

BEYOND A RUNNER'S HIGH: ASSESSING THE RELATIONSHIP BETWEEN TRAIT
MINDFULNESS AND RUNNING ACTIVITY IN ADOLESCENTS

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DEDICATION

For Andy

My strength, my teammate, and my biggest fan all in one; your patience and support throughout this process were unwavering. Thank you.

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Abstract

Mindfulness has been increasingly demonstrated as an effective intervention for improving various mental health outcomes such as anxiety, depression, stress levels, and quality of life. In more recent years, studies have examined the effectiveness of mindfulness-based programs in eliciting such benefits in children and adolescents, and have seen promising results. Furthermore, children also experience positive outcomes such as improvements in school functioning, internalizing and externalizing problems, prosocial behavior, and focus. Exercise is another strategy that has been shown to improve psychological functioning, and research is emerging on the connection between exercise and mindfulness, both as a practice and as an outcome. Findings have shown that those who are higher in levels of trait mindfulness demonstrate increased physical activity and improved diet. Other studies found that mindfulness interventions can have a positive impact on sports performance, and also that exercise participation can lead to an increase in trait mindfulness. This relationship among youth populations has yet to be discussed in the literature. The present study asked questions related to running activity and trait mindfulness levels in adolescents over time, as well as the presence of music while running and its relationship with trait mindfulness. To answer these questions, high-school students were surveyed before and after the duration of a pre-determined period of heightened running. Results indicated that participation in running activity was not a significant predictor of trait mindfulness change. The presence of music while running was found to have a significant negative relationship with trait mindfulness levels. Limitations of the study design, as well as implications for school psychologists and future directions are discussed.

Chapter I: Introduction

Statement of the Problem

The practice of mindfulness is becoming more widespread in adults due to the documented benefits on mental and physical health (Crandall, Cheung, Young, & Hooper, 2019). Today, people can utilize guided meditation from applications on their smart phones and practice yoga in the comfort of their homes. People report using meditative practices for a variety of reasons, such as general wellness and disease prevention; to improve energy, memory, and concentration; or most prevalently, to reduce stress and improve overall health. In particular, feelings of anxiety, depression, frequent stress, and chronic pain were among the most common health problems experienced by people who turn to meditation (Cramer et al., 2016). Research finds meditation and other mindfulness strategies to be effective in the treatment of these health concerns. For example, several studies convey the effectiveness of Mindfulness Based Stress Reduction (MBSR) in significantly improving symptoms of anxiety, depression, and severity of panic attacks (Goldin and Gross, 2010; Kabatt-Zin et al., 1992; Miller, Fletcher, and Kabatt-Zinn, 1995; Vollestad, Siversten, and Nielsen, 2011). Furthermore, stress reduction is an outcome of utilizing MBSR that can be experienced by both those in need of treatment as well as healthy individuals (Chiesa and Serretti, 2009).

Though much of the preliminary research on the effects of mindfulness has been studied in adults, studies are emerging on the positive outcomes that mindfulness practice can have on children and adolescents. Similar to adults, children and adolescents can experience improvements in anxiety, depression, stress levels, and quality of life as a result of practicing mindfulness. This is the case for both clinical and nonclinical samples (Kallapirin, Koo, Kirubakaran, Hancock, 2015). These practices have also been shown to increase trait

mindfulness (Kiken, Garland, Bluth, Palsson, & Gaylord, 2015), which, as a developed characteristic, has its own host of benefits. Similar to state mindfulness, trait mindfulness reflects an awareness of the present moment; however, trait mindfulness is considered to be longer lasting and consistent throughout one's day to day life. A more comprehensive definition of trait mindfulness can be found in the next chapter.

Not only does the act of practicing mindfulness lead to positive outcomes, but when people are higher in trait mindfulness, they often exhibit other advantageous character traits as well. For example, Lawlor, Schonert-Reichl, Gadermann, and Zumbo, 2014 found trait mindfulness to be associated with autonomy, relatedness, and competence. Research shows that if these needs are met, individuals exhibit improvements in self-motivation and mental health. Such fundamental needs are particularly relevant for adolescents, who, at this stage in their development, struggle to formulate their self-identities within their surrounding environments (Erikson and Erikson, 1998). Functional changes occur in the adolescent brain in regard to cognitive control abilities (Dumontheil, 2016), which makes it an appropriate time to instill practices such as mindfulness that emphasize self-regulation of thoughts and feelings.

It is important that mental as well as physical wellness are fostered in adolescence to not only improve health, but also for disease prevention. Research has found a reciprocal relationship between the two, and that it is often helpful to link and promote them within the school context (Miller, Gilman, & Martens, 2008). There are a host of benefits associated with sports participation and physical activity among youth populations, including improved cognitive and academic performance; decreases in internalizing problems such as stress, anxiety, and depression; and improved self-esteem (Rasmussen and Laumann, 2013; Norris, Carroll, and

Cochrane, 1992; Spruit, Assink, van Vugt, van der Put, and Stams, 2016; Schmalz, Deane, Birch, and Davison, 2007; Percy, Dziuban, and Martin, 1981).

To date, there has been no research that addresses the relationship between exercise and mindfulness in youth populations. This knowledge can help address some challenges with mindfulness-based interventions in schools, such as lack of time, failure to engage students, and needing someone trained in mindfulness to administer the intervention (Zenner, Herrnleben-Kurz, and Walach, 2014; Eva and Thayer, 2017). Further, it is an avenue for combining the instillation of both physical and mental wellness, which can maximize the benefits and also save both time and money.

Purpose of the Proposed Study

The purpose of the proposed study is to examine the relationship between trait mindfulness and long-distance running in adolescents, in an attempt to identify an alternative avenue for cultivating mindfulness among this population. As previous research has identified a positive correlation between running and trait mindfulness in adults, the current study will test whether or not this is consistent with an adolescent population. Specifically, trait mindfulness will be measured before a period of consistent running, quantified as the duration of a cross-country season, and after the period is over, measuring whether or not there has been a significant difference in the level of trait mindfulness among these participants over time. From here on out this period of time will be referred to as the “running period,” and any reference to before or after this time period will use the terminology “pre-running period” and “post-running period.” Mindfulness scores will be compared between two groups: runners and non-runners, in order to determine if there is a correlation between running participation and trait mindfulness.

Though limited, some research has addressed the connection between listening to music while running and the influence it has on dissociation, which can be conceptualized as the opposite of being mindful, or associating with one's body and one's surroundings. Though people report significantly more enjoyment and better affect after running with music or music combined with video than those in a no-music control group, the same people experienced higher dissociative thoughts (Jones, Karageorghis, Ekkekakis, 2014; Hutchinson, Karageorghis, and Jones, 2015). Other studies have also found the addition of music to be preferential for runners, and found it to be beneficial at the beginning of the run; however, it does not imply improved endurance and it is not as effective as running without music in sustaining effort throughout a long run (Cole and Maeda, 2015; Tenenbaum et al., 2004). The literature on this topic is brief, and more research is warranted in order to explore the relationship in more depth.

Lastly, this study aligns with the appeal of teaching mindfulness and other practices that have been shown to improve well-being. As it is often difficult to engage adolescents in activities of this nature (Zenner, Herrnleben-Kurz, and Walach, 2014), significant findings will inform professionals on an alternative strategy for cultivating well-being through increased mindfulness.

Definition of Key Terms

Mindfulness. Though several terms have been used to describe the construct of mindfulness, one overarching definition of mindfulness is the attendance to and awareness of the present experience in a non-judgmental way (Brown & Ryan, 2003; Kabat-Zinn, 2003). Further, mindfulness exists in two major forms—state and trait. Either can be cultivated through mindfulness-based practices but vary in the extent to which they are present and measurable within an individual.

State Mindfulness. State mindfulness is best described as a condition of being that can be instilled through meditative or related practices. It is constantly fluctuating, and if measured, the levels can differ on a moment-to-moment basis (Bodhi, 2011).

Trait Mindfulness. Trait mindfulness, also referred to as dispositional mindfulness, is more amenable to change than state mindfulness, but is typically considered more stable over time (Bodhi, 2011). It is much like a personality characteristic, such that everyone is inherently mindful to one degree or another (Jon Kabat-Zinn 2003). In the current study, this is the primary variable that will be measured.

Physical Activity and Exercise. The terms “physical activity” and “exercise” are often used interchangeably to refer to any level of increase in heart rate and movement of the body. However, more specifically, physical activity is classified as the expenditure of energy involving bodily movement produced by the skeletal muscles, while exercise refers to more structured, purposeful movements to improve or maintain physical fitness (Mikkelsen, Stojanovskaa, Polenakovicb, Bosevskic, Apostolopoulos, 2017).

Aerobic Exercise. There are different modes, or levels of exercise intensity that can have differing outcomes on participants. Aerobic exercise facilitates rhythmic abdominal breathing (Berger, 1994) and oxygen consumption, and it also increases endurance of the pulmonary and cardiovascular systems (Doyne et al., 1987).

Long-Distance Running. For the purposes of this study, long-distance running will be classified as 3 miles or more, based on the typical distance for high-school cross-country races. There are no parameters on speed; however, running is typically considered to be any pace over five miles per hour. This is considered to be vigorous-intensity exercise. Fast-walking or jogging

is considered at a speed of four or five miles per hour, or between twelve or fifteen minutes per mile (Bumgardner, 2018).

Research Questions

The proposed study aims to address the following research questions:

1. Relative to the comparison group, is participation in running activity over time associated with increases in trait mindfulness?
2. Does time spent running per week influence one's level of trait mindfulness?
3. Does the addition of music while running influence one's level of trait mindfulness?

Hypotheses

In regard to research question 1, it is hypothesized that participation in running activity over time is correlated with heightened levels of trait mindfulness. Specifically, it is hypothesized that participants in the running group will report higher levels of trait mindfulness at the completion of the running period than those in the non-running comparison group. Further, it is hypothesized that runners will exhibit an increase in trait mindfulness from the start of the running period to the completion, and that non-runners will not experience any significant change in mindfulness levels. These hypotheses are based on the literature summarized in the next chapter, which suggests that exercise, and in particular aerobic exercise and running, is associated with higher levels of trait mindfulness. In addition, Dreyer and Dreyer (2009) expressed that focus and the acceptance of thoughts, as well as attention to breathing, are important components for optimal running performance, which are consistent with some of the key components of mindfulness practice as well.

In regard to research question 2, it is hypothesized that the amount of running per week will be positively correlated with ending levels of trait mindfulness. This hypothesis is in line

with previous research that found participants who successfully maintained their exercise to report significantly higher levels of mindfulness than those who did not (Ulmer, Stetson, and Salmon, 2010). Further, trends show that the more time that is spent in an exercise activity, the more mindful a person is (Kangasniemi, Lappalainen, Kankaanpää, and Tammelin, 2014).

In regard to question 3, it is hypothesized that the presence of music while running will be negatively correlated with trait mindfulness. Research shows that although people report that running is more enjoyable with the addition of music, they also experience dissociation under these conditions (Jones, Karageorghis, Ekkekakis, 2014; Hutchinson, Karageorghis, and Jones, 2015). Also referred to as “dissociative cognitive rehearsal,” this internal experience utilizes stories, narratives, and other cognitive activities to divert attention away from the discomfort associated with somatic cues during running. The opposite of this strategy, association, is often used by elite runners, and it means that they direct their attention to the running-related somatic cues and utilize this sensory information to inform their level of effort (Salmon, Hanneman, Harwood, 2010). The process of association is similar to that of mindful attention, and thus it would be expected that those who use dissociative strategies are less mindful.

Importance of the Study to School Psychologists

One of the many services that school psychologists can provide involves the promotion of positive behavior and mental health, as well as the reinforcement of positive coping skills and resilience (“Who are School Psychologists?” 2019). This study will serve to provide psychologists with a resource that may help adolescents to develop healthy coping skills and increase their overall well-being. The cultivation of mindfulness can positively impact adolescents’ mental health, and the introduction of aerobic exercise can influence their physical health. Aerobic exercise has also been shown to influence mental health by decreasing stress and

depression, and improving overall well-being in adolescents (Norris, Carroll, and Cochrane, 1992).

Should a positive relationship between running and mindfulness be found, it could present an opportunity for the development of an intervention. Running is a more cost-effective strategy than other school mindfulness-based programs, given that there would not be a need for as many materials or training in more formalized procedures such as mindfulness-based stress reduction. Further, there are other running-based positive youth development programs such as *Girls on the Run* and *Heart and Sole* that may serve as models for a similar program that focuses on mindfulness and how it can be incorporated within the activity of running. Should mindfulness naturally increase as a result of running, it could set the foundation for a successful intervention which focuses on actively practicing mindfulness while running.

Contribution to the Literature

There are no known studies that examine the relationship between trait mindfulness and long-distance running in adolescents. While there are several sources that identify the benefits associated with exercise and physical activity among this population, mindfulness is an unexplored outcome. Given the research on the benefits associated with heightened levels of mindfulness, this information may be of interest to those who are invested in the health and wellness of children and adolescents. Concerning exercise participation in adolescents, this study may find running to be a potential therapeutic intervention for those who struggle with mental-health problems such as anxiety or depression, given the relationship between these psychopathologies and mindfulness. In addition, should trait mindfulness be significantly and positively related to running participation, it would reveal another beneficial outcome that could assist with coaching and motivation.

The results of this study could also contribute to the literature on interventions that can be utilized to help instill this trait in children and adolescents. Considering the challenges associated with mindfulness-based interventions with these populations, including time, money, level of engagement, and trained administration, the discovery of running as an intervention could open the doors to another type of program that professionals could turn to. Positive school-wide mental health support is becoming increasingly sought after due to rises in media coverage on school violence and mental illness (Walker, 2018). An intervention of this nature could reach a wide range of students and afford a wealth of beneficial outcomes that could lead to overall improvement in student success and morale.

Chapter II: Review of the Literature

Mindfulness

The practice of mindfulness has gained momentum in the literature over the past several decades. Appearing more frequently in dissertation abstracts and literature reviews, mindfulness has sparked considerable interest, perhaps due to the increased awareness that there is therapeutic benefit for its practice, and novel insights into the mind-body connection (Kabat-Zinn, 2003). Thousands of research articles and many books have discussed potential benefits of the practice and how related forms of meditation can serve as supplemental treatments for various problems (Ladner, 2011). Though a widely-utilized practice, meditation should be distinguished from mindfulness as a general construct. Meditation is a type of mental training involving deliberate focused attention and open monitoring of one's surroundings, which can yield mindfulness and mindful awareness (Bauer-Wu, 2010). Though the implementation of mindfulness practices has become more prevalent, the definition still varies in the literature (Bishop et al., 2004). One overarching definition that has been agreed upon, and which will be used for the purposes of this study, is the attendance to and awareness of the present experience in a non-judgmental way (Brown & Ryan, 2003; Kabat-Zinn, 2003). However, scholars agree that mindfulness is complex and have explored the various facets that make up this construct. The evolution of mindfulness in all its forms is best understood by recognizing the primary usages for which it was developed. Next is a brief history of mindfulness followed by current definitions of mindfulness.

The beginning of mindfulness. Mindfulness is a fundamental attentional stance underlying traditional Buddhist meditative practices (Kabat-Zinn, 2003). Buddha lived and taught in northeast India in the fifth century BC. He utilized the *Dhamma* to offer his teachings, which helped guide people towards happiness and spiritual freedom. The idea that people may

overcome suffering and gain insight into their daily lives is at the heart of such teachings. Followers share a common goal of attaining nibbana, a state of transcendent bliss and peace (Bodhi, 2011).

The concept of mindfulness stems from the term *Sati*, which originally meant “memory.” Over time, Buddha restructured the meaning of the word along with his teachings, so that it was characterized as “lucid awareness.” T.W. Rhys Davids, a British translator and scholar, characterized the new meaning as the memory, recollection, calling-to-mind, and being-aware-of certain specified facts (Bodhi, 2011). Mindfulness of breathing and recognizing physical sensations is consistent throughout much of the practice of Buddhism. Therefore, it is not a separate teaching, but an element of their spiritualism that helps to understand one’s internal experiences in the context of reality (Ladner, 2011). Buddha’s intention for incorporating mindfulness in his practice is for the extinction of suffering (Bodhi, 2011). This remains the central goal of mindfulness centuries later in the modern-day clinical world.

Mindfulness is the precursor to conceptual thought (Bodhi, 2011). In other words, it is the process of recognizing and attending to stimuli without identifying its components and attaching meaning. Though the premise of mindfulness originated from the traditions of Buddhism, many modern-day scholars have identified the components that comprise the overall construct of mindfulness.

Mindfulness as a modern-day construct. Jon Kabat-Zinn defines mindfulness as the awareness that arises through paying attention in the present moment, on purpose, and nonjudgmentally to the unfolding of experience (Kabat-Zinn, 2003). Several studies have discussed the complex and multifaceted nature of mindfulness. Shapiro, Carlson, Astin, and Freedman (2006) posited that there are three fundamental components of mindfulness: a)

intention, b) attention, and c) attitude. Intention, also known as “on purpose” or with specific reason, in regard to mindfulness practice, has been found to directly correlate with outcomes. For example, if one set a goal of self-regulation, he attained such. Attention refers to observing the operations of one’s internal and external experiences in the present moment. Attitude refers to the qualities brought to the focused attention. In particular, mindfulness trainers should instill a sense of kindness, openness, and acceptance of the attentional thoughts and observations as opposed to critique and coldness.

Bishop et al. (2004) proposed that mindfulness consists of two primary components. The first component involves the self-regulation of attention. In other words, mindfulness instills an increased recognition of mental events in the present. The second component reflects a particular orientation toward one’s own present experience, involving curiosity, openness, and acceptance, similar to Shapir et al.’s (2006) attention component of mindfulness. According to Brown and Ryan (2003), mindfulness is an inherent state of consciousness. They believe that individuals differ in regard to mindfulness, as measured by levels of attention and awareness. Mindfulness is often used synonymously with the term “insight meditation,” which involves a deep, non-conceptual seeing into the nature of our minds and the world around us. It demands that one questions whatever rises to awareness in order to gain insight and a unique perspective (Kabat-Zinn, 2003).

Langer and Moldoveanu (2000) conceptualize mindfulness in a slightly different way. In general, they assert that mindfulness is best understood as the process of drawing novel conclusions. In other words, noticing new information, regardless of the importance, is a way of drawing the attention in to the present moment. Engaging in familiar experiences and those which are involved in a daily routine are thought to be mindless behavior. Once a person more

regularly draws novel distinctions, he or she may procure a greater sensitivity to one's environment, a more general openness to new information, and an increased ability to take multiple perspectives in problem solving. According to Langer and Moldoveanu, mindfulness is not a strict cognitive process in itself, but it involves the whole individual.

Another similar yet distinct state of mind that is worth noting is referred to as *flow*. Both flow and mindfulness involve present-moment attention. However, the intense focus of flow state corresponds with a disconnection of external stimuli. This is where the differentiation from mindfulness occurs, since mindfulness requires a broader range of attention to all external stimuli in the surrounding environment. Due to the high intensity of attention to one particular task, flow may be a more appropriate and more commonly experienced state of mentality during performance-based activities such as work or sports (Dust, 2015). However, research has noted the relationship between flow and mindfulness, and how they may influence one another as a result of sports involvement. More on this will be discussed later in the chapter.

Brown, Ryan, and Creswell (2007) discuss a *mindful mode of processing*, referred to as a receptive state of mind in which attention is kept to the simple registration of facts that are observed. Further, this way of thinking does not reflect comparison, categorization, or evaluation, nor does it involve any level of introspection or rumination upon memories. Being present means not reacting through these habitual filters through which we see the world, but being objectively informed about the surrounding world. The authors distinguish between mindful mode of processing and concentration, such that concentration involves the restriction of attention to one single object, ignoring other sensory inputs, while being mindful implicates a voluntary and fluid regulation of both attention and awareness, which can include various

sensations. The term that encapsulates the elements within this mindful mode of processing is called *bare attention*.

Bare attention is conceptualized as the single-minded awareness of what is happening both to and within individuals. According to Buddhists, our minds constitute our sixth sense. Bare attention is the processing of information through our six senses without influence from our prior knowledge or beliefs. Environmental material is taken in and simply dismissed without further speculation or pursuit (Thera, 2014). Thus, while mindfulness has been described using various terminology, all of the definitions share the idea of focused attention of elements in the present moment, without the attachment of meaning and interpretation. Though many early scholars have suggested various terms and descriptions that help in understanding mindfulness, more recent researchers posit that mindfulness exists in two major forms, state and trait, which will be discussed in detail below.

State and trait mindfulness. There are two schools of thought as to how mindfulness can be cultivated and measured. The first considers mindfulness as a state of being that can be instilled through meditative or related practices. Essentially, it is always fluctuating, and if measured, the levels can differ on a moment-to-moment basis. Others characterize mindfulness as a dispositional trait that is amenable to change, but more stable over time than state mindfulness (Bodhi, 2011). According to Jon Kabat-Zinn (2003), everyone is inherently mindful to one degree or another. It is important to distinguish between mindfulness as a trait and as a state in order to measure how it is cultivated.

It has been posited that the greater ability to focus during sitting meditation (i.e., state mindfulness) leads to an increase in mindful awareness in everyday life (i.e., trait mindfulness; Kiken, et al., 2015; Thompson & Waltz, 2007). Kiken et al. (2015) aimed to show that

cultivating state mindfulness can increase trait mindfulness. In their study, participants ($N = 235$) were adults recruited from a community-based mindfulness program and were offered a small reduction in the fee of the program for their participation. Participants completed an eight-week mindfulness intervention and completed questionnaires that measured their trait mindfulness and distress levels both pre- and post-intervention, as well as their state mindfulness levels each week after the mindfulness session. It was found that an increase in state mindfulness over time was positively correlated with post-intervention trait mindfulness. Further, post-intervention distress was inversely correlated with state mindfulness throughout the course of the intervention. Therefore, instilling a state of mindfulness may affect the levels of trait mindfulness thereafter, as well as positively influence psychological functioning.

On the contrary, Thompson and Waltz (2007) did not find a relationship between state and trait mindfulness. Participants consisting of 171 Introductory Psychology students engaged in a single 15-minute mindfulness meditation involving attention to the flow of their breaths. Some of the participants completed the measures of trait mindfulness before the meditation, while others completed it after. The researchers' hypothesis that a correlation exists between state mindfulness induced by the meditation and trait mindfulness was not supported. Therefore, this evidence suggests that trait mindfulness and state mindfulness may in fact be separate constructs. However, if more than one session of mindfulness meditation were completed, it is possible that state mindfulness would have increased over time, evidenced by Kiken et al. (2015).

Trait mindfulness is presumed to be a semi-consistent trait, or a tendency that exists across environments and time (Thompson & Waltz, 2007). Empirical evidence suggests that it exists independently from other forms of mindfulness, such as learned or cultivated mindfulness

(e.g., mindfulness that can be trained or practiced through specific, tailored interventions; Rau & Williams, 2015). Trait mindfulness is also correlated with several distinct personality traits, most notably it has an inverse relationship with neuroticism and negative affect, and a positive relationship with conscientiousness and positive affect (Giluk, 2009), providing some support that dispositional mindfulness may be an enduring personality trait, much like conscientiousness or neuroticism (Hanley, 2016).

In sum, both state and trait mindfulness appear to be equally examined in the literature. While it is often useful to measure state mindfulness after implementing a mindfulness-based intervention, measuring trait mindfulness is also beneficial to note any long-term outcomes. Regardless of how it is measured, much of the research on mindfulness is currently focused on the cultivation of mindfulness through meditative practices, which have been shown to have various therapeutic benefits in both adults, and more recently, in children as well. In the next section, the applications of mindfulness in therapy will be described.

Mindfulness in therapy. There has been a proliferation of mindfulness-based therapeutic techniques and interventions for a broad range of clinical and non-clinical populations of adults and youth in the last four decades. The clinical interest in mindfulness started with the introduction of Mindfulness Based Stress Reduction (MBSR; Bishop et al., 2004). In 1979, Jon Kabat-Zinn presented colleagues at the University of Massachusetts with his MBSR program. Kabat-Zinn originally intended MBSR to help patients who were chronically ill cope with stressors and manage pain that was not successfully treated through other modalities. The program, which is used widely today, runs for eight weeks and focuses on the teaching of mindfulness meditation and its integration into everyday life. Though some may still use MBSR for its original intent, others have adapted the structure to fit the needs of many different target

populations who are coping with stress from both physical and psychological problems (History of MBSR, 2016).

Research on MBSR has centered around the treatment of a variety of mental and physiological conditions. Benefits have been shown, often with moderate to large effect sizes, for the usage of MBSR in the treatment of Generalized Anxiety Disorder (GAD), Social Anxiety Disorder (SAD), and Panic Disorder with Agoraphobia (PD/AG). Many of these studies assessed the change in several outcome variables related to anxiety disorders, including anxiety, worry, trait anxiety, depression, and panic symptoms. Subjects included adults who met DSM criteria for one or several of the anxiety disorders listed above. Results revealed statistically significant reductions in anxiety, worry, depression, and severity of panic attacks, which were maintained across months to up to a year of follow up (Goldin and Gross, 2010; Kabat-Zinn et al., 1992; Miller, Fletcher, and Kabat-Zinn, 1995; Vollestad, Siversten, and Nielsen, 2011).

Other researchers examining the effectiveness of MBSR have targeted populations who undergo significant daily stress, including graduate students, medical and pre-medical students, and healthcare professionals involved in clinical work. Such studies utilized treatment and control groups, with the treatment groups engaging in eight-week MBSR programs. Significant improvements were seen from pre- to post-intervention across all of the outcome measures. These improvements included stress and distress reduction, state and trait anxiety reduction, improved well-being and self-compassion, decreased rumination, decreased job burnout, increased job satisfaction, and increased empathy (Shapiro, Astin, Bishop, and Cordova, 2005; Shapiro, Brown, and Biegel, 2007; Shapiro, Schwartz, and Bonner, 1998). Significant stress reduction as a result of MBSR treatment has also been seen with other healthy individuals, along with decreased ruminative thought, increased empathy and self-compassion, and significant

decreases in state and trait anxiety. In a meta-analysis examining outcomes for healthy individuals (i.e., individuals who did not endorse physical or mental illness), the studies targeted this population to utilize mindfulness-based practices for stress reduction. Results supported the idea that mindfulness strategies can be beneficial for those in need of treatment for some kind of illness, as well as people who are otherwise healthy (Chiesa and Serretti, 2009).

In regard to physiological conditions, MBSR studies have analyzed treatment among individuals with a range of conditions, including vascular disease, coronary heart disease, angina, myocardial infarction, stroke, diabetes, hypertension, hypercholesterolaemia, fibromyalgia, and other chronic medical conditions. Results have shown small, but significant, effects for stress and depression reduction, and significant, small, short-term (in the weeks just after the intervention ends) effects on quality of life and pain intensity. Statistically significant improvements in anxiety were found with more moderate effect sizes (Abbott et al., 2014; Bohlmeijer, Prenger, Taal, and Cuijpers, 2010; Lauche, Cramer, Dobos, Langhorst, and Schmidt, 2013; Tacon, McComb, Caldera, and Randolph, 2003). Though many of the effects are found in the short-term, results suggest that it is necessary to actively continue the practice of mindfulness in order to maintain such benefits.

Another major mindfulness-based therapy, Mindfulness Based Cognitive Therapy (MBCT), was inspired by the work of Jon Kabat-Zinn and his work on healing physical illness and chronic pain. Combined with cognitive science, Zindel Segel, Mark Williams, and John Teasdale originally developed MBCT to prevent recurrence of depression (Crane, 2017). MBCT is characterized through direct attention to the areas of the mind that are often associated with mood disorders and learning to accept the thoughts and feelings that coincide. The general practice combines the ideas of cognitive therapy with the cultivation of mindfulness through

meditative practices (Your Guide to Mindfulness Based Cognitive Therapy, n.d.). Several studies have revealed the usefulness of MBCT in its original intent of preventing relapse in recurrent depression, which is further discussed below. Further, others have identified its usefulness for other mental illnesses, such as Generalized Anxiety Disorder, and other processes such as memory (Evans et al., 2008; Williams, Teasdale, Segal, and Soulsby, 2009).

Research has assessed the usefulness of MBCT in reducing the rates of relapse in patients who have previously experienced depressive episodes and are in remission from Major Depression. Similar results have been found among multiple studies, indicating that fewer individuals who received MBCT as a part of their treatment relapsed in the follow-up (i.e., roughly 40%), as compared to individuals who received treatment as usual (i.e., roughly 60%). This difference corresponds to a medium effect size. Further, MBCT participants reported significantly fewer residual depressive symptoms and better quality of life, as well as significantly fewer comorbid diagnoses (Kuyken, et al., 2008; Teasdale et al., 2000). Another study revealed that MBCT can also be useful in improving the way formerly depressed patients recall personal memories. It is not uncommon for individuals with depression to experience cognitive declines as an associated symptom, which can include memory impairments. Williams, Teasdale, Segal, and Soulsby (2000) found MBCT to help in significantly reducing the tendency to miss details when retrieving memories.

Another type of therapy that incorporates mindfulness practice is Acceptance and Commitment Therapy (ACT). Broadly, ACT is a psychological intervention based on behavioral approaches involving mindfulness and acceptance, as well as commitment to the behavior change process (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). The goal of ACT is psychological flexibility, which involves engagement with the present moment and either

changing or persisting with behavior accordingly (Hayes, 2018). Another therapeutic practice that also uses both acceptance strategies as well as behavioral principles is Dialectical Behavior Therapy (DBT). DBT integrates mindfulness into stage one, or the skill-building phase, when the goal is to increase appropriate behavioral skills such as being mindful and regulating emotions, while decreasing maladaptive behaviors that interfere with therapy and overall quality of life (Dimeff and Linehan, 2001). ACT has been shown to be an effective treatment approach for issues pertaining to substance abuse, somatic health symptoms, and psychological disorders such as anxiety and depression (Lee, An, Levin, & Twohig, 2015; A-tjak, Davis, Morina, Powers, Smits, & Emmelkamp, 2015). The literature is emerging on the effectiveness of DBT on similar psychological symptomology among adults and adolescents (Cook, and Gorraiz, 2016); however, support already exists for DBT as a treatment for more serious psychological conditions such as Borderline Personality Disorder (Kliem, Kröger, & Kosfelder, 2010).

Though it is not widespread, there is some existing research on Mindfulness-Based Music Therapy (MBMT), which is based on the principals of MBSR, with the integration of music listening. This therapeutic approach has been found to significantly improve attention and reduce negative mood states in women undergoing treatment for breast cancer (Lesiuk, 2015). Others classify music therapy as a type of mindfulness therapy (Ziabari & Treur, 2018), suggesting that the elements of song experience, namely cognitive stimulation, singing and listening, can provide similar effects. Graham (2010) discussed that the facilitation of attention to a particular stimulus, namely music, can help reach more mindful functioning and be used as a form of psychotherapy to enhance overall well-being. MBMT is also conceptualized through the teaching of mindfulness strategies to be implemented while listening to music, so that the effects of both practices are amplified (Eckhardt & Dinsmore, 2012). In his study, Diaz (2010) found evidence

that mindfulness, facilitated through guided meditation, may serve as a useful antecedent to engaged music listening. Lesiak (2017) implemented a six-week MBMT intervention that involved mindful music listening, but also active engagement in music playing, and results revealed increases in mindfulness scores over the six weeks and decreases in well-being. Another way in which the integration of music and mindfulness has been studied is through the addition of music as background to meditative practices. Tomaselli (2014) implemented an intervention which consisted of a body scan accompanied by music two times within a week, and found that participants experienced an overall decrease in anxiety symptoms, but not significantly compared to the control group. Further, there were no significant changes in mindful awareness as a result of the short-term intervention. Another researcher found that two groups that engaged in a mindfulness exercise, one with the addition of music and one without music, did not significantly differ on measures of positive and negative affect, nor did they differ on mindful centering and mindful curiosity. The study results did find music to be a moderator of the relationship between psychological flexibility and mindful curiosity, suggesting that music may help those who are less psychologically flexible to be more open to internal experiences (Kowarz, 2015).

In sum, these are some of the most widely used mindfulness interventions among clinical and non-clinical populations of adults. Though the programs are sometimes adapted for specific populations, positive outcomes continue to abound. In more recent years, interventions of this nature have been expanded to the treatment of youth, both in clinical and educational settings. This literature is summarized next.

Mindfulness interventions for youth

Researchers have begun to analyze the effectiveness of mindfulness programs in alleviating stress and other adverse psychological conditions among youth populations. Broadly,

studies have found that participation in mindfulness interventions has positive implications for children's stress, anxiety, depressive symptoms, and quality of life in clinical and non-clinical samples (Kallapirin, Koo, Kirubakaran, Hancock, 2015). It is argued that children are predisposed to benefit from mindfulness more so than adults (Zack, Saekow, Kelly, Radke, 2014). Specifically, children are more likely to live in the present moment—a primary component in the operational definition of mindfulness (Goodman, 2005). Though children as young as four can often be well-engaged, it is recommended that teachers and caregivers be involved in the mindfulness training process in order to support challenges with attentional control and concentration (Burke, 2010). Interventions with youth have been tried and analyzed in both clinical and academic-based settings.

Mindfulness applications to youth in clinical settings. Evidence shows that mindfulness interventions are useful tools while working with youth who are diagnosed with psychological disorders. In particular, children and adolescents with Attention-Deficit Hyperactivity Disorder (ADHD), anxiety, depression, and associated symptomology such as inattention, stress, withdrawal, somatic complaints, and self-esteem have been participants in such studies. Results of randomized controlled trials have shown participation in such interventions can lead to improvements in attention problems, state and trait anxiety, depressive symptoms, perceived stress, quality of life, and somatic symptoms post-treatment (Biegel, Brown, Shapiro, Schubert, 2009; Semple, Lee, Rosa, Miller, 2009; Zack, Saekow, Kelly, Radke, 2014). Children and adolescents with ADHD diagnoses in particular can see significant improvements in inhibition, emotional regulation, and impulse control, and an overall significant reduction in hyperactivity/impulsivity and inattention problems after completion of an eight-week mindfulness intervention program (Kiani, Hadianfard, Mitchell, 2017; Van der Oord,

Bogels, Peijnenburg, 2012). Improvements of this nature have also been maintained through two to three months of follow-up (Van der Oord, Bogels, Peijnenburg, 2012; Van de Weijer-Bergsma, Formsma, de Bruin, Bogels, 2012). Children with mental health concerns, like all children, spend much of their time in schools. Therefore, many researchers and clinicians have increasingly found it beneficial to implement mindfulness-based interventions in school settings. Results of such studies are discussed next.

Mindfulness applications to youth in schools. Schools can serve as a convenient and effective environment to implement mindfulness programs for youths. Many mindfulness programs have utilized the school setting to target mental-health problems in youth, including anxiety and depression (Raes, Griffith, Van der Gucht, Williams, 2014), resiliency and stress (Gould, Dariotis, Mendelson, Greensburg, 2012; Greenberg and Harris, 2012; Zenner, Herrnleben-Kurz, Walach, 2014), negative emotionality (Klingbeil, Renshaw, Willenbrink, Copek, Tai Chan, Haddock, Yassine, Clifton, 2017; Zoogman, Goldberg, Hoyt, Miller, 2015), and body image (Atkinson & Wade, 2015). Mindfulness programs have also targeted more academic and social concerns including cognitive performance (Zenner, Herrnleben-Kurz, Walach, 2014); academic achievement, school functioning, externalizing and internalizing problems, prosocial behavior, peer acceptance (Klingbeil et al., 2017; Schonert-Reichl, Oberle, Lawlor, Abbott, Thomson, Oberlander, Diamond, 2015); and academic engagement (Felter, Margolis, Ravitch, Romer, Horner, 2017). Meta-analyses have concluded that school-based mindfulness interventions are effective in improving problems in the areas noted above. For example, Kallapiran, Koo, Kirubakaran, and Hancock (2015) found most of the studies in their analysis to have positive outcomes for mindfulness-based interventions on stress, anxiety, depressive symptoms, and quality of life in clinical and non-clinical samples. For MBSR and

MBCT studies, the effect sizes (ES) varied, with stress and depression being small to moderate ($ES = .31$ and $ES = .42$, respectively), and anxiety being large ($ES = .96$). For other mindfulness-based interventions (MBIs), such as yoga or meditation, the magnitude of the effects on depression remained the same, while stress symptoms were more effectively improved ($ES = .67$), and the effects on anxiety were slightly lower, but still large ($ES = .87$). Zoogman, Goldberg, Hoyt, and Miller (2015) found moderate effect sizes (average $ES = .5$) for the improvements in psychopathology seen among youth participants, and in particular in clinical populations. The school-based interventions included in the meta-analysis utilized MBSR and MBCT strategies with the treatment groups. The authors of this meta-analysis also did not find significant moderators such as previous experience of the teacher and outside practice of the participants, which are typically moderators of the effects of mindfulness in adults. Therefore, a possible explanation is that children and adolescents may learn mindfulness skills more quickly and require fewer sessions and less outside practice.

In addition to adaptations of MBSR and MBCT, school-based mindfulness interventions include programs such as Mindful Schools, Learning to Breathe, and MindUp, which have all contributed to positive outcomes such as reduced negative affect, increased self-reported calm, and self-acceptance (Greenberg and Harris, 2012); decreased stress, improved resiliency, and cognitive performance (Zenner, Herrnleben-Kurz, Walach, 2014); as well as improved executive functioning, self-reported well-being, and prosocial behavior (Schonert-Reichl, Oberle, Lawlor, Abbott, Thomson, Oberlander, & Diamond, 2015). Mindful Schools specifically targets under-resourced public schools and provides simple mindfulness practices to teachers, which can be used to connect with youth and integrate throughout the school day. The program consists of four six-week long courses, and a one year-long Mindful Teacher Certification Program. All of the

courses can be taken online. Although the target of Mindful Schools is teachers, children still benefit indirectly from the program. When teachers become more mindful and learn to implement the strategies they have learned, they can create a more positive and supportive educational environment that is conducive to optimal learning and productivity (Mindful Schools, 2018).

Learning to Breathe, however, is a curriculum targeted at adolescents to strengthen attention and emotion regulation, instill gratitude and compassion, manage stress, and integrate mindfulness into daily life. The program can be delivered in six, 12, 18, or more sessions and is comprised of six themes that center around the acronym “BREATHE,” which includes body, reflections, emotions, attention, tenderness (or take it as it is), healthy habits of mind, and inner empowerment (Broderick, Pinger, and Worthen, 2012; What is Learning to Breathe?, 2018).

Lastly, MindUp is a 15-lesson curriculum designed for PreK through eighth grade students that teaches gratitude, mindfulness, and perspective taking. The major goals include driving positive behavior, improving academic performance, and increasing qualities such as empathy, compassion, and optimism. Teachers can readily implement the program in their classrooms, knowing that it aligns with Common Core, IB, and Growth Mindset (MindUp, n.d.). Research has demonstrated the effectiveness of mindfulness programs in reducing many forms of psychopathology and improving adaptive behaviors. Further, several of these studies also demonstrated increased levels of mindfulness among youth participants (Schonert-Reichl et al., 2015; Zoogman et al., 2015).

The feasibility of such mindfulness programs in the school setting has been studied, and teachers have reported several problems with implementation. For example, they often feel that the programs end just as the students are coming to understand mindfulness, and they wish they

had more time. Also, some prominent hindrances to the success of the program were lack of time and the students' failure to engage (Zenner, Herrnleben-Kurz, and Walach, 2014). It is also important that those who lead the programs are authentically delivering the curriculum, which to do so would require personal mindfulness practice in order to model the appropriate skills (Eva and Thayer, 2017). Relatedly, the cost of such programs can add up, especially if someone with more extensive training is needed to be hired to implement them. Therefore, it is worth exploring other methods of cultivating mindfulness in children and adolescents that do not require skilled trainers and are less costly to the schools.

It is helpful to understand the benefits of instilling a sense of mindfulness in children and adolescents, and therefore it will be discussed below. However, first it is important to understand the trajectory of the brain's development throughout childhood and adolescence to know that there is a capacity to be mindful at such ages.

Cognitive development in youth

From as early as infancy, the brain consists of several neural networks that are both genetically prescribed and cultivated through life experiences. For example, children are born with mechanisms such as breathing, sucking, sensory detection, and metabolizing. Throughout development, the brain undergoes several periods of both slow and rapid growth which involve targeted areas that are responsible for different humanly functions, and later for higher cognitive functions (Epstein, 2001). A relevant skill that coincides with the practice of mindfulness is self-regulation. In young children, behavioral and neural plasticity are more pronounced, making it an opportune time to cultivate self-regulation (Zelazo and Lyons, 2012). Given that young people need things more explicitly taught to them for the acquisition of new knowledge and skills (Epstein, 2001), mindfulness strategies that are implemented with adults need some adaptations

in order to be successful with children. For example, while adults may be able to sit in one place and attend to their breathing for 45 minutes at a time, children may only be able to do so for three minutes at a time. Further, mindfulness with children might focus more on movement-based activities such as stretching and yoga. Throughout development, children become increasingly able to reflect on their experiences, facilitating cognitive flexibility, inhibitory control, and emotional reappraisal (Zelazo and Lyons, 2012). Therefore, as children transition into adolescence, such structured, broken down training in mindfulness may not be necessary.

Adolescence is a period of time in which the brain develops in regions pertinent to emotional and behavioral regulation, as well as the perception of risk and reward (Steinberg, 2005). While cognitive control abilities improve greatly during childhood, functional changes take place during adolescence, which elicit more complex cognitive control tasks such as performance monitoring, feedback monitoring, and relational reasoning. Additionally, the brain exhibits more reactivity to social and emotional stimuli, which then calls for this new-found cognitive control (Dumontheil, 2016). These changes take place in the prefrontal cortex, which processes information for goal-directed behaviors and affect regulation (Caballero, Granberg, Tseng, 2016). Provided this information about adolescents' brain development, it can be deduced that mindfulness is not only a cognitively appropriate skill, but a useful one given the challenges faced during this time of life. There has been a substantial body of research that outlines the beneficial outcomes of cultivating mindfulness in both adult and youth populations, some of which will be described next.

Benefits of being mindful

Studies that have assessed the effectiveness of mindfulness interventions have shown that increased mindfulness levels are often associated with various psychological benefits. Brown and

Ryan (2003) have identified several correlations that reflect a positive relationship between overall well-being and mindfulness. Specifically, participants with higher mindfulness scores tend to be more in tune with their emotional states and conscientious of their overt behaviors, making them more likely to alter them and fulfill their basic psychological needs. Further, these individuals are less likely to be self-conscious, socially anxious, and ruminative.

Mindfulness as a trait has also been found to be positively related to three fundamental needs—autonomy, relatedness, and competence— within self-determination theory (Lawlor, Schonert-Reichl, Gadermann, and Zumbo, 2014). This theory is based on the process of integrating internal and external experiences with the goal of competence and self-determination (Deci and Ryan, 1985). Relatedly, trait mindfulness has been found to be predictive of autonomous activity in daily life. These benefits are associated with trait mindfulness, whereas those associated with state mindfulness, namely momentary positive experience and affect, are not longstanding (Brown and Ryan, 2003). Such outcomes of trait mindfulness are particularly relevant for adolescents, who, according to Erikson and Erikson (1998) are struggling to formulate their self-identities within their surrounding environments. The proposed study will help to inform the usefulness of being mindful in adolescence.

It has been shown that the cultivation of mindfulness is beneficial to people of all ages, including youth. In particular, mindfulness strategies adapted for children and adolescents have been shown to improve self-regulation, attention, concentration, social-emotional competence, and overall self-control both at school and home (Zelazo and Lyons, 2012). Children's executive control can also be significantly improved through mindfulness intervention, as evidenced by a pilot study for the Mindful Schools program (Biegel and Brown, 2010). Further, it has been found that meditative practices can significantly increase academic engagement as well as

improve performance on math problems in children with ADHD (Singh et al., 2016). The Soles of the Feet mindfulness intervention has also been found to have a positive impact on neurotypical students' academic engagement (Felter, Frank, and McEachern, 2014).

While many youth participants express acceptance and enjoyment of mindfulness programs after participation (Felter, Felter, Margolis, Ravitch, Romer, Horner, 2017; Lee, Semple, Rosa, Miller, 2008; Zenner, Herrnelben-Kurz, Walach, 2014), some report that the meditation was “boring” (Britton, Lepp, Niles, Rocha, Fisher, Gold, 2014; Milligan, Badali, Spiroiu, 2015). Therefore, it is useful to explore other activities that might increase one's trait mindfulness. In fact, exercise has been shown to lead to mindfulness as an outcome, and to elicit other benefits in conjunction with mindfulness practice (Mothes, Klaperski, Seelig, Schmidt, and Fuchs, 2014). Before exploring the relationship between different forms of exercise and mindfulness, it is useful to take a broader perspective in analyzing other psychological benefits associated with exercise.

Impact of exercise on psychological functioning

Research has identified general trends in both physical and psychological improvements through participation in various forms of exercise. First, though, it is both relevant and important to acknowledge the support for the connection between the mind and the body. As cited by Etner et al. (1997), several researchers have explored the science behind the mind-body connection. They have found that exercise can increase cerebral blood flow, thus increasing the supply of essential nutrients to the brain, which benefits cognitive functioning. In addition, bouts of exercise have been found to increase levels of key neurotransmitters involved in mood and memory such as norepinephrine, serotonin, and endorphins. In the long term, exercise increases norepinephrine, which plays an important role in memory (Brown et al., 1979 and Kalat, 1992,

as cited in Etnier et al., 1997). Serotonin has also been known to play a role in long-term memory, as well as control of behavior (Potter and Keeling, 2005). The release of endorphins has been shown to have positive implications for one's mood and overall well-being, and correlates particularly with decreased depressive symptoms (Craft and Perna, 2004). Etnier et al. (1997) performed a meta-analysis in which the results supported the usefulness of long-term exercise in improving cognitive functioning. Although they acknowledged the limitation that there may be pre-existing cognitive differences between those who elect to participate in physical activities and those who do not, there was still a small significant positive effect ($ES = .25$) of long-term exercise programs on the cognitive functioning of previously sedentary individuals.

A physically-active lifestyle can have positive implications for one's mood, stress management, development of the self, and subjective well-being. Not only can habitual exercise promote the overall enhancement of one's mood, but it is also associated with various short-term changes in mood, including decreased anxiety, depression, anger, and fatigue. Increased sense of well-being, alertness, and energy have also been noted, all of which were found in a meta-analysis by Berger (1996). Though the acuteness of these mood enhancements is two to four hours, the changes might cause a ripple effect that influences other aspects of exercisers' lives and instill long-term effects on quality of life (Berger and Tobar, 2011). Both men and women can gain overall happiness after engaging in sports and other forms of physical activity, even after controlling for potential moderating factors such as immediate proximity of facilities where physical activity, sports, and exercise take place (Huang and Humphreys, 2012). It has been found that those with better overall mental health more commonly engage in physical activity. However, that being said, there are a certain range of hours per week that elicit the most beneficial outcomes. Those who engaged in less than two hours of physical activity per week or

more than seven hours were found to have the poorest mental health. Those who engaged in five to seven hours of physical activity per week had the best mental health. Thus, a curvilinear association between optimal levels of physical activity and mental health was found (Kim, Park, Allegrante, Marks, Ok, Cho, and Garber, 2012), where a moderate amount of exercise is associated with the best outcomes.

When more specific facets of mental health are explored, some research found that psychological distress, anxiety, depression, stress, and burnout all have negative relationships with all levels of physical activity, such that increased physical activity led to decreases in these variables (Lindwall, Liung, Hadzibajramovic, and Jonsdottir, 2011; Mikkelsen, Stojanovaska, Polenakovic, Bosevski, Apostolopoulos, 2017). In a meta-analysis, Martinsen (2008) notes that several studies, both experimental and non-experimental, found that aerobic exercise used in conjunction with therapeutic treatment resulted in a decrease in depressive symptoms. Though often times depression was reduced even in other treatment groups, those in the aerobic exercise condition often experienced a significantly greater reduction. Others have also found aerobic exercise to be a superior treatment for anxiety as compared to strength and mobility exercises (Steptoe et al., 1989, as cited in Ströhle, 2009), though several studies found both aerobic and nonaerobic exercises to be comparably beneficial in regard to outcomes associated with anxiety and depression (Ströhle, 2009).

Others have posited a mediating factor in the relationship between mental health and exercise. Through research utilizing twin and sibling registries, support has been found for a genetic factor underlying the association. In such studies, it was found that exercisers were, on average, happier in life than non-exercisers. Further, similar to previous studies, it was found that a familial resemblance in exercise behavior was a likely explanation. In other words, twins and

other siblings had similar propensities to engage in exercise activities, which when accounted for, did not elicit the same significant correlations between exercise and mental health (Stubbe, Moor, Boomsma, Geus, 2006; Geus and Moor, 2008). Such information could be useful for helping professionals who feel that exercise may be beneficial in the treatment of their clients, both physically and psychologically.

Some studies have noted rhythmic breathing as an essential component to the enhancement of mood through physical activity. Both aerobic activity and yoga have been shown to elicit improvements in mood, and both share the practice of rhythmical abdominal breathing. Such is also a core component of stress reduction and meditative techniques, which are designed to foster psychological well-being (Berger, 1996). Swimming and running, specifically, have been known to have meditative qualities (Apter, Kerr, Murgatroyd, 1993; Holloway, 2007). Running can give people a sense of control over their breathing and heart rate, which is also a goal of therapy to help decrease feelings of anxiety (Solomon and Bumpus, 1978). Theoretical foundations of mindfulness have compared the basic Buddhist mindfulness traditions of breathing and attention to bodily sensations to stretching out in athletics (Ladner, 2011). The presence of non-judgmental, present-focused awareness of the physical sensations of one's body during running will be discussed further in the section connecting mindfulness and exercise.

In youth. Despite well-known health benefits of increased exercise in children, many studies have explored the influence of increasing exercise in youth on outcomes such as academic performance, cognition, mood, self-concept, and self-esteem. Overall, research conducted in schools has found that increasing the amount of time that students spend in physical education may lead to academic benefits. In fact, several studies noted that, over about a year, students who receive more physical education time slightly outperform students who receive less

physical education time based on grades and ratings of classroom behavior (Rasmussen and Laumann, 2013). In regard to cognition, Rasmussen and Laumann (2013) learned through their meta-analysis that there is a small positive effect between exercise in youth and cognitive improvement, specifically elements such as concentration, memory performance, and reaction time, particularly in exercise activities that involve a cognitive component or working with others. Such activities include aerobic circuit training and team games.

As mood in adults improves with the participation in exercise, similar improvements in mood are found in children. Norris, Carroll, and Cochrane (1992) conducted a study that analyzed adolescents who participated in varying frequencies of exercise and sports and their stress and psychological well-being over time. It was found that exercise had a negative correlation to stress and depression, such that as exercise increased, stress and depression decreased. A second study was conducted in which adolescents were divided into four groups, either moderate or high intensity aerobic training, flexibility training, or a control group, and were measured again on stress and psychological well-being. Results showed that those who participated in high intensity aerobic exercise displayed significantly lower scores in both stress and depression than participants in the other three groups at the conclusion of the study (Norris et al., 1992). Therefore, it can be deduced that participation in activities of this nature is beneficial for youth in regard to their well-being.

Much like the studies with adult populations, research has been conducted on more specific facets of mental health with children and adolescents. Similarly, it has been found that higher levels of physical activity are associated with decreases in internalizing problems such as anxiety and depression (Spruit, Assink, van Vugt, van der Put, and Stams, 2016). Moreover, some studies found this effect to be more pronounced in girls than in boys. However, boys

experience benefits of their own. For example, Moljord, Moksnes, Espnes, Hiemdal, and Erikson (2014) found a significant positive correlation between physical activity levels and social resources, or external support from friends and relatives, among boys. This is particularly useful because at baseline, girls have significantly more social resources than boys, which can serve as a protective factor. Thus, engaging in physical activity may have the added benefit of creating more social resources, and subsequently protective factors, among boys in particular.

While several studies can agree that a relationship between exercise and mental health exists, some believe that there are mediating factors at play. McPhie and Rawana (2012) utilized the National Longitudinal Study of Adolescent Health and in their analysis found physical activity and depression to be fully mediated by self-esteem. In other words, physical activity was no longer associated with lower depressive symptoms once self-esteem was included in the regression analysis. Therefore, studies should consider self-esteem levels when assessing the effects of exercise in adolescence.

Self-concept and self-esteem are constructs that have been shown to improve after the implementation of short-term exercise programs, particularly among those who start out with lower self-esteem. When the program is long-term, however, a broader population can benefit (Rasmussen and Laumann, 2013). For example, Schmalz, Deane, Birch, and Davison (2007) found that physical activity in children ages nine and 11 predicted self-esteem later at ages 11 and 13, such that exercise led to better self-esteem. Thus, there is support for the positive impact exercise can have on child development. Similarly, Percy, Dziuban, and Martin (1981) studied 30 fifth and sixth grade children after assigning them to either a running group or a control group, and measured their self-esteem before and after the program was implemented. They found an increase in self-esteem among participants of the running program. Beyond this study,

others have examined more narrowly the influence of running on mental health, which the next section will discuss.

Running. There have been many health benefits associated with recreational running such as cessation of smoking; weight loss; increased cardiorespiratory fitness; reductions in risks of cardiovascular disease, hypertension, and diabetes; and higher life expectancy (Koplan, Powell, Sikes, Shirley, and Campbell, 1982; Lee, Brellenthin, Thompson, Sui, Lee, and Lavie, 2017; Lee, Pate, Lavie, Sui, Church, and Blair, 2014; Marti, 1991). Much of the literature on benefits related to psychological health is centered around the treatment of depression or other disorders with depressive symptomology. Interestingly, it appears as though the 1970s and 1980s were popular periods of time to study the relationship between running and psychological processes.

Running behavior has been found to alter depression in both clinical and non-clinical populations (Brown, Ramirez, and Taub, 1978; Hinkle, 1992). Among subjects who previously received treatment modalities such as Cognitive Behavior Therapy (CBT) and antidepressant medication that were not effective in improving functioning, running elicited positive effects (Blue, 1979). Further, those who experience moderate depressive symptoms may also benefit from running if they do not respond to traditional treatment. However, running may be counterproductive to severely depressed individuals if not coupled with additional therapeutic support (Hinkle, 1992; Knapen, Vancampfort, Moriën, Marchal, 2015).

In an experimental study by Greist, Klein, Eischens, and Paris (1978), moderately depressed subjects were assigned to either a running treatment, time-limited psychotherapy, or time-unlimited psychotherapy, all of which lasted twelve weeks. Within this study, time-limited psychotherapy was limited to ten sessions and focused on the small changes people can make to

better their lives. Time-unlimited psychotherapy was more insight oriented and dynamic, and was not constrained to a prescribed number of sessions. The running-treatment group experienced dramatically-reduced depression scores after the twelve weeks of treatment, which compared favorably to the psychotherapy groups. Further, follow-up measurements at one, three, six, nine, and 12 months after the end of treatment indicated continued low depression scores for those who were in the running-treatment group. The authors also identified potential reasons for this therapeutic effect on depression, such as a sense of mastery and improved self-image. These outcomes are particularly relevant for depressed individuals who tend to experience decreased feelings of competency and self-worth (Silva and Shultz, 1984).

While some research suggests that running may elicit feelings of anxiety and irritability due to the lactate build-up from vigorous physical activity (Silva and Shultz, 1984), the preponderance of evidence indicates that running and jogging have many benefits on other elements of mental health such as anxiety, self-concept, body image, stress tolerance, and coping (Hinkle, 1992; Knapen, Vancampfort, Moriën, Marchal, 2015; Salmon, 2001; Weinstein and Meyers, 1983). Affective states such as positive engagement, revitalization, tranquility, and physical exhaustion have also been identified as improving after bouts of self-planned running (Szabo and Abraham, 2013). Possible explanations for the positive implications of running on these facets of mental health are that it can provide a distraction from depressive thoughts, or that it is attributed to the adrenaline crossing the blood brain barrier (Hinkle, 1992). Other neurobiological explanations address evidence that shows exercise stimulates dopamine, serotonin, and noradrenergic activity in the central nervous system (Meeusen & De, 1995), which as previously discussed, can result in improved mood.

There are mixed results as to whether the effects of running are dose-dependent or not. In other words, some have found that a higher frequency of running results in stronger effects. For example, Wilson, Morely, and Bird (1980) found that marathoners, or those who ran between six and twenty miles on six or seven days per week, and joggers, who ran one to two miles on three to five days per week, reported significantly less depression, anger, confusion, and significantly more vigor than non-exercisers. Further, they found that the marathoners and joggers differed significantly across these areas in that the marathoners reported significantly less depression, less anger, less confusion, and more vigor than the joggers. However, Ekkekakis and Petruzzello (1999) found that neither level of exertion nor duration of exercise affect outcomes. Similarly, Szabo (2003) found that the intensity of exercise was not a mediator in the relationship between acute psychological effects and planned, self-paced running. It has also been found that there may be an element of competition that plays a role in anxiety-related outcomes. Specifically, those who were more successful (i.e., did better than their expectations) in a 5K running race, experienced significant decreases in anxiety post-race than those who were unsuccessful (i.e., did not meet their expectations for the race; Clingman and Hilliard, 1994).

In a review, Weinstein and Meyers (1983) discussed the results of several studies that identified these trends between running and mental health, while acknowledging the methodological limitations. Limitations included small sample size, lack of experimental control, and non-clinical samples, which prevents generalization to those with clinically-depressive symptomology. Though many of the studies found positive implications for depression and other psychological concerns from pre- to post-running intervention, the procedural limitations make it difficult to recognize a causal relationship. Nonetheless, running can still be considered to be promising as a strategy for improving mental well-being.

Music and running. One factor that researchers have considered in the relationship between psychological health and running is the addition of music. Though people report significantly more enjoyment and better affect after running with music or music combined with video than those in a no-music control group, the same people experienced higher dissociative thoughts (Jones, Karageorghis, Ekkekakis, 2014; Hutchinson, Karageorghis, and Jones, 2015). Other studies have also found the addition of music to be preferential for runners, and found it to be beneficial at the beginning of the run; however, it does not imply improved endurance and it is not as effective as running without music in sustaining effort throughout a long run (Cole and Maeda, 2015; Tenenbaum et al., 2004). The literature on this topic is brief, and more research is warranted in order to explore the relationship in more depth. While the majority of the literature focuses on running in adult populations, the results have implications for youth populations as well. Though fewer exist, some studies analyze the effects of distance running on children and adolescents. These findings and implications will be discussed in the following section.

Running in youth. Many of the benefits that arise as a result of running in adulthood may also be beneficial to children and adolescents. However, it is first beneficial to acknowledge the literature on the implications of distance running for young children. Some researchers contend that the practice of distance running should not be recommended to children based on the risk of musculoskeletal injury (Jenny & Armstrong, 2013). The Academy of Pediatrics Committee on Sports Medicine stated that most commonly among those who develop musculoskeletal injuries are overtraining injuries that can be directly traced to their total mileage. This may lead to medical problems later in life such as chronic arthritis or growth deformity (Committee on Sports Medicine, 1990). Others worry that running may not be enjoyable to young children, that they are not physically ready to participate in an activity of this caliber, or

that they will mentally burn out. In addition, some fear that there may be social deprivation due to the time-consuming nature of long-distance training (Blankson & Brenner, 2016). That being said, researchers have cited guidelines for children's physical activity levels, and safeguards for distance running participation. Additionally, several studies have identified beneficial outcomes from participation in running programs.

According to the American College of Sports Medicine, it is recommended that youth 13 years of age and younger engage in 60 minutes of physical activity per week throughout three or four days. Further, the 60-minute total should be broken down into 30 minutes of moderate exercise and 30 minutes of vigorous exercise. Moderate exercise is classified as noticeable differences in breathing, sweating, and heart rate, while vigorous exercise is substantial differences in these body functions (American College of Sports Medicine, 2013). The National Association for Sport and Physical Education has different recommendations. It is stated that children between the ages of five and twelve should engage in a total of 60 minutes of physical activity daily. This should consist of intermittent activity in which moderate activities such as walking or running are of longer duration, and more intense activities such as sprinting are of shorter duration, and include rests (Corbin & Pangrazi, 2004, as cited in Jenny & Armstrong, 2013). For long-distance running specifically, it is recommended that children under 10 years of age do not run more than five to six miles in one training session. Children ages 11 to 15 can handle about one-third of the training load of an adult, and should not go more than 10 to 20 minutes before resting. Older adolescents ages 16 to 18 should be able to handle one half to two-thirds of the training load of an adult (Noakes, 2003).

Beyond these recommendations, there are several safeguards that have been recommended by researchers for the proper teaching and implementation of running activity in

children. Before children engage in distance running, it is advised that they first be examined by a medical professional to assess the risk of injury. They should also be allowed to cease participation whenever they choose, should they feel they are missing opportunities to spend time with their peers (Blackson & Brenner, 2016). It is important to teach children proper running form, movement concepts (e.g., pace, foot landing, smoothness), nutrition and hydration, proper footwear, and sun safety (Jenny & Armstrong, 2013). If the practice of running among children is facilitated safely and effectively, there are several benefits, both physical and psychological, that can be produced.

Though the breadth of the research is more limited than that with adult populations, several studies have noted both physical and psychological benefits associated with aerobic exercise or running participation in children. Back in 1986, Tuckman and Hinkle conducted an experimental study of the physical and psychological effects of aerobic exercise on school children. The participants were 154 fourth, fifth, and sixth graders who were randomly assigned to the running treatment condition or the control group. The experimental treatment consisted of three running sessions per week at 30 minutes per session. The treatment lasted 12 weeks, during which time students in the control group were assigned to regular PE classes. Outcomes were measured both before and after the 12-week experiment. Results showed significant improvement in cardiorespiratory effectiveness, improvement in creative capacity and divergent thinking, and for boys, a significant reduction in body fat.

Other studies have found similar outcomes. For example, Siegel and Manfredi (1984) conducted an experiment in which third graders either participated in the experimental running program for ten weeks, or a control condition in which they were allowed to free play. Results showed faster running among treatment group participants, as well as increased maximum heart

rate. Duke, Johnson, and Nowicki (1977) found that elementary-aged children experienced improved internal locus of control after participation in aerobic fitness activities, including fitness running, throughout an eight-week sports fitness camp. Cooper et al. (1975) found that adding jogging to a high-school gym class significantly improved endurance among students. Another study with adolescents found that, after participating in a running treatment group in which they ran every morning for 30 minutes at a moderate intensity for three weeks, these adolescents experienced significantly higher mood in the morning than the control group, their mood significantly increased over the course of the experiment, their concentration increased significantly, and their sleepiness decreased over time (Kalak et al., 2012). Though it may sometimes be difficult to get adolescents to participate in running activities outside of school, there are several who elect to do so in cross-country. Since this is an organized sport within the school district, it is a good avenue for data collection, and therefore it is worth exploring the literature on outcomes that have already been identified as a result of participation in cross-country and other organized sports.

Sports participation in youth. One way in which children and adolescents stay physically active is through participation in organized sports. Although females tend to participate in multiple sports at a lower rate than males (Fisher, Juszczak, Friedman, 1996; Slater and Tiggerman, 2011), both reap both physical and psychological benefits as a result. In a systematic review, Eime, Young, Harvey, Charity, and Payne (2013) found that children and adolescents experienced improved self-esteem and social interactions, as well as fewer depressive symptoms as a result of sports participation. Further, they concluded that team sports in particular are helpful due to their opportunities for social interactions. The feeling of connectedness can help adolescents cope with stressors affecting their mental health (Swann et

al., 2018). Others have also found psychological benefits in that sports participation is positively correlated with prosocial behavior and overall well-being (Super, Hermens, Verkooijen, Koelen, 2018). Sports have also been an avenue for managing stress in adolescence (Swann et al., 2018). Physical benefits experienced by children and adolescents who participate in sports include improved overall health, body mass, and pulse rate, such that sports participants' resting pulse rate is significantly lower (Felfe, Lechner, Steinmayr, 2016; Super, Hermens, Verkooijen, Koelen, 2018). However, it is important to acknowledge that some studies associated sports participation in adolescents with alcohol-abuse behaviors, bulimia, and suicidal ideation (He, Paksarian, Merikangas, 2018; Rodelli, De Bourdeaudhuij, Dumon, Portzky, DeSmet, 2018).

In regard to school-related outcomes, one study found a statistically significant positive relationship between sports participation and class attendance, homework completion, and getting along with people (Samarasinghe, Khan, McCabe, and Lee, 2017). O'Donnell and Barber (2018) found that sports participation in adolescence was inversely related to externalizing behaviors, but this relationship was moderated by the presence of prosocial peers. In other words, levels of externalizing behaviors were low when peers had fewer risky behaviors.

Sports participation in adolescence has also been linked to beneficial outcomes later on in young adulthood. Ashdown-Franks, Sabiston, Solomon-Krakus, O'Loughlin (2017) found that the greater number of years participating in sports during the adolescent years (grades 7 through 11), was protective of panic and agoraphobic symptoms in young adulthood (e.g., around 20 years old). Other mental health outcomes in early adulthood as a result of adolescent school sport participation are decreased depression, lowered stress, and high self-rated mental health (Jewett et al., 2014). Physical activity in adulthood is also higher after participation in organized sports in adolescence, which is consistent with better health (Dodge and Lambert, 2009; Tammelin,

Nayha, Hills, Riitta-Jarvelin, 2003). In sum, participation in sports in adolescence is linked to many positive physical, social, academic, and psychological outcomes. However, one indicator of psychological well-being that is an under-explored outcome of sports participation is mindfulness. Though there are some studies on the link between mindfulness and sports performance, studies have emerged investigating the nature of the relationship between exercise, primarily running, and both state and trait mindfulness.

Mindfulness and exercise

The emerging research on the link between physical activity and mindfulness has identified a positive relationship. Heightened levels of trait mindfulness have been shown to be associated with beneficial health outcomes such as increased physical activity, higher self-efficacy, and improved diet, as evidenced by increased fruit and vegetable intake (Gilbert and Waltz, 2010). Further, those who are higher in trait mindfulness experience more positive health outcomes associated with exercise, including heart rate, blood pressure, and breathing patterns (Gotink et al., 2017).

One way in which trait mindfulness is cultivated is through mindfulness interventions, which have been geared particularly toward improving sports performance. Gardner and Moore (2004) suggest that The Mindfulness-Acceptance-Commitment based approach to performance enhancement, which integrates the fundamentals of Acceptance and Commitment Therapy (ACT) and Mindfulness-Based Cognitive Therapy (MBCT), should be used with athletes. This approach targets the development of non-judgmental, present-moment attention, acceptance of internal experiences, and a focus of attention on performance-related cues and appropriate actions in order to achieve athletic goals.

Bernier, Thienot, Codron, and Fournier (2009) found that golfers who participated in a psychological skills training program, comprised of MBCT and supplemented by elements of ACT, significantly enhanced their activation skills, more so than those in the control group did. This revealed heightened physiological and mental states during times in which increased energy, motivation, and focus are needed. Therefore, performance improved. Such an experience is similar to the mental state referred to as “flow,” which is an optimal mental state that involves complete absorption in the activity with which a person is engaged (Csikszentmihalyi, 1990).

Kee and Wang (2008) found that participants who scored highest on a measure of dispositional (i.e., trait) mindfulness scored significantly higher in flow dispositions than those who had the lowest mindfulness scores. The flow dispositions consisted of challenge-skill balance, clear goals, concentration, sense of control, and loss of self-consciousness. The authors concluded that those who are more likely to attend to the present moment throughout their daily living have a higher chance of experiencing flow. Therefore, it may be argued that mindfulness must be practiced and instilled prior to engaging in sports or exercise in order to attain the flow state. In a similar vein, in a different study, cyclists who participated in an eight-week mindfulness program involving regular weekly workshop sessions, home meditation training, and group stationary cycle mindful-spinning sessions experienced statistically significant increases in mindfulness and flow than control group participants. Further, increases in mindfulness between baseline and post-test were related to increases in flow, and both elicited moderate effect sizes (Scott-Hamilton, Schutte, & Brown, 2016).

There is a theoretical link between the two constructs in the attention and awareness that defines mindfulness and the total concentration, merging of action and awareness, and transformation of time involved in flow (Kaufman, Glass, & Pineau, 2018). More specifically, a

moderate, positive correlation has been found between trait mindfulness and flow ($r = .44$). The same study found a significant linear relationship such that mindfulness predicted flow ($p < .001$) (Bervoets, 2013). Given that sports involvement provides opportunities for moment-to-moment attention, it is plausible that there may be a bidirectional relationship between flow and trait mindfulness. Specifically, flow might help in cultivating trait mindfulness and vice versa.

In more recent years, studies have shifted the focus to measuring mindfulness as an outcome of exercise participation. Generally speaking, trends show that the more time that is spent in an exercise activity, the more mindful a person is (Kangasniemi, Lappalainen, Kankaanpää, and Tammelin, 2014). Some argue that the repetitive nature of running causes the mind to wander and fail to attend to breathing and proper running technique. Further, it can foster negative thoughts that cause pain and also interfere with running form (De Petrillo, Kaufman, Glass, and Arnkoff, 2009). However, others assert that mindfulness techniques have parallels to long-distance running. For example, Dreyer and Dreyer (2009) stated that focus and the acceptance of thoughts, as well as attention to breathing, are important components for optimal running performance. In order to highlight other related variables that may influence the increase in mindfulness as a result of exercise, numerous studies are discussed in more detail below.

Ulmer, Stetson, and Salmon (2010) examined the relationship between exercise maintenance and both state and trait mindfulness, using the Friedberg Mindfulness Inventory to measure state mindfulness, and the Mindful Attention and Awareness Scale (MAAS) to measure trait mindfulness. Participants included primarily adult exercisers ($M \text{ age} = 49.96$) from seven regional YMCA facilities. Exercise maintenance was measured using a self-report questionnaire that included questions about the consistency of the participants' exercise over the past year. For

example, it was asked whether or not the participants missed one, two, or three continuous weeks of exercise within the last year. Inconsistent exercise is perpetuated by avoidant behaviors, opposite from acceptance, which is a component of mindfulness. Results of the study showed that exercisers who were successful in maintaining exercise scored higher in both mindfulness and acceptance, both at statistically significant levels. Though causal inferences could not be made, the question as to whether more mindful and accepting people are drawn to exercise, or whether it is exercise that promotes mindfulness and acceptance, is raised.

In order to help determine a causal relationship, a controlled experiment must be conducted. To assess the relationship between trait mindfulness and aerobic exercise, Mothes, Klaperski, Schmidt, and Fuchs (2014) implemented a randomized, controlled trial utilizing a 12-week intervention period and three different groups. One group, the exercise training group, included initially inactive men who were to participate in an outdoor heart-rate controlled running training. The other groups were a relaxation training group and a waitlist control group. The relaxation group consisted primarily of progressive muscle relaxation, and did not address mindfulness at any point. It was hypothesized that participants in the exercise group would show greater improvements in trait mindfulness than the other two groups, and that the other two groups would not differ in regard to their trait mindfulness levels. Results confirmed both of the hypotheses, revealing that the exercise group had significantly higher levels of mindfulness after the intervention than the non-exercising control groups, and that there was no difference between the mindfulness levels of the relaxation group and the waitlist control. Therefore, it can be deduced that participation in an aerobic exercise activity alone elicited an increase in trait mindfulness. Explanations for this finding include an improved body awareness, and repeated exposure to bodily functions including increased breathing, heart rate, temperature regulation,

and hormone release. Further, the nature of self-regulation of attention during aerobic exercise is similar to that of mindfulness training.

Summary of Literature

The study of mindfulness can trace back to traditional Buddhist meditative practice, where an underlying attentional stance is required. Through the years, the overall construct of mindfulness has taken on many different titles, such as lucid awareness, insight meditation, and bare attention. More prevalently, mindfulness is categorized as either a state of being or a dispositional trait. State mindfulness is cultivated through meditative practice, while trait mindfulness is a characteristic that is amenable to change, but generally more stable over time. Further, scholars of trait mindfulness posit that everyone is inherently mindful to some degree. Both state and trait mindfulness have been found to be cultivated through a variety of interventions and practices, and were integrated into therapy for treatment purposes.

The instillation of mindfulness was first introduced to the realm of therapy in 1979 by Jon Kabat-Zinn with his Mindfulness-Based Stress Reduction (MBSR) Program. The development of other mindfulness-based interventions stemmed from Kabat-Zinn's MBSR program, and have gained popularity within the past several decades. Such programs elicit an increase in state mindfulness, along with a host of other psychological benefits such as decreased anxiety and depression, decreased stress, and improved overall well-being, both immediately following the intervention, and in the long-term. Findings in the literature are mixed as to whether the cultivation of state mindfulness correlates with increased trait mindfulness over time. Alternatively, research links trait mindfulness to several personality traits such as conscientiousness and positive affect, thus suggesting that trait mindfulness is its own personality construct. There are activities, however, some of which involve mindfulness practice

and others that do not, that stimulate an increase in trait mindfulness over time. While the majority of the literature on mindfulness interventions involve adult populations, more recent studies have adapted these programs for younger populations across multiple contexts.

Settings with youth involvement, including clinical settings and schools, have introduced mindfulness practices at an increased frequency. In a clinical context, children with a vast array of mental health concerns, including ADHD, anxiety, and depression have seen improvements with mindfulness interventions. Children with mental health concerns, like all children, spend much of their time in schools. Therefore, many schools have implemented specific mindfulness programs including Mindful Schools, Learning to Breathe, and MindUp, which have all contributed to positive outcomes such as reduced negative affect, increased self-reported calm, self-acceptance, decreased stress, improved resiliency, and cognitive performance, as well as improved executive functioning, self-reported well-being, and prosocial behavior. The growing emphasis on overall wellness in today's society involves not only the cultivation of mental health, but also physical health.

The importance of physical health has been addressed in youth through sports participation and increases in physical education. Participation in these activities brings a host of benefits, similar to those experienced by adults who engage in more exercise than their counterparts. Such benefits include improved overall psychological well-being, decreases in depression, anxiety, and stress, and physiological benefits. Children may also experience benefits related to cognitive functioning and academic achievement. Some argue that aerobic exercise in particular is responsible for eliciting these outcomes; however, the majority of the research notes that an increase in heart rate, no matter what the intensity, can lead to improvements.

More recent years have introduced the combination of these two larger bodies of research of mindfulness and exercise. Studies show that mindfulness interventions can have a positive impact on sports performance, and can also instill a state of “flow,” which allows one to be completely absorbed in the activity with which he or she is engaged. In the opposite direction, other studies have demonstrated that exercise participation can lead to an increase in trait mindfulness. Even with experimental control, it was found that participants in an exercise condition had significantly higher levels of mindfulness after the intervention than non-exercising control groups. Thus, this research provides an alternative avenue to the cultivation of trait mindfulness, which may be particularly appealing to more reluctant participants of formal meditative practice, such as modern-day adolescents.

Purpose of the Proposed Study

The literature provides evidence for trait mindfulness as a correlate of involvement in physical activity and sports among adults. However, there is potential for such a trend to be consistent with younger populations as well. The benefits of mindfulness among adolescents provide promising implications should there exist a relationship with sport participation, and in particular, cross-country running. Further, the stage in which adolescents are developing cognitively afford optimal opportunities to cultivate this heightened sense of attention and awareness. The current study aims to answer the following research questions:

1. Relative to the comparison group, is participation in running activity over time associated with increases in trait mindfulness?
2. Does amount of running per week influence one’s level of trait mindfulness?
3. Does the addition of music while running influence one’s level of trait mindfulness?

Chapter III: Methodology

The current study explored the relationship between distance running and trait mindfulness in high-school students through a combination of retrospective and quasi-experimental design. The study involved survey completion both before and after a full cross-country running season by participants across the ninth through twelfth grade. This chapter describes information pertaining to the study's participants and procedures, the measure that was used for examining the primary outcome variable, along with an overview of data analyses. Ethical considerations are also discussed.

Participants

High-school students from one school in central New York were recruited for participation in the study. Aligning with the research on self-regulation and cognitive control and the trajectory of youth development, this study elicited the participation of older rather than younger adolescents. In other words, the study included secondary students from grades nine through twelve, and excluded students in grades six through eight. In order to establish both the comparison and running group, the opportunity for study participation was extended to all students across grades nine through twelve. The nature of the exercise activities in which the students engaged was accounted for in order to distinguish which group each participant was assigned to. The school from which students were recruited was chosen based on professional connection and convenience sampling.

Procedures

Recruitment of student participants. The proposed study elicited buy-in from the school district through contact with the cross-country team coach. In order to ensure group matching between the running and comparison groups, participant recruitment was limited to

high-school-aged adolescents. Therefore, middle-school students and those who participate on modified-level cross-country teams were excluded. Students who received parental consent were eligible to participate in the study. Letters were sent home to parents of all students in grades nine through twelve within the district, outlining the purpose of the study. The letter denoted the bounds of passive consent, indicating that parents should respond if they did not wish for their children to partake in the study. If no parental response was provided, those students were eligible to participate. Based on the responses to questions described below on the demographics survey, students were assigned to either the running or non-running group.

Student survey administration. After recruitment was complete, the students with parental consent to participate completed a demographics survey, which also included information pertinent to group categorization, such as whether or not they were members of the cross-country team, frequency, duration, and distance they ran each week (whether they ran as a member of the team or not), as well as other exercise activities in which they were engaged. The survey also contained questions regarding what, if any, mindfulness-cultivating activities they participated in. The frequency and duration were also measured for such activities.

Students also completed a self-report mindfulness measure, described below, at two points during the first trimester of the 2019-2020 school year—once before the start of the cross-country running season in September 2019 and once when the season concluded in November 2019. The cross-country season was used as a parameter in order to ensure there would be runners in the sample; however, in the end, there were only 16 students, which comprised 6% of the sample, who identified being members of the cross-country team. Both the demographics survey and the self-report mindfulness measure were completed via a secure online platform. The link to the survey was provided to students in a google classroom created by the head of the

Social Studies department. The surveys were completed in the students' Social Studies classes, since the cross-country coach was a member of this academic department and this was a class in which all students were required to take. The students completed the surveys at the same time and in the same location at both the pre-running period and post-running period.

Student Self-Report Measures

Demographics form. The demographics form (see Appendix A) that was used in the current study contains questions regarding students' gender, age, grade, race, and ethnicity. It also includes questions concerning the student's participation in the cross-country running team, namely if they are members, participation in running in other capacities, a question regarding their participation in other mindfulness-cultivating activities (e.g., yoga), and a question regarding their participation in other exercise-based activities (e.g., other sports teams, weight lifting at the gym). As mentioned above, there were also questions that asked about the frequency and duration of all running activities. All items on the demographics form include multiple choice answer options, as well as an "other" option so that they could provide any additional activities that were not listed as answer choices. Lastly, the form included a Likert-scale question regarding how often the participants typically listen to music while running. Some of the questions regarding participants' running patterns and alternate activities were also asked at the follow-up (see Appendix B).

Child and Adolescent Mindfulness Measure (CAMM; Greco, Baer, & Smith, 2011). The Child and Adolescent Mindfulness Measure (see Appendix C) is a 10-item, empirically-supported tool designed to assess mindfulness skills such as awareness of the present and nonjudgment toward internal experiences in children and adolescents. It is intended to be used with youths over the age of nine. The CAMM was developed out of an initial pool of 25 items,

which asked respondents to rate how often each item was true for them according to a 5-point scale (0= *never true*, 4= *always true*). The original 25 items were adapted from three facets of mindfulness that were found on the Kentucky Inventory of Mindfulness Skills (KIMS), which include observing, acting with awareness, and acting without judgment. The fourth facet, describing, was not included due to the developmental appropriateness of the items. A later study utilized exploratory factor analyses to further analyze the suitability of the 25 items for youth populations. Ultimately, a 10-item scale was accepted with an internal consistency of .80.

The last study in the initial development of the CAMM analyzed correlations between the CAMM and other relevant constructs. Results revealed small to moderate negative correlations between the CAMM scores and child-reported somatic symptoms, from the Children's Somatization Inventory (-.40), internalizing behavior (-.50), and externalizing behavior problems, from the Symptoms and Functioning Scale (-.37), and positive correlations with overall quality of life, from the Youth Quality of Life Inventory (.25). Further, CAMM scores were found to be significantly negatively correlated with thought suppression, from the White Bear Suppression Inventory (-.58) and psychological inflexibility, from the Avoidance and Fusion Questionnaire for Youth (-.60; Greco, Baer, & Smith, 2011). A separate study assessed the psychometric properties of the CAMM among racial-minority adolescents from low-income environments and found the CAMM to be a reliable and valid measure of mindfulness skills in this population (Prenoveau et al., 2018), lending additional support for the utility of this measure with a wide-range of youth.

Analyses

Several statistical analyses were performed in order to answer the proposed research questions. Data were transferred from the online survey platform into SPSS in order to conduct

appropriate statistical analyses. Prior to input into SPSS, the data was screened for systematic errors in participants' responding (e.g., unusual response patterns such as selecting the same response option for each item). When such errors were found, they were omitted from the data set but stored on the original data collection platform.

Preliminary analyses. Means, standard deviations, and additional descriptive data were calculated and reported for the primary outcome variable, levels of trait mindfulness. Following preliminary analyses, a series of statistical analyses were conducted to answer the research questions posed in this study.

1. *Relative to the comparison group, is participation in running activity over time associated with increases in trait mindfulness?*
2. *Does amount of running per week influence one's level of trait mindfulness?*
3. *Does the addition of music while running influence one's level of trait mindfulness?*

Group differences and regression analyses. A Multiple Linear Regression was conducted to address the question of whether or not participation in running activity over time is associated with increases in trait mindfulness (research question 1). Another regression analysis was conducted in order to answer question two, in determining if the amount of running per week influences one's level of trait mindfulness. Lastly, one-way ANOVA was used to answer the third and final research question, which asked whether or not listening to music while running influenced one's level of trait mindfulness.

Ethical Considerations

A series of steps were taken in order to protect participants' rights. First, the author obtained approval from Alfred University's Human Subjects Research Committee (HSRC), as well as the Board of Education from the participating school district. Next, parents were notified

via a passive consent letter and were given the opportunity to opt their children out of the study. The passive consent form outlined the purpose of the study, potential risks and benefits of participation, and contact information for the primary researcher in case there were questions or concerns. Parents who did not wish for their child to participate in the study were able to return their signed form to the school. Further, students completed an assent form, which also included the purpose of the study and any other important details for participation. Students were able to elect to participate or opt out and were permitted to withdraw from the study without penalty.

While students were required to provide their first and last names, this information was used solely for the purposes of organizing pre- and post-season data entry. The author is the only individual who has access to students' names, and this data has been stored in a secured password-protected platform. No other identifying information was collected. Student's anonymity is protected in the presentation of the study results.

Chapter IV: Results

Data were collected at two different times, before and after the duration of a high school cross-country season. There were six weeks between the two survey completion dates, which will be referred to as the running period. Participants were assigned to groups based on their responses to survey questions regarding their participation in running and exercise. The running group consisted of those who indicated that they participate in running as an independent activity, either on the school cross-country team or recreationally. These participants may have also indicated that they participate in another exercise-based activity that does not involve running (e.g. weight-lifting, manual labor). Participants in the comparison group did not indicate participation in running, with the exception of those who indicated participating in a sport which involves running (e.g. soccer, football), who were also included in the comparison group. This chapter provides the results of the analyses that were conducted to answer the following questions:

1. Relative to the comparison group, is participation in running activity over time associated with increases in trait mindfulness?
2. Does time spent running per week influence one's level of trait mindfulness?
3. Does the addition of music while running influence one's level of trait mindfulness?

Sample Description

In total, data from 267 participants were analyzed in this study (see Table 1). There were 116 participants in the running group, and there were 151 participants in the comparison group. The age of the participants ranged from fourteen to eighteen or older, with 32.7% of the sample being fourteen years of age, 17.2% being fifteen, 36% being sixteen, 13.1% being seventeen, and 0.7% being eighteen or older. A total of 0.4% of participants did not indicate their age. The

sample was comprised of 45.3% male participants, 51.3% female, 1.5% transgender, and 1.5% other. Again, the remaining 0.4% accounts for missing items. The sample was predominantly Caucasian (88%), followed by mixed race (5.6%), Hispanic (3%), Asian or Pacific Islander (1.9%), Black or African American (1.1%), and other (0.4%). A total of 227 participants out of the 494 survey responders were not included in the study due to extraneous responses, absence on the day of the post-running-period survey completion, or choosing not to complete the post-running-period survey. Eighteen students returned letters signed by their parents to exempt them from participating in the study. Students who were not given parental consent to participate did not take a chrome book at the time of survey completion, and instead engaged in an independent activity.

Group Equivalence

Group equivalency was determined by assessing the participants' mean scores on the Child and Adolescent Mindfulness Measure (CAMM) at the beginning of the study. The CAMM is reverse scored, so for example, if the participant indicated "1" as an answer, it was scored as "5." The higher a participant's total score, the more mindful they are. The scores within this sample ranged from 11 to 50, with 50 being the highest possible score. The overall mean score for the sample, as reported by students on the pre-running period CAMM, was 32.41. The running group mean was 32.03 (SD = 7.29), and the comparison group mean was 32.8 (SD = 8.59), indicating that there was an approximate equivalence in regard to the scores reported. An independent samples t-test was conducted to examine differences in the groups prior to the start of the running period, and the results were not significant ($t = -.732, p = .465$). Therefore, any results found at the end of the running period are not attributed to group differences in the beginning.

Multiple Regression Analyses

This study was designed to determine the influence of running activity on students' trait mindfulness, when controlling for initial levels of trait mindfulness and participation in other mindfulness-based activities. Results from preliminary analyses confirmed that there were no violations of the assumptions of normality, linearity, and homoscedasticity. The overall multiple regression was statistically significant ($F[3, 245] = 10.443, p < .000, R^2 = .103$), and the three independent variables, namely the grouping variable, initial levels of trait mindfulness, and participation in other mindfulness-based activities, accounted for 10% of the variation in mindfulness change (see Table 4). One's initial level of trait mindfulness was significantly predictive of the overall change in mindfulness, such that those who were more mindful in the beginning changed significantly less than people who were less mindful in the beginning ($B = -.236, p < .001$). The other two independent variables, namely the grouping variable and participation in other mindfulness-based activities, were not found to be significant in regard to the change in mindfulness. The unstandardized regression coefficient (B) for the participation in other mindfulness-based activities was $-.986$ ($t(245) = -1.371, p = 0.171$). The unstandardized regression coefficient (B) for the group assignment was -1.214 ($t(245) = -1.723, p = 0.086$). In sum, in regard to research question one, the mindfulness levels of the running group changed less over time than did the levels of the comparison (i.e., non-runner) group. In other words, results indicate that participation in running over this time was not associated with a significant change in mindfulness.

Research question two was addressed in another multiple linear regression. This regression was calculated to predict post-running-period mindfulness score based on number of minutes of running per week, while controlling for pre-running-period mindfulness score and

participation in other mindfulness-based activities. Results confirmed that there were no violations of the assumptions of normality, linearity, and homoscedasticity. The overall multiple regression was statistically significant ($F[3, 2212] = 87,645, p < .000, R^2 = .547$), and the three variables, namely the number of minutes of running per week, pre-running-period mindfulness score, and participation in other mindfulness-based activities accounted for 55% of the variation in post-running-period mindfulness scores (see Table 5). The amount of running one engaged in each week, measured in minutes, was not found to be significantly predictive of a higher post-running-period mindfulness score. The unstandardized regression coefficient (B) was .000192 ($t(212) = .781, p = 0.436$). In other words, while the combination of the three independent variables predicted significant changes in post-running-period mindfulness scores, time spent running per week was not found to be a significant unique predictor.

Analysis of Variance

A one-way, between subject analysis of variance (ANOVA) was conducted to explore the relationship between the frequency with which participants listen to music while running and their levels of trait mindfulness (research question three). In this analysis, how often participants reported listening to music while running (if applicable) was the independent variable, and there were five different levels: never, sometimes, often, almost always, and always. The dependent variable was total post-running-period mindfulness score, which was measured by the CAMM on a scale of 1-50. The ANOVA was found to be significant, ($F(4, 218) = 2.757, p = .029$; see Table 6). There was a small to medium effect size suggesting that 4.8% of the variance in mindfulness could be accounted for by the frequency with which participants listen to music while running (partial eta squared = .048). Linear planned contrasts revealed that those who never listen to music while running compared with those who listen to music sometimes, often,

almost always, or always, resulted in significantly higher levels of post-running-period mindfulness ($t(218) = 2.418, p = .016$). Furthermore, it was found that those who sometimes listen to music while running had significantly higher levels of post-running-period mindfulness than those who often, almost always, or always listen to music while running ($t = 2.157, df = 218, p = .032$). There were no significant differences, however, between mean scores of those who never listened to music while running and those who sometimes listened to music while running ($t = .816, df = 218, p = .416$).

Follow-Up Analyses

A follow-up linear regression was conducted in order to further examine the significant finding from the preliminary analysis that those with lower pre-running-period mindfulness scores experienced significantly greater change in post-running-period mindfulness scores. The overall regression was not statistically significant ($F[2, 150] = 2.505, p = .085, R^2 = .019$). Therefore, the independent variables are not jointly predictive of overall mindfulness change. Participants with total pre-running-period mindfulness scores that were less than 35 were chosen for the analysis due to the distribution of the scores among the population. Considering only these participants, the grouping variable was found to be significant in predicting mindfulness change ($B = -2.051, p < .05$). More specifically, runners' mindfulness scores, though higher at the post-running period, changed significantly less than non-runners, whose scores also increased from the pre- to post-running period (see Table 7).

Another follow-up linear regression was conducted in order to evaluate post-running-period mindfulness scores rather than the change scores. In this regression, the independent variables included the running grouping variable, the pre-running-period mindfulness score, and the mindfulness-based activity variable, and the dependent variable was the post-running-period

mindfulness score. The overall regression was statistically significant ($F[3, 213] = 89.845, p = .000, R^2 = .552$), and the three variables accounted for 55% of the variation in mindfulness change (see Table 8). Results showed that one's initial level of trait mindfulness was significantly predictive of one's post-running-period mindfulness score, as with each standard deviation unit increase in pre-running-period mindfulness, post-running-period mindfulness scores increased by .747 standard deviation units ($B = .747, t(213) = 15.691, p = .000$). Similar to the preliminary analysis, the other two independent variables, namely the grouping variable and participation in other mindfulness-based activities, were not found to be significant in regard to post-running-period mindfulness. The unstandardized regression coefficient (B) for the participation in other mindfulness-based activities was $-.978$ ($t(213) = -1.273, p = 0.204$). The unstandardized regression coefficient (B) for the group assignment was -1.345 ($t(213) = -1.798, p = 0.074$).

Chapter V: Discussion

The present study sought to explore the relationship between running activity and trait mindfulness in adolescents. The study was designed to control for participation in other mindfulness-based activities as well as initial levels of trait mindfulness, as measured before the start of the “intervention” period. The period of time between data collection, referred to as the running period, was the duration of a high-school cross-country season (approximately six weeks). This was classified as a period of time when there were increased amounts of running in which students were engaged. Trait mindfulness was measured using the Child and Adolescent Mindfulness Measure (CAMM).

The first hypothesis stated that participation in running activity over time would be correlated with heightened levels of trait mindfulness. Results of the initial multiple regression revealed that the three variables, namely the grouping variable (i.e., runner vs. non-runner), initial level of trait mindfulness, and participation in other mindfulness-based activities, accounted for 11% of the variance in change in mindfulness scores. It was found that only one’s initial level of trait mindfulness was significantly predictive of an overall change in mindfulness over time. Specifically, those who were more mindful in the beginning changed significantly less than people who were less mindful in the beginning. The other two independent variables, namely the grouping variable and participation in other mindfulness-based activities, were not found to be significant predictors in regard to the change in mindfulness. Therefore, the first hypothesis was not supported.

Though unanticipated, the finding that participants with higher levels of trait mindfulness pre-running period changed significantly less than those with lower levels of trait mindfulness is not surprising. It is often true that those with higher scores of the targeted variable experience a

ceiling effect such that they are unable to grow even with the addition of a potentially cultivating activity. However, prior research found that people with higher initial levels of mindfulness experienced greater effects, which included an increase in mindfulness, from the mindfulness-based interventions in which they participated (Shapiro, Brown, Thoresen, & Plante, 2011). Moreover, due to the study design, confounding variables (i.e., any variables other than running and participation in other mindfulness-based activities) could have led to such changes in mindfulness levels. Further, the study did not involve the implementation of a specific mindfulness-based intervention, which is what has been shown to be the catalyst for such an effect (Shapiro, Brown, Thoresen, & Plante, 2011). Research has suggested that there may be gender differences in regard to outcomes of mindfulness-based interventions, such as affective health (Kang, Rahrig, Eichel, Niles, Rocha, Lepp, Gold, & Britton, 2018). Therefore, it may be beneficial to include gender as a predictor variable in future research. Additionally, socio-economic status might be an interesting construct to control for, provided that children and adolescents from differing backgrounds have different opportunities for experiences that might serve to cultivate trait mindfulness.

In a follow-up analysis, it was found that these individuals with lower preliminary mindfulness scores (less than 35) who were also non-runners experienced significantly greater change in mindfulness scores than runners who had lower preliminary mindfulness scores. Although both runners and non-runners with lower pre-running-period mindfulness scores experienced increases in trait mindfulness levels at the post-running period, this finding suggests that running activity itself was not a predictor of higher mindfulness scores, which was also found in the preliminary regression analysis. Such a result is also fairly surprising given the literature on the connection between mindfulness and exercise, and in particular, aerobic

exercise. For example, Ulmer, Stetson, and Salmon (2010) found that exercisers who were successful in maintaining exercise scored higher in both mindfulness and acceptance, both at statistically significant levels. In addition, Mothes, Klaperski, Schmidt, and Fuchs (2014) found in a controlled experiment that an exercise group, who participated in an outdoor running training, had significantly higher levels of mindfulness after the intervention than the non-exercising control groups, and that there was no difference between the mindfulness levels of the relaxation group and the waitlist control. Conversely, some researchers argue that running may foster negative thoughts that cause pain and also interfere with running form (De Petrillo, Kaufman, Glass, and Arnkoff, 2009). The design of the current study does not lend itself to determining whether the latter was true for the participants.

The second hypothesis that the amount of running would be positively correlated with trait mindfulness scores was not supported from the regression analysis. This was somewhat surprising, based on the literature that shows the more time someone spends in an exercise activity, the more mindful he or she is (Kangasniemi, Lappalainen, Kankaanpää, and Tammelin, 2014). Further, it has been found that people who regularly exercise over time report higher levels of trait mindfulness than those who do not (Ulmer, Stetson, and Salmon, 2010). Therefore, it was thought that those who ran more frequently and consistently throughout the 6-week period, rather than missing days of weeks, would report higher levels of mindfulness. However, previous studies that have implemented mindfulness-based interventions have commonly utilized an 8-week time period, likely because the original MBSR program was designed to run for eight weeks (History of MBSR, 2016), and therefore it is possible that 6 weeks was not long enough to elicit any changes in mindfulness levels. More research is warranted on running specifically in order to make a more confident determination about the relationship. Furthermore, research is

lacking with adolescent populations in this area. Though adolescents are at a stage in their cognitive development wherein mindfulness could be cultivated, it is less likely that this trait is strengthened without the introduction of mindfulness practice. The literature discusses mindfulness interventions with youth populations and the explicit teaching that is involved in this novel skill. Trait mindfulness, though innate, is often strengthened through repeated mindfulness practice over time (Brown & Ryan, 2003; Thompson & Waltz, 2007). Therefore, adolescents likely do not have the amount of exposure necessary to mindfulness-cultivating activities to increase levels trait mindfulness.

The final hypothesis stated that the presence of music while running would be negatively correlated with trait mindfulness. It was found that those who never listen to music while running had significantly higher levels of post-running-period mindfulness compared with those who listen to music sometimes, often, almost always, or always, thus supporting this hypothesis. This finding is consistent with research on music listening and running. Specifically, although people report that running is more enjoyable with the addition of music, they also experience dissociation under these conditions (Jones, Karageorghis, Ekkekakis, 2014; Hutchinson, Karageorghis, and Jones, 2015). Dissociation utilizes stories, narratives, and other cognitive activities to divert attention away from the discomfort associated with somatic cues during running. The opposite of this strategy, association, is often used by elite runners, and it means that they direct their attention to the running-related somatic cues and utilize this sensory information to inform their level of effort (Salmon, Hanneman, Harwood, 2010), which has parallels with the characteristics of mindfulness, namely the attendance to and awareness of the present experience in a non-judgmental way (Brown & Ryan, 2003; Kabat-Zinn, 2003). Thus,

when individuals do not listen to music while running, they are less likely to dissociate and more likely to engage in association and similarly experience higher levels of mindfulness.

This finding also supports the existing literature on the integration of music into mindfulness practice, which states that music accompaniment during mindfulness practice does not elicit a significant difference in mindful awareness over time (Tomaselli, 2014; Kowarz, 2015). Another study found that, through the implementation of a six-week mindful music listening intervention, participants experienced increases in mindfulness scores over time (Lesiak, 2017). This suggests that there needs to be an intentionality of mindfulness practice, which is then applied to the activity, which in this case was music-listening, for a change in mindfulness to exist. Therefore, it begs the question: would direct teaching of mindfulness before running activity influence mindfulness levels over time?

Study Limitations

The current study was designed to minimize threats to its reliability and validity. However, there are still notable limitations to address. Primarily, there are concerns with population validity in regard to generalizability. While the researcher intended to elicit participation from schools from across upstate and western New York, all were from Central New York State, which is demographically limiting. For example, the district is located in a town with a median household income of \$71,158, and 9% of people live below the poverty line. Due to the nature of convenience sampling rather than random sampling, it is difficult to generalize results to the larger population. Further, the sample size consisted of predominantly Caucasian participants (88%), followed by mixed race (5.6%), Hispanic (3%), Asian or Pacific Islander (1.9%), Black or African American (1.1%), and other (0.4%). Such a pattern of demographic characteristics is not reflective of the overall racial diversity of the state. The United States

Census Department states that 63.3% of New York's residents are Caucasian, 15.7% are Black or African American, < 1% are American Indian and Alaska Native, 8.5% are Asian, and 3.3% identify as multiracial (US Census Bureau, 2019). The racial diversity of New York reflects the overall diversity of the United States, as well. Therefore, future research should consider a more diverse student population in order to generalize the findings to a wider population of adolescents.

A second limitation is that the study relied exclusively on self-report data. One way in which self-report surveys are limiting is that there is potential for social desirability to drive the participants' responding. Furthermore, the respondents' introspective ability may make it difficult to assess themselves accurately, especially on a trait that is not commonly examined such as mindfulness. Another difficulty with self-report surveys is that Likert scales are sometimes difficult to accurately portray one's perspectives, thus leading to potentially misrepresented findings.

Another limitation that presents a threat to internal validity is participant attrition. There were 494 responses on the pre-running-period survey and only 316 responses on the post-running-period survey. The survey was completed at the same time of the day in the same classrooms. Since the implementation was monitored by the classroom teachers, the reasons as to why some students did not participate in the post-running-period survey are unknown.

Finally, though the study design was a combination of retrospective and quasi-experimental, it can be challenging to control all extraneous variables that may influence the raters' mindfulness levels. Consequently, there may be other factors that instill this trait that are not accounted for in the demographic form. More exploratory research may be warranted for determining additional influences on adolescents' trait mindfulness. An additional limitation

pertaining to the study's design is that it was not a true experiment such that the "intervention" was not controlled. The "intervention" was the pre-existing cross-country running season, which was a known timeframe in which there would be increased time spent running for some students. There was no prescribed intervention, nor was there an intentionality of mindfulness application to the running activity. For adolescents especially, such may be a key component in facilitating the cultivation of trait mindfulness. Lastly, was no way of monitoring running participation, and the data resulted from self-reports. There was also no random assignment of participants into groups. In light of some of these limitations, future research considerations are discussed later in the chapter.

Implications for the field of School Psychology

Within the realm of a school psychologist's position is the responsibility to provide children and families with resources that can help to foster overall well-being. Sometimes, school psychologists are called upon to search for and disseminate information on the latest research on the most effective practices for successful academic and social-emotional functioning. Other times, they can lead interventions themselves and monitor the progress and outcomes to inform the field of novel, effective practices. Mindfulness interventions have gained momentum in the field and have been implemented with children in the school setting. Programs have targeted anxiety and depression (Raes, Griffith, Van der Gucht, Williams, 2014), resiliency and stress (Gould, Dariotis, Mendelson, Greensburg, 2012; Greenberg and Harris, 2012; Zenner, Herrnleben-Kurz, Walach, 2014), negative emotionality (Klingbeil, Renshaw, Willenbrink, Copek, Tai Chan, Haddock, Yassine, Clifton, 2017; Zoogman, Goldberg, Hoyt, Miller, 2015), and body image (Atkinson & Wade, 2015). They can also offer improvements in more academic and social concerns including cognitive performance (Zenner, Herrnleben-Kurz, Walach, 2014);

academic achievement, school functioning, externalizing and internalizing problems, prosocial behavior, peer acceptance (Klingbeil et al., 2017; Schonert-Reichl, Oberle, Lawlor, Abbott, Thomson, Oberlander, Diamond, 2015); and academic engagement (Felter, Felter, Margolis, Ravitch, Romer, Horner, 2017). Future research on the topic of the present study can help to inform practice such that, if limitations were addressed and significant results were found, running may be used as an avenue for mindfulness cultivation. School psychologists could implement a running group with students as an after-school program, which would also contribute to the efforts in fostering good physical health among children and adolescents.

This knowledge can also help to inform school psychologists about ways in which they can contribute to Positive Youth Development (PYD) efforts. According to Moore (2017), PYD is a set of practices that is designed to instill one or more positive outcomes. Sometimes, this can involve the implementation of a certain program. For example, Girls on the Run and Heart and Sole are two running-based PYD programs that have established chapters throughout the country. School psychologists may choose to be coaches for the program and could use the findings of the present study, namely that refraining from listening to music while running is associated with higher trait mindfulness, to integrate into their lessons. A new running program that integrates mindfulness could be developed and follow a similar format to the existing PYD programs.

Lastly, the study may provide insight for psychologists who are looking to develop a more holistic approach to treatment. In the twenty-first century, it is challenging to treat people psychologically without also taking into consideration their physical and spiritual well-being (Robbins, 1998). Connecting the mind and body in medicine has been studied since the late 1960's, when it was found that it is possible to calm the body by quieting the mind (Casey,

Benson, MacDonald, 2004). Since then, this knowledge has been used in helping people with physiological improvements, such as increased immune response to vaccinations and reduced inflammation (Morgan, Irwin, Chung, Wang, 2014), improved static balance in older adults (Chen, Zhang, Wang, & Liu, 2016), improved cognitive functioning in adults with mild cognitive impairment (Zou, Loprinzi, Yeung, Zeng, & Huang, 2019), and improved cardiovascular health (Casey, Benson, MacDonald, 2004) through mind-body therapies. Psychological benefits from exercise have already been discussed. Research has begun to explore the integration of mind and body through interventions in the schools. Pearrow and Jones (2020) discussed a program called LAUGH Time, which uses an art-based approach to mindfulness to increase social-emotional well-being and cultivate resilience. The mind-body connection was activated in students through attending to breathing patterns and creating digital art with their fingers. For school psychologists, this area of study lends itself to collaboration with families, but also with art teachers and physical education teachers. There is potential for these school professionals to come together to implement programs such as LAUGH Time, or develop novel programs or curriculums to help support students holistically.

Future Research

Considering the mixed findings of the present study, future research should consider altering the design to reflect more of a true experiment in order to decrease threats to validity and to be able to infer more of a causal relationship between the variables. For example, participants should be randomly assigned to either the running or comparison group. Since the time spent running was not found to be a significant predictor of mindfulness change, the running group could be assigned a uniform amount of running in order to further exercise control over the conditions. Running activity should also be more closely monitored to ensure the integrity of the

intervention. Groups could also be further delineated based on the additional variable of listening to music while running, such that one running group would be required to listen to music while running, while the other running group would be denied listening to music while running, again to gain more control over the experiment, but also to confirm the significant findings of the present study.

Given the previous literature on pre-exposure to mindfulness practice, it may also be valuable for future research to integrate mindfulness lessons prior to, or along with, the running intervention. Further, the running intervention could be thought of as a “mindful running” intervention, wherein participants apply mindfulness techniques while engaging in running activity. Such an approach exists and was conducted in a study with twenty-five recreational long-distance runners, who ranged from 18 to 55 years of age. The mindfulness training involved techniques drawn from Kabat-Zinn’s MBCT, with a walking meditation that was modified to be relevant for long-distance runners. The protocol explained the usefulness of mindfulness in overcoming distractibility, poor running form, pain, and fatigue associated with the repetitive and arduous nature of running. Though there was not a significant difference between the groups found in levels of trait or state mindfulness, both groups experienced significant increases in mindfulness over time. Limitations that were discussed include length of the intervention and sample size, and it was suggested that participant recruitment happen through cross-country teams (De Petrillo, et al., 2009). Therefore, an integration of elements from the De Petrillo et al. (2009) study, as well as the present study, might lend itself to more significant results.

Summary

Research has shown that mindfulness interventions for youth can be effective in improving attention problems, state and trait anxiety, depressive symptoms, perceived stress,

quality of life, and somatic symptoms (Biegel, Brown, Shapiro, Schubert, 2009; Semple, Lee, Rosa, Miller, 2009; Zack, Saekow, Kelly, Radke, 2014). School-based mindfulness interventions have also demonstrated improvements in more academic and social concerns including cognitive performance (Zenner, Herrnleben-Kurz, Walach, 2014); academic achievement, school functioning, externalizing and internalizing problems, prosocial behavior, peer acceptance (Klingbeil et al., 2017; Schonert-Reichl, Oberle, Lawlor, Abbott, Thomson, Oberlander, Diamond, 2015); and academic engagement (Felter, Felter, Margolis, Ravitch, Romer, Horner, 2017). While many youth participants express acceptance and enjoyment of mindfulness programs after participation (Felter, Felter, Margolis, Ravitch, Romer, Horner, 2017; Lee, Semple, Rosa, Miller, 2008; Zenner, Herrnleben-Kurz, Walach, 2014), some report that the meditation was “boring” (Britton, Lepp, Niles, Rocha, Fisher, Gold, 2014; Milligan, Badali, Spiroiu, 2015). Therefore, it is useful to explore other activities that might increase one’s trait mindfulness. In fact, exercise has been shown to lead to mindfulness as an outcome, and to elicit other benefits in conjunction with mindfulness practice (Mothes, Klaperski, Seelig, Schmidt, and Fuchs, 2014).

The present study sought to explore the relationship between trait mindfulness and running activity in an adolescent population. Students from one school district were surveyed before and after the duration of the school’s cross-country running season, which was conceptualized as a time when there was known to be heightened amounts of running in some of the sample. Three research questions were posed along with three hypotheses in order to gain more insight into a potential naturally-occurring relationship. First, it was hypothesized that participation in running activity over time was correlated with heightened levels of trait mindfulness. Specifically, it was hypothesized that participants in the running group would

report higher levels of trait mindfulness at the completion of the cross-country season than those in the non-running comparison group. Further, it was hypothesized that runners will exhibit an increase in trait mindfulness from the start of the cross-country season to the completion, and that non-runners will not experience any significant change in mindfulness levels. The second hypothesis stated that the amount of running per week would be positively correlated with ending levels of trait mindfulness. The last hypothesis posited that the presence of music while running would be negatively correlated with trait mindfulness.

Results of the multiple regression analysis revealed that running was not shown to be a significant predictor of mindfulness change. Participation in other mindfulness-based activities was also not revealed to be a significant predictor, but initial level of trait mindfulness was. A follow-up analysis of mindfulness change among those with lower initial levels of trait mindfulness indicated that running was found to significantly influence mindfulness change, such that non-runners experienced a greater change in their mindfulness scores. There were noted limitations that may have contributed to the lack of support for the first two hypotheses, such as lack of experimental control, lack of diversity among the sample population, reliance on self-report data, and participant attrition.

The third hypothesis was supported in the findings of the one-way, between subject analysis of variance (ANOVA), which explored the relationship between the frequency with which participants listen to music while running and their levels of trait mindfulness. Results showed that those who never listened to music while running reported significantly higher post-running-period mindfulness scores than those who sometimes, often, almost always, or always listened to music while running. Further, those who sometimes listened to music while running had significantly higher post-running-period mindfulness scores than those who often, almost

always, or always listened to music while running. These outcomes align with previous literature on running and dissociative thought patterns, such that running participants experience greater levels of dissociation when listening to music while they run (Jones, Karageorghis, Ekkekakis, 2014; Hutchinson, Karageorghis, and Jones, 2015), and thereby limiting mindfulness.

Future researchers should consider exploring this unique area of the literature, which combines facets of mindfulness and exercise research, to continue the development of new findings in order to inform practice. Should future research be conducted, it should address the limitations of the current study, and expand upon the study design such that mindfulness instruction is conducted before the running activity takes place. Further, there should be experimental control in the form of random group assignment, amount of running, and music listening. With prior learned mindfulness practice, such techniques could then be applied to the running intervention, and it is possible that significant results would be found.

This study's findings along with future research in this realm may have implications for fostering trait mindfulness and other positive psychological outcomes, specifically through the combination of mindfulness and running. The study can also serve to inform the research base for holistic approaches to mental health and fostering overall well-being. Since the information contained in this study is applicable from mental health professionals to health coaches, the avenues for increased collaboration between these fields widen, thus creating unique opportunities for health advocates of any kind.

References

- American College of Sports Medicine. (2013). ACSM's guidelines for exercise testing and prescription. Lippincott Williams & Wilkins.
- Apter, M. J., Kerr, J. H., & Murgatroyd, S. (Eds.). (1993). Advances in reversal theory. CRC Press.
- Ashdown-Franks, G., Sabiston, C. M., Solomon-Krakus, S., & O'Loughlin, J. L. (2017). Sport participation in high school and anxiety symptoms in young adulthood. *Mental Health and Physical Activity*, 12, 19-24.
- A-tjak, J. G., Davis, M. L., Morina, N., Powers, M. B., Smits, J. A., & Emmelkamp, P. M. (2015). A meta-analysis of the efficacy of acceptance and commitment therapy for clinically relevant mental and physical health problems. *Psychotherapy and Psychosomatics*, 84(1), 30-36.
- Bauer-Wu, S. (2010). Mindfulness meditation. *Oncology*, 24(10).
- Berger, B. G. (1994). Coping with stress: The effectiveness of exercise and other techniques. *Quest*, 46(1), 100-119.
- Berger, B. G. (1996). Psychological benefits of an active lifestyle: What we know and what we need to know. *Quest*, 48(3), 330-353.
- Berger, B.G., Tobar, D.A. (2011). Exercise and Quality of Life. *New Sport and Exercise Psychology Companion*, 483-505.
- Bernier, M., Thienot, E., Codron, R., & Fournier, J. F. (2009). Mindfulness and acceptance approaches in sport performance. *Journal of Clinical Sport Psychology*, 3(4), 320-333.
- Bervoets, J. (2013). Exploring the relationships between flow, mindfulness, & self-talk: a correlational study.

- Biegel, G.M., Brown, K.W., (2010). Assessing the Efficacy of an Adapted In-Class Mindfulness-Based Training Program for School-Age Children: A Pilot Study. *Mindful Schools: Engaging Children. Supporting Educators. Transforming Schools.*
- Biegel, G. M., Brown, K. W., Shapiro, S. L., & Schubert, C. M. (2009). Mindfulness-based stress reduction for the treatment of adolescent psychiatric outpatients: A randomized clinical trial. *Journal of consulting and clinical psychology*, 77(5), 855.
- Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z.V., Abbey, S., Specia, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical psychology: Science and practice*, 11(3), 230-241. DOI: 10.1093/clipsy.bph077
- Blankson, K. L., & Brenner, J. S. (2016). Anticipatory guidance for long-distance running in young athletes. *Pediatric annals*, 45(3), e83-e86.
- Bodhi, B. (2011). What does mindfulness really mean? A canonical perspective. *Contemporary Buddhism*, 12(1), 19-39.
- Britton, W. B., Lepp, N. E., Niles, H. F., Rocha, T., Fisher, N. E., & Gold, J. S. (2014). A randomized controlled pilot trial of classroom-based mindfulness meditation compared to an active control condition in sixth-grade children. *Journal of School Psychology*, 52(3), 263-278. <https://doi.org/10.1016/j.jsp.2014.03.002>
- Broderick, P. C., Pinger, L. J., & Worthen, D. S. (2012). Case study 12A: Learning to BREATHE. *Handbook of prosocial education*, 399-408.
- Brown, R. S., Ramirez, D. E., & Taub, J. M. (1978). The prescription of exercise for depression. *The Physician and Sportsmedicine*, 6(12), 34-45.

- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of personality and social psychology*, 84(4), 822.
<http://dx.doi.org/10.1037/0022-3514.84.4.822>
- Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological inquiry*, 18(4), 211-237.
<http://dx.doi.org/10.1080/10478400701598298>
- Bumgardner, W. (2018). Predict Your Finish Time for Walks and Runs With a Speed Calculator. Retrieved April 8, 2019, from <https://www.verywellfit.com/walking-and-running-pace-and-speed-calculator-3952317>
- Burke, C. A. (2010). Mindfulness-based approaches with children and adolescents: A preliminary review of current research in an emergent field. *Journal of child and family studies*, 19(2), 133-144.
- Caballero, A., Granberg, R., & Tseng, K. Y. (2016). Mechanisms contributing to prefrontal cortex maturation during adolescence. *Neuroscience & Biobehavioral Reviews*, 70, 4-12.
- Casey, A., Benson, H., & MacDonald, A. (2004). Mind your heart: a mind/body approach to stress management, exercise, and nutrition for heart health. Simon and Schuster.
- Chen, S., Zhang, Y., Wang, Y. T., & Liu, X. L. (2016). Traditional Chinese mind and body exercises for promoting balance ability of old adults: a systematic review and meta-analysis. *Evidence-based complementary and alternative medicine*, 2016.
- Chiesa, A., & Serretti, A. (2009). Mindfulness-based stress reduction for stress management in healthy people: a review and meta-analysis. *The journal of alternative and complementary medicine*, 15(5), 593-600.

- Clingman, J. M., & Hilliard, D. V. (1994). Anxiety reduction in competitive running as a function of success. *Journal of Sport Behavior*, 17(2), 120.
- Cole, Z., & Maeda, H. (2015). Effects of listening to preferential music on sex differences in endurance running performance. *Perceptual and motor skills*, 121(2), 390-398.
- Committee on Sports Medicine. (1990). Risks in distance running for children. *Pediatrics*, 86(5), 799-800.
- Cook, N. E., & Gorraiz, M. (2016). Dialectical behavior therapy for nonsuicidal self-injury and depression among adolescents: Preliminary meta-analytic evidence. *Child and Adolescent Mental Health*, 21(2), 81-89.
- Cooper, K. H., Purdy, J. G., Friedman, A., Bohannon, R. L., Harris, R. A., & Arends, J. A. (1975). An aerobics conditioning program for the Fort Worth, Texas school district. *Research Quarterly*, 4, 345-350.
- Craft, L. L., & Perna, F. M. (2004). The benefits of exercise for the clinically depressed. *Primary care companion to the Journal of clinical psychiatry*, 6(3), 104.
- Cramer, H., Hall, H., Leach, M., Frawley, J., Zhang, Y., Leung, B., Adams, J., & Lauche, R. (2016). Prevalence, patterns, and predictors of meditation use among US adults: A nationally representative survey. *Scientific reports*, 6, 36760.
- Crandall, A., Cheung, A., Young, A., & Hooper, A. P. (2019). Theory-Based Predictors of Mindfulness Meditation Mobile App Usage: A Survey and Cohort Study. *JMIR mHealth and uHealth*, 7(3), e10794.
- Crane, R. (2017). Mindfulness-based cognitive therapy: Distinctive features. Taylor & Francis.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. Harper & Row.

- Deci, E., & Ryan, R. M. (1985). Cognitive Evaluation Theory. *Intrinsic motivation and self-determination in human behavior*, 43-85.
- Dimeff, L., & Linehan, M. M. (2001). Dialectical behavior therapy in a nutshell. *The California Psychologist*, 34(3), 10-13.
- De Petrillo, L. A., Kaufman, K. A., Glass, C. R., & Arnkoff, D. B. (2009). Mindfulness for long distance runners: An open trial using Mindful Sport Performance Enhancement (MSPE). *Journal of Clinical Sport Psychology*, 3(4), 357-376.
- Diaz, F. M. (2010). Preliminary Investigation into the Effects of a Brief Mindfulness Induction on Perceptions of Attention, Aesthetic Response, and Flow during Music Listening (Doctoral dissertation, Florida State University).
- Dodge, T., & Lambert, S. F. (2009). Positive self-beliefs as a mediator of the relationship between adolescents' sports participation and health in young adulthood. *Journal of Youth and Adolescence*, 38(6), 813-825.
- Doyne, E. J., Ossip-Klein, D. J., Bowman, E. D., Osborn, K. M., McDougall-Wilson, I. B., & Neimeyer, R. A. (1987). Running versus weight lifting in the treatment of depression. *Journal of consulting and clinical psychology*, 55(5), 748.
- Dreyer, D., & Dreyer, K. (2009). ChiRunning: A revolutionary approach to effortless, injury-free running. Simon and Schuster.
- Duke, M., Johnson, T. C., & Nowicki Jr, S. (1977). Effects of sports fitness camp experience on locus of control orientation in children, ages 6 to 14. Research Quarterly. *American Alliance for Health, Physical Education and Recreation*, 48(2), 280-283.
- Dumontheil, I. (2016). Adolescent brain development. *Current opinion in behavioral sciences*, 10, 39-44.

- Dust, S. B. (2015). Mindfulness, flow, and mind wandering: The role of trait-based mindfulness in state-task alignment. *Industrial and Organizational Psychology*, 8(4), 609-614.
- Eckhardt, K. J., & Dinsmore, J. A. (2012). Mindful music listening as a potential treatment for depression. *Journal of Creativity in Mental Health*, 7(2), 175-186.
- Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *International journal of behavioral nutrition and physical activity*, 10(1), 98.
- Ekkekakis, P., & Petruzzello, S. J. (1999). Acute aerobic exercise and affect. *Sports medicine*, 28(5), 337-347.
- Epstein, H. T. (2001). An outline of the role of brain in human cognitive development. *Brain and cognition*, 45(1), 44-51.
- Erikson, E. H., & Erikson, J. M. (1998). The life cycle completed (extended version). WW Norton & Company.
- Etnier, J. L., Salazar, W., Landers, D. M., Petruzzello, S. J., Han, M., & Nowell, P. (1997). The influence of physical fitness and exercise upon cognitive functioning: A meta-analysis. *Journal of sport and Exercise Psychology*, 19(3), 249-277.
- Eva, A. L., & Thayer, N. M. (2017). Learning to BREATHE: A pilot study of a mindfulness-based intervention to support marginalized youth. *Journal of Evidence-Based Complementary & Alternative Medicine*, 22(4), 580-591.
- Evans, S., Ferrando, S., Findler, M., Stowell, C., Smart, C., & Haglin, D. (2008). Mindfulness-based cognitive therapy for generalized anxiety disorder. *Journal of anxiety disorders*, 22(4), 716-721.

- Felfe, A. C., Lechner, M., & Steinmayr, A. (2011). Sports and child development. *CESifo Working Paper Series No. 3629*.
- Felver, J. C., Felver, S. L., Margolis, K. L., Ravitch, N. K., Romer, N., & Horner, R. H. (2017). Effectiveness and social validity of the Soles of the Feet mindfulness-based intervention with special education students. *Contemporary School Psychology, 21*(4), 358-368.
- Felver, J. C., Frank, J. L., & McEachern, A. D. (2014). Effectiveness, acceptability, and feasibility of the soles of the feet mindfulness-based intervention with elementary school students. *Mindfulness, 5*(5), 589-597.
- Fisher, M., Juszczak, L., & Friedman, S. B. (1996). Sports participation in an urban high school: Academic and psychologic correlates. *Journal of Adolescent Health, 18*(5), 329-334.
[https://doi.org/10.1016/1054-139X\(95\)00067-3](https://doi.org/10.1016/1054-139X(95)00067-3)
- Gardner, F. L., & Moore, Z. E. (2004). A mindfulness-acceptance-commitment-based approach to athletic performance enhancement: Theoretical considerations. *Behavior therapy, 35*(4), 707-723.
- Gilbert, D., & Waltz, J. (2010). Mindfulness and health behaviors. *Mindfulness, 1*(4), 227-234.
<https://link.springer.com/journal/12671>
- Giluk, T. L. (2009). Mindfulness, Big Five personality, and affect: A meta-analysis. *Personality and Individual Differences, 47*(8), 805-811.
- Girls on the Run International. The Girls on the Run Program. <https://www.girlsontherun.org/>.
Accessed April 4, 2019.
- Goldin, P. R., & Gross, J. J. (2010). Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. *Emotion, 10*(1), 83.
- Goodman, T. A. (2005). Working with children: Beginner's mind. In C. K. Germer, R. D. Siegel,

- & P. R. Fulton (Eds.), *Mindfulness and psychotherapy*. Guilford.
- Gotink, R. A., Young, J. O., Wery, M. F., Utens, E. M., Michels, M., Rizopoulos, D., van Rossum, L.F.C., Roos-Hesselink, J.W., & Hunink, M. M. (2017). Online mindfulness as a promising method to improve exercise capacity in heart disease: 12-month follow-up of a randomized controlled trial. *PloS one*, 12(5), e0175923.
<https://doi.org/10.1371/journal.pone.0175923>
- Graham, R. (2010). A cognitive-attentional perspective on the psychological benefits of listening. *Music and Medicine*, 2(3), 167-173.
- Greco, L. A., Baer, R. A., & Smith, G. T. (2011). Assessing mindfulness in children and adolescents: development and validation of the Child and Adolescent Mindfulness Measure (CAMM). *Psychological assessment*, 23(3), 606.
- Greenberg, M. T., & Harris, A. R. (2012). Nurturing mindfulness in children and youth: Current state of research. *Child Development Perspectives*, 6(2), 161-166.
- Greist, J. H., Klein, M. H., Eischens, R. R., & Faris, J. T. (1978). Running out of depression. *The Physician and sportsmedicine*, 6(12), 49-56.
- Hanley, A. W. (2016). The mindful personality: associations between dispositional mindfulness and the five factor model of personality. *Personality and Individual Differences*, 91, 154-158.
- Hayes, S. (2018, November). Acceptance & Commitment Therapy (ACT). Retrieved February 25, 2019, from <https://contextualscience.org/act#>
- Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour research and therapy*, 44(1), 1-25.

- He, J. P., Paksarian, D., & Merikangas, K. R. (2018). Physical activity and mental disorder among adolescents in the United States. *Journal of Adolescent Health, 63*(5), 628-635.
- Hinkle, J. S. (1992). Aerobic running behavior and psychotherapeutics: Implications for sports counseling and psychology. *Journal of Sport Behavior, 15*(4), 263.
- Holloway, L.R. (2007). Take the plunge! Swimming is a great way to keep fit & stay cool. *Ebony, 62*(8), 172+. Retrieved from http://link.galegroup.com/apps/doc/A163864488/EAIM?u=suny_ceramics&sid=EAIM&xid=36ab7c5a
- Huang, H., & Humphreys, B. R. (2012). Sports participation and happiness: Evidence from US microdata. *Journal of Economic Psychology, 33*(4), 776-793.
- Hutchinson, J. C., Karageorghis, C. I., & Jones, L. (2014). See hear: Psychological effects of music and music-video during treadmill running. *Annals of Behavioral Medicine, 49*(2), 199-211.
- Jenny, S., & Armstrong, T. (2013). Distance running and the elementary-age child. *Journal of Physical Education, Recreation & Dance, 84*(3), 17-25.
- Jewett, R., Sabiston, C. M., Brunet, J., O'Loughlin, E. K., Scarapicchia, T., & O'Loughlin, J. (2014). School sport participation during adolescence and mental health in early adulthood. *Journal of Adolescent Health, 55*(5), 640-644.
- Jones, L., Karageorghis, C. I., & Ekkekakis, P. (2014). Can high-intensity exercise be more pleasant? Attentional dissociation using music and video. *Journal of Sport and Exercise Psychology, 36*(5), 528-541.

- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: past, present, and future. *Clinical psychology: Science and practice*, 10(2), 144-156. DOI: 10.1093/clipsy/bpg016
- Kabat-Zinn, J., Massion, A.O., Kristeller, J., Peterson, L. G., Fletcher, K.E., Pbert, L., Lenderking, W.R., Santorelli, S.F., (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *Am J Psychiatry*, 149(7), 936-43.
- Kalak, N., Gerber, M., Kirov, R., Mikoteit, T., Yordanova, J., Pühse, U., Holsboer-Trachsler, E., & Brand, S. (2012). Daily morning running for 3 weeks improved sleep and psychological functioning in healthy adolescents compared with controls. *Journal of Adolescent Health*, 51(6), 615-622.
- Kallapiran, K., Koo, S., Kirubakaran, R., & Hancock, K. (2015). Effectiveness of mindfulness in improving mental health symptoms of children and adolescents: a meta-analysis. *Child and Adolescent Mental Health*, 20(4), 182-194.
- Kangasniemi, A., Lappalainen, R., Kankaanpää, A., & Tammelin, T. (2014). Mindfulness skills, psychological flexibility, and psychological symptoms among physically less active and active adults. *Mental Health and Physical Activity*, 7(3), 121-127.
<https://doi.org/10.1016/j.mhpa.2014.06.005>
- Kaufman, K. A., Glass, C. R., & Pineau, T. R. (2018). Mindful sport performance enhancement: Mental training for athletes and coaches. American Psychological Association.
- Kiani, B., Hadianfard, H., & Mitchell, J. T. (2017). The impact of mindfulness meditation training on executive functions and emotion dysregulation in an Iranian sample of female adolescents with elevated attention-deficit/hyperactivity disorder symptoms. *Australian Journal of Psychology*, 69(4), 273-282.

- Kiken, L. G., Garland, E. L., Bluth, K., Palsson, O. S., & Gaylord, S. A. (2015). From a state to a trait: trajectories of state mindfulness in meditation during intervention predict changes in trait mindfulness. *Personality and Individual differences*, 81, 41-46.
- Kim, Y. S., Park, Y. S., Allegrante, J. P., Marks, R., Ok, H., Cho, K. O., & Garber, C. E. (2012). Relationship between physical activity and general mental health. *Preventive medicine*, 55(5), 458-463.
- Kliem, S., Kröger, C., & Kosfelder, J. (2010). Dialectical behavior therapy for borderline personality disorder: a meta-analysis using mixed-effects modeling. *Journal of consulting and clinical psychology*, 78(6), 936.
- Klingbeil, D. A., Fischer, A. J., Renshaw, T. L., Bloomfield, B. S., Polakoff, B., Willenbrink, J. B., Copek, R.A., & Chan, K. T. (2017). Effects of Mindfulness-Based Interventions on Disruptive Behavior: A Meta-Analysis of Single-Case Research. *Psychology in the Schools*, 54(1), 70-87.
- Knapen, J., Vancampfort, D., Moriën, Y., & Marchal, Y. (2015). Exercise therapy improves both mental and physical health in patients with major depression. *Disability and rehabilitation*, 37(16), 1490-1495.
- Koplan, J. P., Powell, K. E., Sikes, R. K., Shirley, R. W., & Campbell, C. C. (1982). An epidemiologic study of the benefits and risks of running. *Jama*, 248(23), 3118-3121.
- Kowarz, K. M. (2015). Background Music in Mindfulness Practice: Associations With and Among Emotional Arousal, State Mindfulness, and Psychological Flexibility (Doctoral dissertation, Kean University).
- Kuyken, W., Byford, S., Taylor, R.S., Watkins, E., Holden, E., White, K., Barrett, B., Byng, R., Evans, A., Mullan, E., Teasdale, J., et al., 2008; D. (2008). Mindfulness-based

- cognitive therapy to prevent relapse in recurrent depression. *Journal of consulting and clinical psychology*, 76(6), 966.
- Ladner, L. (2011). Mindfulness. In J. D. Aten, M. R. McMinn, & E. L. Worthington, Jr., Spiritually oriented interventions for counseling and psychotherapy (pp. 229-250). American Psychological Association.
- Langer, E. J., & Moldoveanu, M. (2000). The construct of mindfulness. *Journal of social issues*, 56(1), 1-9.
- Lawlor, M. S., Schonert-Reichl, K. A., Gadermann, A. M., & Zumbo, B. D. (2014). A validation study of the mindful attention awareness scale adapted for children. *Mindfulness*, 5(6), 730-741.
- Lee, E. B., An, W., Levin, M. E., & Twohig, M. P. (2015). An initial meta-analysis of Acceptance and Commitment Therapy for treating substance use disorders. *Drug and alcohol dependence*, 155, 1-7.
- Lee, D. C., Brellenthin, A. G., Thompson, P. D., Sui, X., Lee, I. M., & Lavie, C. J. (2017). Running as a key lifestyle medicine for longevity. *Progress in cardiovascular diseases*, 60(1), 45-55.
- Lee, D. C., Pate, R. R., Lavie, C. J., Sui, X., Church, T. S., & Blair, S. N. (2014). Leisure-time running reduces all-cause and cardiovascular mortality risk. *Journal of the American College of Cardiology*, 64(5), 472-481.
- Lee, J., Semple, R. J., Rosa, D., & Miller, L. (2008). Mindfulness-based cognitive therapy for children: Results of a pilot study. *Journal of Cognitive Psychotherapy*, 22(1), 15-28.

- Lesiak, M. (2017). Mindfulness-based music therapy group protocol for individuals with serious mental illnesses and chronic illnesses: A feasibility study (Doctoral dissertation, University of Kansas).
- Lesiuk PhD, T. (2015). The effect of mindfulness-based music therapy on attention and mood in women receiving adjuvant chemotherapy for breast cancer: A pilot study. In *Oncology nursing forum* (Vol. 42, No. 3, p. 276). Oncology Nursing Society.
- Lindwall, M., Ljung, T., Hadžibajramović, E., & Jonsdottir, I. H. (2012). Self-reported physical activity and aerobic fitness are differently related to mental health. *Mental Health and Physical Activity*, 5(1), 28-34.
- Marti, B. (1991). Health effects of recreational running in women. *Sports medicine*, 11(1), 20-51.
- Martinsen, E. W. (2008). Physical activity in the prevention and treatment of anxiety and depression. *Nordic journal of psychiatry*, 62(sup47), 25-29.
- McPhie, M. L., & Rawana, J. S. (2012). Unravelling the relation between physical activity, self-esteem and depressive symptoms among early and late adolescents: A mediation analysis. *Mental Health and Physical Activity*, 5(1), 43-49.
- Meeusen, R., & De Meirleir, K. (1995). Exercise and brain neurotransmission. *Sports Medicine*, 20(3), 160-188.
- Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. (2017). Exercise and mental health. *Maturitas*, 106, 48-56.
- Miller, J. J., Fletcher, K., & Kabat-Zinn, J. (1995). Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *General hospital psychiatry*, 17(3), 192-200.

- Miller, D. N., Gilman, R., & Martens, M. P. (2008). Wellness promotion in the schools: Enhancing students' mental and physical health. *Psychology in the Schools, 45*(1), 5-15.
- Milligan, K., Badali, P., & Spiroiu, F. (2015). Using Integra Mindfulness Martial Arts to address self-regulation challenges in youth with learning disabilities: A qualitative exploration. *Journal of Child and Family Studies, 24*(3), 562-575.
- MindUp. (n.d.). Retrieved September 24, 2018, from <https://mindup.org/mindup-for-schools/>
- Moljord, I. E., Moksnes, U. K., Espnes, G. A., Hjemdal, O., & Eriksen, L. (2014). Physical activity, resilience, and depressive symptoms in adolescence. *Mental Health and Physical Activity, 7*(2), 79-85.
- Moore, K. A. (2017). Commentary: Positive youth development goes mainstream. *Child development, 88*(4), 1175-1177.
- Morgan, N., Irwin, M. R., Chung, M., & Wang, C. (2014). The effects of mind-body therapies on the immune system: meta-analysis. *PloS one, 9*(7), e100903.
- Mothes, H., Klaperski, S., Seelig, H., Schmidt, S., & Fuchs, R. (2014). Regular aerobic exercise increases dispositional mindfulness in men: a randomized controlled trial. *Mental Health and Physical Activity, 7*(2), 111-119. <https://doi.org/10.1016/j.mhpa.2014.02.003>
- Noakes, T. (2003). Lore of running. Human Kinetics. Oxford University Press.
- Norris, R., Carroll, D., & Cochrane, R. (1992). The effects of physical activity and exercise training on psychological stress and well-being in an adolescent population. *Journal of psychosomatic research, 36*(1), 55-65.
- Pearrow, M., & Jones, J. (2020). School-based behavioral health services: A public health model for prevention. In C. Maykel & M. A. Bray (Eds.), *Applying psychology in the schools*.

- Promoting mind–body health in schools: Interventions for mental health professionals* (p. 45–60). American Psychological Association. <https://doi.org/10.1037/0000157-004>
- Percy, L. E., Dziuban, C. D., & Martin, J. B. (1981). Analysis of effects of distance running on self-concepts of elementary students. *Perceptual and Motor Skills*, 52(1), 42.
- Potter, D., & Keeling, D. (2005). Effects of moderate exercise and circadian rhythms on human memory. *Journal of Sport and Exercise Psychology*, 27(1), 117-125.
- Rasmussen, M., & Laumann, K. (2013). The academic and psychological benefits of exercise in healthy children and adolescents. *European journal of psychology of education*, 28(3), 945-962.
- Rau, H. K., & Williams, P. G. (2016). Dispositional mindfulness: a critical review of construct validation research. *Personality and Individual Differences*, 93, 32-43.
- Robbins, A. (1998). *Therapeutic presence: Bridging expression and form*. Jessica Kingsley Publishers.
- Rodelli, M., De Bourdeaudhuij, I., Dumon, E., Portzky, G., & DeSmet, A. (2018). Which healthy lifestyle factors are associated with a lower risk of suicidal ideation among adolescents faced with cyberbullying?. *Preventive medicine*, 113, 32-40.
- Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. *Clinical psychology review*, 21(1), 33-61.
- Salmon, P., Hanneman, S., & Harwood, B. (2010). Associative/dissociative cognitive strategies in sustained physical activity: Literature review and proposal for a mindfulness-based conceptual model. *The Sport Psychologist*, 24(2), 127-156.
<https://doi.org/10.1123/tsp.24.2.127>

- Samarasinghe, N., Khan, A., McCabe, E., & Lee, A. (2017). Does Participation in Organized Sports Influence School Performance, Mental Health, and/or Long-Term Goal Setting in Adolescents?. *Journal of Adolescent Health, 60*(2), S71.
- Schmalz, D. L., Deane, G. D., Birch, L. L., & Davison, K. K. (2007). A longitudinal assessment of the links between physical activity and self-esteem in early adolescent non-Hispanic females. *Journal of Adolescent Health, 41*(6), 559-565.
- Schonert-Reichl, K. A., Oberle, E., Lawlor, M. S., Abbott, D., Thomson, K., Oberlander, T. F., & Diamond, A. (2015). Enhancing cognitive and social-emotional development through a simple-to-administer mindfulness-based school program for elementary school children: A randomized controlled trial. *Developmental psychology, 51*(1), 52.
<http://dx.doi.org/10.1037/a0038454>
- Scott-Hamilton, J., Schutte, N. S., & Brown, R. F. (2016). Effects of a mindfulness intervention on sports-anxiety, pessimism, and flow in competitive cyclists. *Applied Psychology: Health and Well-Being, 8*(1), 85-103.
- Semple, R. J., Lee, J., Rosa, D., & Miller, L. F. (2010). A randomized trial of mindfulness-based cognitive therapy for children: Promoting mindful attention to enhance social-emotional resiliency in children. *Journal of Child and Family Studies, 19*(2), 218-229.
- Shapiro, S. L., Brown, K. W., & Biegel, G. M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training and education in professional psychology, 1*(2), 105.
- Shapiro, S. L., Brown, K. W., Thoresen, C., & Plante, T. G. (2011). The moderation of mindfulness-based stress reduction effects by trait mindfulness: results from a randomized controlled trial. *Journal of clinical psychology, 67*(3), 267-277.

- Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of clinical psychology*, 62(3), 373-386.
- Siegel, J.A., & Manfredi, T. G. (1984). Effects of a ten month fitness program on children. *The Physician and Sports Medicine*, 12, 91-97.
- Silva, J. M., & Shultz, B. B. (1984). Research in the psychology and therapeutics of running: A methodological and interpretive review. *Running as therapy*, 304-320.
- Singh, N. N., Lancioni, G. E., Karazsia, B. T., Felver, J. C., Myers, R. E., & Nugent, K. (2016). Effects of samatha meditation on active academic engagement and math performance of students with attention deficit/hyperactivity disorder. *Mindfulness*, 7(1), 68-75.
- Slater, A., & Tiggemann, M. (2011). Gender differences in adolescent sport participation, teasing, self-objectification and body image concerns. *Journal of adolescence*, 34(3), 455-463.
- Solomon, E. G., & Bumpus, A. K. (1978). The running meditation response: An adjunct to psychotherapy. *American Journal of Psychotherapy*, 32(4), 583-592.
- Spruit, A., Assink, M., van Vugt, E., van der Put, C., & Stams, G. J. (2016). The effects of physical activity interventions on psychosocial outcomes in adolescents: A meta-analytic review. *Clinical psychology review*, 45, 56-71.
- Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in cognitive sciences*, 9(2), 69-74.
- Ströhle, A. (2009). Physical activity, exercise, depression and anxiety disorders. *Journal of neural transmission*, 116(6), 777.

- Stubbe, J. H., De Moor, M. H. M., Boomsma, D. I., & de Geus, E. J. C. (2007). The association between exercise participation and well-being: a co-twin study. *Preventive medicine, 44*(2), 148-152.
- Super, S., Hermens, N., Verkooijen, K., & Koelen, M. (2018). Examining the relationship between sports participation and youth developmental outcomes for socially vulnerable youth. *BMC public health, 18*(1), 1012.
- Swann, C., Telenta, J., Draper, G., Liddle, S., Fogarty, A., Hurley, D., & Vella, S. (2018). Youth sport as a context for supporting mental health: Adolescent male perspectives. *Psychology of sport and exercise, 35*, 55-64.
- Szabo, A. (2003). Acute psychological benefits of exercise performed at self-selected workloads: implications for theory and practice. *Journal of sports science & medicine, 2*(3), 77.
- Szabo, A., & Ábrahám, J. (2013). The psychological benefits of recreational running: A field study. *Psychology, health & medicine, 18*(3), 251-261.
<http://dx.doi.org/10.1080/13548506.2012.701755>.
- Tammelin, T., Näyhä, S., Hills, A. P., & Järvelin, M. R. (2003). Adolescent participation in sports and adult physical activity. *American journal of preventive medicine, 24*(1), 22-28.
- Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of consulting and clinical psychology, 68*(4), 615.
- Tenenbaum, G., Lidor, R., Lavyan, N., Morrow, K., Tonnel, S., Gershgoren, A., Meis, J. & Johnson, M. (2004). The effect of music type on running perseverance and coping with effort sensations. *Psychology of Sport and Exercise, 5*(2), 89-109.

- Thera, N. (2014). *The heart of Buddhist meditation: The Buddha's way of mindfulness*. Weiser Books.
- Thompson, B. L., & Waltz, J. (2007). Everyday mindfulness and mindfulness meditation: Overlapping constructs or not?. *Personality and Individual Differences*, 43(7), 1875-1885.
- Tomaselli, K. A. (2014). *Effect of Mindfulness-Based Music Listening on the Anxiety Symptoms and Awareness of Older Adults in a Senior Living Facility* (Doctoral dissertation, Florida State University).
- Tuckman, B. W., & Hinkle, J. S. (1986). An experimental study of the physical and psychological effects of aerobic exercise on schoolchildren. *Health psychology*, 5(3), 197.
- Ulmer, C. S., Stetson, B. A., & Salmon, P. G. (2010). Mindfulness and acceptance are associated with exercise maintenance in YMCA exercisers. *Behaviour research and therapy*, 48(8), 805-809. <https://doi.org/10.1016/j.brat.2010.04.009>
- US Census Bureau. (2019). Census.gov. Retrieved May 04, 2020, from <https://www.census.gov/>
- Van der Oord, S., Bögels, S. M., & Peijnenburg, D. (2012). The effectiveness of mindfulness training for children with ADHD and mindful parenting for their parents. *Journal of child and family studies*, 21(1), 139-147.
- Van de Weijer-Bergsma, E., Formsma, A. R., de Bruin, E. I., & Bögels, S. M. (2012). The effectiveness of mindfulness training on behavioral problems and attentional functioning in adolescents with ADHD. *Journal of child and family studies*, 21(5), 775-787.

- Vøllestad, J., Sivertsen, B., & Nielsen, G. H. (2011). Mindfulness-based stress reduction for patients with anxiety disorders: Evaluation in a randomized controlled trial. *Behaviour research and therapy*, 49(4), 281-288.
- Walker, T. (2018, September 13). Are Schools Ready to Tackle the Mental Health Crisis? Retrieved April 16, 2019, from <http://neatoday.org/2018/09/13/mental-health-in-schools/>
- Weinstein, W. S., & Meyers, A. W. (1983). Running as treatment for depression: is it worth it?. *Journal of Sport Psychology*, 5(3), 288-301.
- “Who Are School Psychologists.” National Association of School Psychologists (NASP), 2019, www.nasponline.org/about-school-psychology/who-are-school-psychologists.
- Williams, J. M. G., Teasdale, J. D., Segal, Z. V., & Soulsby, J. (2000). Mindfulness-based cognitive therapy reduces overgeneral autobiographical memory in formerly depressed patients. *Journal of abnormal psychology*, 109(1), 150.
- Wilson, V. E., Morley, N. C., & Bird, E. I. (1980). Mood profiles of marathon runners, joggers and non-exercisers. *Perceptual and Motor Skills*, 50(1), 117-118.
- Your Guide to Mindfulness Based Cognitive Therapy. (n.d.). Retrieved April 05, 2018, from <http://mbct.com/>
- Zack, S., Saekow, J., Kelly, M., & Radke, A. (2014). Mindfulness based interventions for youth. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 32(1), 44-56.
- Zelazo, P. D., & Lyons, K. E. (2012). The potential benefits of mindfulness training in early childhood: A developmental social cognitive neuroscience perspective. *Child Development Perspectives*, 6(2), 154-160.
- Zenner, C., Herrnleben-Kurz, S., & Walach, H. (2014). Mindfulness-based interventions in schools—a systematic review and meta-analysis. *Frontiers in psychology*, 5, 603.

- Ziabari, S. S. M., & Treur, J. (2018). An adaptive cognitive temporal-causal network model of a mindfulness therapy based on music. In International Conference on Intelligent Human Computer Interaction (pp. 180-193).
- Zoogman, S., Goldberg, S. B., Hoyt, W. T., & Miller, L. (2015). Mindfulness interventions with youth: A meta-analysis. *Mindfulness*, 6(2), 290-302.
- Zou, L., Loprinzi, P. D., Yeung, A. S., Zeng, N., & Huang, T. (2019). The beneficial effects of mind-body exercises for people with mild cognitive impairment: A systematic review with meta-analysis. *Archives of physical medicine and rehabilitation*, 100(8), 1556-1573.

Appendix A: Demographics Questionnaire

Name: _____

Age:

- ☐ 14
- ☐ 15
- ☐ 16
- ☐ 17
- ☐ 18
- ☐ Other _____

I identify my gender as:

- ☐ Male
- ☐ Female
- ☐ Transgender
- ☐ Other

I identify my race/ethnicity as (check all that apply):

- ☐ White
- ☐ Hispanic or Latino
- ☐ Black or African American
- ☐ Native American or American Indian
- ☐ Asian/Pacific Islander
- ☐ Mixed Race
- ☐ Other _____

My current grade in school is:

- ☐ 9
- ☐ 10
- ☐ 11
- ☐ 12

Do you participate in your school's cross-country running team?

- ☐ Yes
- ☐ No

Do you participate in recreational running?

- ☐ Yes
- ☐ No

On average, how many hours per week do you spend running?

- ☐ 1-2
- ☐ 3-4

- ☐ 5-6
- ☐ 7+

On average, how many miles per week do you run?

- ☐ 1-4
- ☐ 5-8
- ☐ 9-12
- ☐ 13+

How often do you listen to music while running?

- ☐ Never
- ☐ Sometimes
- ☐ Often
- ☐ Almost Always
- ☐ Always

Other exercise activities that I participate in during the months of August-December are (check all that apply):

- ☐ Soccer
- ☐ Football
- ☐ Swimming
- ☐ Basketball
- ☐ Volleyball
- ☐ Kickboxing
- ☐ Other _____

Other activities that I participate in are (check all that apply):

- ☐ Yoga
- ☐ Meditation
- ☐ Deep breathing
- ☐ Tai Chi
- ☐ Shiatsu
- ☐ Other _____

Appendix B: Follow-Up Questionnaire

On average, how many hours per week did you spend running over the past 3 months? Please estimate.

_____ hours

On average, how many miles per week did you run?

_____ miles

How often did you listen to music while running?

- ☐ Never
- ☐ Sometimes
- ☐ Often
- ☐ Almost Always
- ☐ Always

Over the past 3-4 months, other exercise activities that I participated in were (e.g. other sports, weight-lifting, cardio, machines at the gym, manual labor, etc.)

Other activities that I participated in were (check all that apply):

- ☐ Yoga
- ☐ Meditation
- ☐ Deep breathing
- ☐ Tai Chi
- ☐ Shiatsu
- ☐ Massage
- ☐ Aromatherapy
- ☐ Chiropractic work
- ☐ Reflexology
- ☐ Other _____

Appendix C: Child and Adolescent Mindfulness Measure (CAMM)

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

1. I get upset with myself for having feelings that don't make sense.

Never True Rarely True Sometimes True Often True Always True

2. At school, I walk from class to class without noticing what I'm doing.

Never True Rarely True Sometimes True Often True Always True

3. I keep myself busy so I don't notice my thoughts or feelings.

Never True Rarely True Sometimes True Often True Always True

4. I tell myself that I shouldn't feel the way I'm feeling.

Never True Rarely True Sometimes True Often True Always True

5. I push away thoughts that I don't like.

Never True Rarely True Sometimes True Often True Always True

6. It's hard for me to pay attention to only one thing at a time.

Never True Rarely True Sometimes True Often True Always True

7. I get upset with myself for having certain thoughts

Never True Rarely True Sometimes True Often True Always True

8. I think about things that have happened in the past instead of thinking about things that are happening right now.

Never True Rarely True Sometimes True Often True Always True

9. I think that some of my feelings are bad and that I shouldn't have them.

Never True Rarely True Sometimes True Often True Always True

10. I stop myself from having feelings that I don't like

Never True Rarely True Sometimes True Often True Always True

Table 1*Demographics Characteristics as a Percentage of the Sample (n=267)*

	<i>Total*</i>	<i>Running Group</i>	<i>Comparison</i>
	(n=267)	(n=116)	(n= 151)
<i>Variable</i>	<i>%</i>	<i>%</i>	<i>%</i>
Gender*			
Male	45.3	36.2	52.7
Female	51.3	61.2	44.0
Transgender	1.5	0.9	2.0
Other	1.5	1.7	1.3
Age*			
14	32.7	36.2	30.0
15	17.2	15.5	18.7
16	36.0	38.8	34.0
17	13.1	9.5	16.0
18+	0.7	0.0	1.3
Race			
Caucasian	88.0	91.4	85.4
Hispanic	3.0	1.7	4.0
Asian/Pacific Islander	1.9	0.9	2.6
Black/African American	1.1	0.9	1.3
Mixed Race	5.6	5.2	6.0

Other 0.4 0.0 0.7

*.04% missing or not indicated

Table 2

Means and Standard Deviations of Mindfulness Scores for Running Group

	Pre-Running Period		Post-Running Period	
<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
CAMM total score	32.03	7.288	31.85	7.252

Table 3

Means and Standard Deviations of Mindfulness Scores for Comparison Group

	Pre-Running Period		Post-Running Period	
<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
CAMM total score	32.47	8.601	33.48	8.966

Table 4

Multiple Regression Analysis between Running Intervention Group and Comparison Group with Mindfulness Change

Mindfulness Change

Variable	<i>B</i>	<i>t</i>	<i>sig (2-tailed)</i>
Constant	9.113	5.739	
Runner Group	-1.214	-1.723	.086
CAMM Total T1	-.236	-5.293	.000**
Mindfulness Activity Participation	-.986	-1.371	.171
<i>R</i> ²	.103		
<i>F</i>	10.443		

Note: *N* = 249, * *p* < .05, ** *p* < .01

Table 5

Multiple Regression Analysis examining Time Spent Running and Mindfulness

Mindfulness Change			
Variable	<i>B</i>	<i>t</i>	<i>sig (2-tailed)</i>
Constant	9.109	5.392	
Minutes running per week	.000192	.781	.436
CAMM Total T1	.748	15.594	.000**
Mindfulness Activity Participation	-1.207	-1.575	.117
<i>R</i> ²	.554		
<i>F</i>	87.645		

Note: *N* = 249, * *p* < .05, ** *p* < .01

Table 6*Analysis of Variance between Frequency of Music Listening and Trait Mindfulness*

Predictor	<i>Sum of Squares</i>	<i>df</i>	<i>F</i>	<i>P</i>	<i>partial η^2</i>
Corrected Model	694.334	4	2.757	.029*	0.48
Intercept	225090.767	1	3575.536	.000**	.943
Music	696.334	4	2.757	.029*	.048
Error	13723.755	218			

*Note. $N = 249$, * $p < .05$, ** $p < .01$

Table 7

Multiple Regression Analysis between Running Intervention Group and Comparison Group with Lower Pre-Running-Period Mindfulness Scores

Variable	Mindfulness Change		
	<i>B</i>	<i>t</i>	<i>sig (2-tailed)</i>
Constant	2.748	3.400	
Runner Group	-2.051	-2.164	.032*
Mindfulness Activity Participation	-.449	-4.73	.637
R^2	.019		
F	2.505		

Note: $N = 249$, * $p < .05$, ** $p < .01$

Table 8

Multiple Regression Analysis between Running Intervention Group and Comparison Group with Post-Running Period Mindfulness

Variable	Post-Running Period Mindfulness		
	<i>B</i>	<i>t</i>	<i>sig (2-tailed)</i>
Constant	9.786	5.722	
Runner Group	-1.345	-1.798	.074
CAMM Total T1	.747	.725	.000**
Mindfulness Activity Participation	-.978	-1.273	.204
<i>R</i> ²	.552		
<i>F</i>	89.845		

Note: *N* = 249, * *p* < .05, ** *p* < .01