation or yoga group meetings on your own (about 10-20 minutes) on the days that you don't have meetings.
5) Keep track of what you are practicing at home on a log sheet that will be collected each week.
6) If you are on the waitlist group, you will be asked to wait 4 weeks before you begin participating in a sitting meditation or yoga group.

IT'S YOUR CHOICE:

Your participation in this study is voluntary. That means that everyone will respect your decision of whether or not you want to be in the study. If you decide now that you want to join the project, you can still change your mind later. If you want to skip some parts of the project, just tell me.

PRIZES:

Throughout the study, you will be receiving raffle tickets by completing surveys, attending yoga and mindful sitting sessions, and turning in weekly home practice logs. These raffle tickets will give you the opportunity to win one of two raffle prizes (**1 Galaxy 2 Tablet**) at the end of the

study. These raffle tickets will also give you the opportunity to win $5 gift cards each week (for example, iTunes, Target, Starbucks, etc.).

PRIVACY:

Everything you tell me during this project will be kept private. That means that no one else will know your name or what answers you gave on the surveys. The only time I have to tell someone is if I learn about something that could hurt you or someone else.

ASKING QUESTIONS:

If you have any questions, you can ask them now or have your parents call Ms. Dianna Quach at 626-215-5419, or Dr. Kristen Jastrowski Mano at 858-635-4721. The Institutional Review Board of Alliant International University can also answer questions about your rights and may be contacted at 858-635-4752. I will give you a copy of this form.

I have read and I understand this form and I agree to be part of this project.

Name_____

Your signature_____

Date_____

Please sign form and return the form to the researcher.

Appendix E

Adolescent Demographic Questionnaire

Please complete the following items. All information is confidential.

1. Age (please circle one): 12 13 14 15 16 17 18 and over

2. What *grade* are you in (please circle)? 6th 7th 8th 9th 10th 11th 12th

3. Gender Male Female

4. Race/Ethnicity (Check one)
_____African/African American/Black, non-Hispanic
_____Latino/Hispanic
_____Asian/Asian American
_____Biracial (describe) _____
_____Caucasian/ European/ White, non-Hispanic
_____Native American/ Pacific Islander/ Eskimo
_____Other (describe)_____

10. List any sports or extracurricular activities you participate in:
_____
_____

Previous Mindfulness Experience

13. Amount of yoga experience (please check one)?
_____Never tried
_____Tried once or twice
_____Practice a few times a year
_____Practice a few times each month
_____Practice once a week
_____Practice a few times a week
_____Practice daily

14. Any experience with sitting meditation (please check one)?
_____Never tried
_____Tried once or twice
_____Practice a few times a year
_____Practice a few times each month
_____Practice once a week
_____Practice a few times a week
_____Practice daily

Thank you for your participation! Looking forward to our weekly meetings!

Appendix F

Parent Demographic Questionnaire

Please complete the following items. All information is confidential.

1. Relationship to adolescent (please circle one): mother father legal guardian other

2. Your marital status (please circle one): single married divorced separated widowed

3. Is the student's mother/primary female caregiver presently (circle one)?

A. Employed full-time (40hrs./wk.)
B. Employed part-time
C. Full-time homemaker
D. Unemployed
E. Student

4. What is the student's mother/primary female caregiver highest level of education achieved (circle one):

A. Less than 7th grade
B. Junior high school
C. Some high school
D. High school graduate
E. Some college
F. College graduate
G. Graduate/professional
H. Unknown

5. What is the student's mother/primary female caregiver's job title and/or company type?

Job title:_____

Kind of work:_____

Kind of Company or Business:_____

6. 3. Is the student's father/primary male caregiver presently (circle one)?

A. Employed full-time (40hrs./wk.)
B. Employed part-time
C. Full-time homemaker
D. Unemployed
E. Student

7. What is the student's father/primary male caregiver highest level of education achieved (circle one):

A. Less than 7th grade
B. Junior high school
C. Some high school
D. High school graduate
E. Some college
F. College graduate
G. Graduate/professional
H. Unknown

8. What is the student's father/primary male caregiver's job title and/or company type?

Job title:_____

Kind of work:_____

Kind of Company or Business:_____

9. What is the your estimated annual household income? (Please circle one)

A. Less than $20,000	E. $50,000-59,999	I. $90,000-99,999
B. $20,000-29,999	F. $60,000-69,999	J. $100,000-149,999
C. $30,000-39,999	G. $70,000-79,999	K. $150,000 or above
D. $40,000-49,999	H. $80,000-89,999	

10. Does your adolescent receive special services at school or in the community for any of the following (please circle one or more)?

A. None/No services B. Attention Deficit/Hyperactivity Disorder C. Communication Disorder

D. Autism Disorder E. Motor Skills Disorder F. Learning Disorder G. Other (s)_____

11. Does your adolescent have any general behavioral problems (please circle one)?

No Yes If yes, please be specific_____

Additional comments:_____
_____

Thank you for your participation!

Spanish Version (Parent Demographic Questionnaire)

Cuestionario demográfico para los padres
Complete lo siguiente: Toda la información es confidencial.

1. Relación con el adolescente (encierre en un círculo una opción): madre padre tutor legal otro

2. Estado civil (encierre en un círculo una opción): soltero casado divorciado separado viudo

3. La madre o el principal cuidador femenino del estudiante actualmente es (encierre en un círculo una opción):

A. Empleada de tiempo completo (40hrs./sem.)

B. Empleada de medio tiempo

C. Ama de casa a tiempo completo

D. Desempleada

E. Estudiante

4. ¿Cuál es el nivel más alto de educación que alcanzó la madre o el principal cuidador femenino del estudiante? (encierre en un círculo una opción)

A. Inferior al 7º grado
B. Escuela secundaria
C. Algunos años de escuela secundaria
D. Graduado de escuela secundaria
E. Algunos años de universidad
F. Graduado universitario
G. Graduado/formación profesional
H. Desconocido

5. ¿Cuál es el cargo que desempeña o el tipo de empresa en que trabaja la madre o el principal cuidador femenino del estudiante?
Cargo:_____

Tipo de trabajo:_____

Tipo de empresa o actividad comercial:_____

6. El padre o el principal cuidador masculino del estudiante actualmente es: (encierre en un círculo una opción)

A. Empleado de tiempo completo (40hrs./sem.)

B. Empleado de medio tiempo

C. Persona que atiende la casa a tiempo completo

D. Desempleado

E. Estudiante

7. ¿Cuál es el nivel más alto de educación que alcanzó el padre o el principal cuidador masculino del estudiante? (encierre en un círculo una opción)

A. Inferior al 7º grado
B. Escuela secundaria
E. Algunos años de universidad
F. Graduado universitario

C. Algunos años de escuela secundaria
D. Graduado de escuela secundaria
G. Graduado/formación profesional
H. Desconocido

8. ¿Cuál es el cargo que desempeña o el tipo de empresa en que trabaja el padre o el principal cuidador masculino del estudiante?
Cargo:_____

Tipo de trabajo:_____

Tipo de empresa o actividad comercial:_____

9. ¿Cuál es el ingreso anual aproximado de su hogar? (encierre en un círculo una opción)

A. Inferior a $20,000
B. $20,000 a 29,999
C. $30,000 a 39,999
D. $40,000 a 49,999
E. $50,000 a 59,999
F. $60,000 a 69,999
G. $70,000 a79,999
H. $80,000 a 89,999
I. $90,000 a 99,999
J. $100,000 a 149,999
K. $150,000 o más

10. ¿El adolescente recibe servicios especiales en la escuela o en la comunidad por alguna de las situaciones siguientes (encierre en un círculo una opción)?

A. Nada/ningún servicio
B. Trastorno por déficit atencional con hiperactividad
C. Trastornos de la comunicación
D. Autismo
E. Trastornos de habilidades motoras
F. Trastornos del aprendizaje
G. Otros _____

11. ¿El adolescente tiene algún problema general de conducta (encierre en un círculo una opción)?

No Sí Si la respuesta es sí, especifique_____

Comentarios adicionales:_____
_____

¡Gracias por su participación!

Appendix G

Screener Form

This form is used to ensure that participants meet the research study's eligibility criteria.

1. Are you between the ages of 13 and 17 years old? YES NO

2. Are you fluent in English? YES NO

3. Can you attend 8 classes of yoga or sitting meditation for the next 4 week? YES NO

4. Do you have any physical injury or health condition(s) that might limit your physical activities? YES NO

If yes, please describe_____
_____
_____

Appendix H

Acceptability Measures

Expectation Form (Yoga)

1. How helpful do you think *yoga* (the whole 4 week session - overall) will be to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

3. Do you think yoga will be *relaxing*?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

4. How helpful do you think the *CD/DVD* will be to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

5. How helpful do you think yoga will be to your *concentration/attention* in school?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

6. Do you think you will *enjoy* practicing yoga?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

Further Comments:

_____
_____
_____
_____

Expectation Form (Sitting Meditation)

1. How helpful do you think *sitting meditation* (the whole 4 week session **overall**) will be to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

2. Do you think sitting meditation will be *relaxing*?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

3. How helpful do you think the *CD/DVD* will be to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

4. How helpful do you think sitting meditation will be to your *concentration/attention* in school?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

5. Do you think you will *enjoy* practicing sitting meditation?

1	2	3	4	5
Not at all	a little	somewhat	a lot	completely

Further Comments:

_____
_____
_____
_____

Experience Form (Yoga)

1. How helpful was *yoga* (the whole 4 week session **overall**) to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

2. Did you find the practice *relaxing*?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

3. Did you find the practice helpful to your *concentration/attention* in school?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

4. How helpful was the CD/*DVD* to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

5. How *enjoyable* was yoga to you?

1	2	3	4	5
Not at all	a little	somewhat	very	Completely

6. Can you find yourself *continuing* to practice yoga in the future?

1	2	3	4	5
Not at all	a little	somewhat	very	Completely

What is/are your favorite yoga posture(s)? Least favorite_____

What did you *like the most* about yoga? What did you like *the least*?

_____

_____

_____

Further comments:

_____

_____

_____

_____

Experience Form (Sitting Meditation)

1. How helpful was *sitting meditation* (the whole 4 week session **overall**) to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

2. Did you find the practice *relaxing*?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

3. Did you find the practice helpful to your *concentration/attention* in school?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

4. How helpful was the *CD/DVD* to you?

1	2	3	4	5
Not at all	a little	somewhat	a lot	Completely

5. How *enjoyable* was sitting meditation to you?

1	2	3	4	5
Not at all	a little	somewhat	very	Completely

6. Can you find yourself *continuing* to practice sitting meditation in the future?

1	2	3	4	5
Not at all	a little	somewhat	very	Completely

What is/are your favorite type(s) of sitting meditation? Least favorite?_____

What did you *like the most* about sitting meditation? What did you like *the least*?

_____

_____

_____

Further comments:

_____

_____

Appendix I

Child and Adolescent Mindfulness Measure (CAMM; Greco, Baer, & Smith, 2010)

We want to know more about what you think, how you feel, and what you do. **Read** each sentence. Then, circle the number that tells **how often each sentence is true for you.**

	Never True	Rarely True	Some-times True	Often True	Always True
1. I notice small changes in my body, like when my breathing slows down or speeds up.	0	1	2	3	4
2. I get upset with myself for having feelings that don't make sense.	0	1	2	3	4
3. I pay attention to my muscles and notice when they feel tight or relaxed.	0	1	2	3	4
4. At school, I walk from class to class without noticing what I'm doing.	0	1	2	3	4
5. I do things without thinking about what I'm doing.	0	1	2	3	4
6. I pay close attention to my thoughts.	0	1	2	3	4
7. I try only to think about things that make me feel happy.	0	1	2	3	4
8. I keep myself busy so I don't notice my thoughts or feelings.	0	1	2	3	4
9. When I'm doing something, I focus only on what I'm doing and nothing else.	0	1	2	3	4
10. I tell myself that I shouldn't feel the way I'm feeling.	0	1	2	3	4
11. When something good happens, I can't stop thinking about it.	0	1	2	3	4
12. When I take a shower or bath, I notice how the water feels on my skin.	0	1	2	3	4
13. I notice my thoughts as they come and go.	0	1	2	3	4

14. When I'm eating, I notice the way it feels to chew my food.	0	1	2	3	4
15. I push away thoughts that I don't like.	0	1	2	3	4
16. It's hard for me to pay attention to only one thing at a time.	0	1	2	3	4
17. I think about things that have happened in the past instead of thinking about things that are happening right now.	0	1	2	3	4
18. I get upset with myself for having certain thoughts.	0	1	2	3	4
19. I do many things at once.	0	1	2	3	4
20. I think about the future.	0	1	2	3	4
21. I think that some of my feelings are bad and that I shouldn't have them.	0	1	2	3	4
22. I notice when my feelings begin to change.	0	1	2	3	4
23. I pay close attention to whatever is happening right now.	0	1	2	3	4
24. I notice how thing around me smell.	0	1	2	3	4
25. I stop myself from having feelings that I don't like.	0	1	2	3	4

Scoring Instructions: Compute total score on the CAMM by reverse scoring and summing all items.

Appendix J

SCREEN FOR CHILD ANXIETY RELATED EMOTIONAL DISORDERS

BIRMAHER, BORIS M.D.; BRENT, DAVID A. M.D.; CHIAPPETTA, LAUREL B.S.; BRIDGE, JEFFREY B.S.; MONGA, SUNEETA M.D.; BAUGHER, MARIANNE M.A.

Please mark one box for each statement.

		NOT TRUE	SOMETIMES TRUE	OFTEN TRUE
1	When I feel frightened, it is hard to breathe.			
2	I get headaches when I am at school.			
3	I don't like to be with people I don't know well.			
4	I get scared if I sleep away from home.			
5	I worry about other people liking me.			
6	When I get frightened, I feel like passing out.			
7	I am nervous.			
8	I follow my mother or father wherever they go.			
9	People tell me I look nervous.			
10	I feel nervous with people I don't know well.			
11	I get stomachaches at school.			
12	When I get frightened, I feel like I am going crazy.			
13	I worry about sleeping alone.			
14	I worry about being as good as other kids.			
15	When I get frightened, I feel like things are not real.			
16	I have nightmares about something bad happening to my parents.			
17	I worry about going to school.			
18	When I get frightened, my heart beats fast.			
19	I get shaky.			
20	I have nightmares about something bad happening to me.			
21	I worry about things working out for me.			
22	When I get frightened, I sweat a lot.			
23	I am a worrier.			
24	I get really frightened for no reason at all.			
25	I am afraid to be alone in the house.			
26	It is hard for me to talk with people I don't know well.			
27	When I get frightened, I fell like I am choking.			
28	People tell me that I worry too much.			
29	I don't like to be away from my family.			
30	I am afraid of having anxiety (or panic) attacks.			
31	I worry that something bad might happen to my parents.			
32	I feel shy with people I don't know well.			
33	I worry about what is going to happen in the future.			
34	When I get frightened, I feel like throwing up.			
35	I worry about how well I do things.			
36	I am scared to go to school.			
37	I worry about things that have *already* happened.			
38	When I get frightened, I feel dizzy.			
39	I feel nervous when I am with other children or adults and I have to do something while they watch me (for example: read aloud, speak, play a game, play a sport).			
40	I feel nervous about going to parties, dances, or any place where there will be people that I don't know well.			
41	I am shy.			

Appendix K

PARENT Version

Please mark one box for each statement.

		Not True	Sometimes True	Often True
1.	When my child feels frightened, it is hard for him/her to breathe.			
2.	My child gets headaches when he/she is at school.			
3.	My child doesn't like to be with people he/she doesn't know well.			
4.	My child gets scared if he/she sleeps away from home.			
5.	My child worries about other people liking him/her.			
6.	When my child gets frightened, he/she feels like passing out.			
7.	My child is nervous.			
8.	My child follows me wherever I go.			
9.	People tell me that my child looks nervous.			
10.	My child feels nervous with people he/she doesn't know well.			
11.	My child gets stomachaches at school.			
12.	When my child gets frightened, he/she feels like he/she is going crazy.			
13.	My child worries about sleeping alone.			
14.	My child worries about being a good as other kids.			
15.	When my child gets frightened, he/she feels like things are not real.			
16.	My child has nightmares about something bad happening to his/her parents.			
17.	My child worries about going to school.			
18.	When my child gets frightened, his/her heart beats fast.			
19.	My child gets shaky.			
20.	My child has nightmares about something bad happening to him/her.			
21.	My child worries about things working out for him/her.			
22.	When my child gets frightened, he/she sweats a lot.			
23.	My child is a worrier.			
24.	My child gets really frightened for no reason at all.			
25.	My child is afraid to be alone in the house.			
26.	It is hard for my child to talk to people he/she doesn't know well.			
27.	When my child gets frightened, he/she feels like he/she is choking.			
28.	People tell me that my child worries too much.			
29.	My child doesn't like to be away from his/her family.			
30.	My child is afraid of having anxiety (or panic) attacks.			
31.	My child worries that something bad might happen to his/her parents.			
32.	My child feels shy with people he/she doesn't know well.			
33.	My child worries about what is going to happen in the future.			
34.	When my child gets frightened, he/she feels like throwing up.			
35.	My child worries about how well he/she does things.			
36.	My child is scared to go to school.			
37.	My child worries about things that have already happened.			
38.	When my child gets frightened, he/she feels dizzy.			
39.	My child feels nervous when he/she is with other children or adults and he/she has to do something while they watch him/her (for example: read aloud, speak, play a game, play a sport.)			
40.	My child feels nervous when he/she is going to parties, dances or any place where there will be people that he/she doesn't know well.			
41.	My child is shy.			

FORMA PARA LOS PADRES (SCARED-P SPANISH)

		Casi nunca o nunca es cierto	Es cierto algunas veces	Casi siempre o siempre es cierto
1.	Cuando siente miedo, no puede respirar bien.			
2.	Cuando esta en la escuela, se queja de dolor de cabeza.			
3.	No le gusta estar con personas que no conoce bien.			
4.	Le da miedo dormir en otras casas.			
5.	Se preocupa de lo que piensan de el (ella).			
6.	Cuando tiene miedo, siente que se va a desmayar.			
7.	Es un niño(a) nervios(a).			
8.	Me sigue a todas partes donde voy (es como mi "sombra").			
9.	La gente dice que mi hijo(a) se ve nervioso(a).			
10.	Se pone nervioso(a) con personas que no conoce bien.			
11.	Cuando esta en la escuela le duele el estomago.			
12.	Cuando tiene mucho miedo, se siente como si se fuera a "enloquecer".			
13.	Se preocupa si tiene que dormir solo(a).			
14.	Se preocupa de ser tan bueno(a) como los otros niños.			
15.	Cuando tiene mucho miedo siente como si las cosas no fueran reales.			
16.	Sueña que algo malo le va a pasar a su mama o a su papa.			
17.	Se preocupa cuando tiene que ir a la escuela.			
18.	Cuando tiene miedo, el corazon le late muy rapido.			
19.	Se pone tembloroso.			
20.	Sueña que algo malo le va a pasar a el (ella).			
21.	Le preocupa como le van a salir las cosas.			
22.	Cuando tiene miedo (nervios) suda mucho.			
23.	Se preocupa demasiado.			
24.	Le da miedo sin tener ningun motivo.			
25.	Le da miedo estar solo en casa.			
26.	Le cuesta trabajo hablar con personas que no conoce.			
27.	Cuando tiene miedo, siente que no puede tragar.			
28.	Las personas dicen que se preocupa demasiado.			
29.	No le gusta estar separado de la familia.			
30.	Le da miedo de tener ataques de nervios (panico).			
31.	Le preocupa que algo malo le pueda pasar a sus padres.			
32.	Le da verguenza cuando esta con personas que no conoce.			
33.	Le preocupa que le va a pasar en el futuro.			
34.	Cuando tiene miedo le dan ganas de vomitar.			
35.	Le preocupa saber si esta haciendo las cosas bien.			
36.	Tiene miedo de ir al colegio.			
37.	Le preocupan las cosas que ya han pasado.			
38.	Cuando tiene miedo, se siente mareado(a).			
39.	Se siente nervioso(a) cuando tiene que hacer algo delante de otros niños o adultos (por ejemplo: leer en voz alta, hablar, jugar).			
40.	Se siente nervioso(a) de ir a fiestas, bailes, o alguna parte donde hay gente que no conoce.			
41.	Mi hijo(a) es timido(a).			

Appendix L

PERCIEVED STRESS SCALE-10

1. In the last month, how often have you been upset because of something that happened unexpectedly?
___0=never __1=almost never ___2=sometimes ___3=fairly often ___4=very often

2. In the last month, how often have you felt that you were unable to control the important things in your life?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

3. In the last month, how often have you felt nervous and "stressed"?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

4. In the last month, how often have you felt confident about your ability to handle your personal problems?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

5. In the last month, how often have you felt that things were going your way?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

6. In the last month, how often have you found that you could not cope with all the things that you had to do?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

7. In the last month, how often have you been able to control irritations in your life?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

8. In the last month, how often have you felt that you were on top of things?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

9. In the last month, how often have you been angered because of things that were outside of your control?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?
___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

Appendix M

WEEKLY PRACTICE LOG
Week 1

Participant ID_____ Date_____

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Practice (Yes/No)							
With or Without CD							
Number of Minutes							
Comments							