5-2011

An Examination of the Effects of Mindfulness and Task-Relevant Attentional Focus on Running Performance

Anthony R. Atchley
Western Kentucky University, anthony.r.atchley@gmail.com

AN EXAMINATION OF THE EFFECTS OF MINDFULNESS AND TASK-RELEVANT ATTENTIONAL FOCUS ON RUNNING PERFORMANCE

A Thesis
Presented to
The Faculty of the Department of Psychology
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts in Experimental Psychology

By
Anthony R. Atchley

May, 2011

AN EXAMINATION OF THE EFFECTS OF
MINDFULNESS AND TASK-RELEVANT ATTENTIONAL FOCUS ON
RUNNING PERFORMANCE

Date Recommended 11/19/2010

Steven R. Wininger

Steven R. Wininger Ph.D.
Director of Thesis

Anthony Paquin

Anthony Paquin Ph.D.

Andrew Mienaltowski

Andrew Mienaltowski Ph.D.

Richard L. Bowker May 16, 2011

Dean, Graduate Studies and Research Date

Acknowledgements

This project would have been an impossible task to accomplish without the help of a few very dedicated individuals. Thank you to Selina Langford, without who I would have been hopelessly in need of a mountain of literature that was impossible to locate on my own. To Dr. Andrew Mienaltowski, thank you for bringing a new perspective and opening new avenues for data analysis, and for stepping in when he was truly needed. Thank you to Dr. Tony Paquin for the guidance, advice, and technical tips to help me sort through the process. To Dr. Steven Wininger, thank you for the seemingly endless amount of patience, guidance, help, and advice that really kept this project moving forward, however slowly. If it had been anyone else, this project would have never been completed, and for that I am ever thankful. Finally, to my wife Candice, thank you for the never ending support, encouragement, confidence, and pride. You have done more in this process than you could possibly realize and I promise to ensure you still think it was all worth it in the end.

Table of Contents

AN EXAMINATION OF THE EFFECTS OF

MINDFULNESS AND TASK-RELEVANT ATTENTIONAL FOCUS ON

RUNNING PERFORMANCE

Anthony R. Atchley May 2011 Pages: 56

Directed by: Dr. Steven Wininger, Dr. Tony Paquin, and Dr. Andrew Mienaltowski

Department of Psychology Western Kentucky University

The purpose of the current study was to investigate the effect of mindfulness and task-relevant attentional focus on running performance. WKU psychology undergraduate students were assigned to one of two conditions: task-relevant attentional focus experimental training and no training control. Participants in the experimental condition received training designed to optimize the use of attentional focus strategies in a running context. Trait level mindfulness was examined as a covariate. Participants were compared on two mile run times and the use of attentional focus strategies. Differences were expected to reveal the effectiveness of the training by showing faster running times in the experimental group, and higher use of task-relevant attentional focus strategies. Only higher use of task-relevant attentional focus strategies, specifically focus on bodily sensation was supported by the data. Explanations of the results as well as exploratory analyses are provided in addition to suggestions for future research.

Introduction

The ultimate goal for many who engage in aerobic activities such as running is to enhance their performance. But how does one decide which approach will most efficiently produce the desired results? On this point, the science is inconclusive. It has been popular in the West to traditionally emphasize physical conditioning as the appropriate approach to improving performance, but that may be slowly changing. In the past thirty or forty years, research on and the application of mental training in performance enhancement has steadily grown. The research aspect of mental training in the West has been concerned with concepts like affect, perceived exertion, and attentional focus (Morgan & Pollock, 1977; Sainting, Richman, & Bergey, 1988), though new concepts from Eastern cultures are slowly being integrated by proponents in sport and athletic communities (Gardner & Moore, 2006).

One of these concepts is mindfulness which has recently become the subject of many popular press books concerning stress and anxiety. Only a few authors have adapted mindfulness to aspects of running (Dreyer and Dreyer, 2004; DePetrillo, Kaufman, Glass, & Arnkoff, 2007). However, there have been no efforts to reconcile these seemingly divergent trends in science and popular application regarding performance enhancement. The goal of the current study, therefore, was to develop an intervention to optimize attentional focus and to examine mindfulness as a potential mediator of the effectiveness of attentional focus strategies on running performance. To accomplish this, the following sections will discuss what mindfulness is, the current state of research concerning attentional focus strategies, and an explanation of how the

merging of these two concepts may prove to be an effective approach to performance enhancement.

What is Mindfulness?

Mindfulness as a meditative practice has been an Eastern philosophical tradition for over 2500 years. It was said to have its origins in the direct teachings of the Buddha as sattipatana vipassana or insight meditation (Paramananda, 1996). This form of meditation is considered separate from the contemplative traditions of Zen or Yogic mantras that are more readily known in the West. In Buddhist thought, mindfulness is a way of cultivating a direct experience of reality that is free of greed, hate, or delusion in order to liberate oneself from the suffering of the world and to achieve enlightenment (Thera, 1962). In Western thought, mindfulness is often characterized as a way to relieve stress or cope with emotional or physical trauma (Kabat-Zinn, 1994). Mindfulness, however, is difficult to define and operationalize scientifically.

One of the leading researchers in the field of alternative medicine defines mindfulness as paying attention to one's present moment to moment experience purposefully with a non-judgmental attitude (Kabat-Zinn, 1982, 1990, 1994). This conceptualization would become the foundation of Kabat-Zinn's Mindfulness Based Stress Reduction (MBSR) and has generally been the accepted definition of the construct. Very similar to this definition is that provided by Baer (2003) which states that mindfulness is the "nonjudgmental observation of the ongoing stream of internal and external stimuli as they arise." In both of these conceptualizations of mindfulness, the aspect of nonjudgmental observation is central. Indeed, it is this aspect that is most highly emphasized in MBSR and in Baer, Smith and Allen's (2004) self-report measure

of mindfulness the Kentucky Inventory of Mindfulness Skills (KIMS). However, attempts at operationally defining mindfulness as opposed to describing it have been lacking. To date there are two conflicting hypotheses as to the mechanisms underlying mindfulness, one of which falls neatly in line with the conceptualization presented above.

Bishop et al. (2004) outline their two part operational definition of mindfulness as the self-regulation of attention and the maintenance of an accepting orientation towards the events attended. The self-regulation of attention involves sustaining attention through vigilance, switching or shifting attention between stimuli, and the non-elaborative evaluation of thoughts. The authors consider mindfulness to be a meta-cognitive process because it requires both the control and monitoring of cognitive processes simultaneously. The second part of their definition involves maintaining an accepting orientation toward current experience. This entails the conscious action of allowing current thoughts, feelings, and sensations to be experienced openly and freely. From this operational conceptualization of mindfulness, Bishop and colleagues go on to indicate that several predictions regarding mindfulness can be tested empirically. Among these are that higher levels of mindfulness lead to: higher performance on vigilance and switching tasks, improvement in cognitive inhibition, expanded attentional capacity, reduction of experiential avoidance, increases in dispositional openness, and improved affect tolerance. (Bishop et al., 2004)

Furthermore, Bishop and colleagues (2004) suggest that mindfulness be considered a state or mode that can be developed and mastered over time. This sentiment is echoed by Baer, Smith, and Allen (2004) in the development of the KIMS. MBSR also approaches mindfulness

in this fashion because the actual training consists of mindful techniques (skills) intended to develop higher levels of mindfulness. However, mindfulness could be considered both a state and a trait and a considerable amount of hypothesizing in this area has recently been conducted.

In contrast to the operational definition developed by Bishop and colleagues (2004), Brown and Ryan (2004) have argued for a competing conceptualization. There are two important distinctions made by Brown and Ryan. The first is the distinction between attention and awareness. Unlike Bishop et al. attention and awareness are considered two different yet complimentary processes with distinctly important roles in the operationalization of mindfulness. Awareness is defined as "the apperception and perception of the field of events that encompass our reality at any given moment" (Brown & Ryan, p, 242-243). In other words, awareness is the radar upon which objects in reality appear. Attention then is considered the direction of awareness toward specified objects in the field of reality. To use the radar example, awareness serves to detect all blips or objects in the current field of reality, attention then magnifies particular objects surveyed by the radar for a closer examination. This distinction is important because of its relationship to the concept of attentional focus strategies which will be addressed later.

Brown and Ryan (2004) also challenge the necessity of the acceptance aspect of mindfulness commonly proposed as a fundamental dimension of the construct (Baer, 2003; Bishop et al., 2004; Kabat-Zinn, 1990). When constructing the Mindful Attention Awareness Scale, the dimension of acceptance was originally included in the measure. However, the dimension added no additional explanatory capacity in terms of convergent, discriminative, or criterion validity and was thus deemed redundant (Brown

& Ryan, 2004). It is important to note that this lack of explanatory capacity was described as unpublished data by the authors and the measures or constructs included in those validity investigations were not reported. As such, interpretation of the suggestion that acceptance is non-functional in the mindfulness construct should be met with caution. Because of the lack of explanatory power from acceptance, it was proposed that the operationalization of mindfulness as only attention to and awareness of present moment reality was more important in the construction of the MAAS. However, it was acknowledged that at some level acceptance does play a role in the concept of mindfulness (Brown & Ryan, 2004). It is here that mindfulness can be seen as both a state and a trait, where mindfulness rests upon a foundation of general openness and receptivity to experience (trait) and functionally operates through current awareness and attention (state).

Bishop et al. (2004) frame mindfulness as primarily concerning internal experience, but Brown and Ryan (2004) caution that this limits the applicability of mindfulness. Their operational definition calls for the awareness of and attention to all of experience, not only internal psychological experience. This encompasses external events and internal physiological experience that are many of the targets of MBSR training (Kabat-Zinn 1982, 1985), and opens the door for the application of mindfulness to virtually any aspect of human experience including the target of the current study: running performance.

Beneficial Effects of Mindfulness

Mindfulness training and higher levels of mindfulness have been shown to positively influence or relate to a number of psychological phenomena and medical

conditions across a wide array of clinical and non-clinical samples. Examples include anxiety (Gross et al., 2004; Grossman, Niemann, Schmidt, & Walach, 2004; Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, & Burney 1985; Tacon, McComb, Caldera, & Randolph 2003; Rosenzweig, Reibel, Greeson, Brainard, & Hojat, 2003), depression (Ramel, Goldin, Carmona, & McQuaid, 2004), stress (Carlson, Speca, Patel, & Goodey, 2003; Robert-McComb, Tacon, Randolph, & Caldera, 2004; Simpson et al., 2007), brain functioning (Davidson et al., 2003; Slagter et al., 2007), heart rate and blood pressure (Solberg et al., 2004; long meditation), behavioral motivation (Levesque & Brown, 2007), emotional interference (Ortner, Kilner, & Zelazo 2007), substance abuse (Simpson et al., 2007; Witkiewitz, Marlatt, & Walker 2005), marital satisfaction (Burpee & Langer, 2005), and ecologically responsible behavior (Brown & Kasser, 2005). However, limited evidence is available for the effectiveness of mindfulness training to enhance athletic performance (Gardner & Moore, 2004, 2006; De Petrillo et al., 2007).

Recently, however, a mindful-based approach to running has gained considerable favor among some athletes, both recreational and Olympic. This approach is ChiRunning, a system developed by Dreyer and Dreyer (2004) that is derived from the Eastern tradition of Tai Chi and incorporates many techniques outlined by experimentally applied mindful approaches to sport performance. The system incorporates aspects of breathing meditation and a technique known as the body scan. The body scan seeks to develop a heightened sense of awareness for bodily sensations while in motion. This is achieved through a progressive focusing of attention on various parts of the body beginning at the feet and moving upward through the whole body. These aspects of the

system are very much in line with the current conceptualization of mindfulness, but have yet to be empirically studied for their effectiveness.

Kabat-Zinn, Beall, and Rippe (1985; as cited by De Petrillo et al., 2007) on the other hand, have examined the effectiveness of MBSR for performance enhancement and stress reduction in a study of competitive collegiate and Olympic rowers. They reported improvements in performance in addition to increases in concentration and relaxation and a reduction in negative thoughts and fatigue.

More recently Gardner and Moore (2006) have argued for the potential benefits of Mindfulness-Acceptance-Commitment (MAC) training in the enhancement of athletic performance. MAC incorporates mindfulness as the non-judgmental awareness of present reality to help athletes generate more focus on their internal mental and physical experiences. Aspects of commitment (actions consistent with personal goals) and acceptance (of events, thoughts, and emotions as they are) are then introduced in a discussion format with the researcher to try to produce positive performance enhancement. The emphasis of MAC is placed on reducing emotional labeling of events, thoughts, and emotions. The mindfulness aspect serves to increase attention to and awareness of those thoughts, events, and emotions and to subsequently "let go" of them (Gardner & Moore, 2006, p. 104). They have demonstrated the effectiveness of this approach in a pair of case studies: one with a female bodybuilder and another with a male swimmer (Gardner & Moore, 2004) as well as in a study using Division I collegiate field hockey and volleyball players (Gardner et al., 2005 as cited by Gardner & Moore, 2006). The 2005 study reported a noticeable but small treatment effect that the authors noted was similar to traditional psychological skills training. Both athletes in the case studies

achieved personal bests (Gardner & Moore, 2004). However, due to the introduction of separate commitment and conceptually different acceptance aspects in this training, it is difficult to interpret the effects of this form of performance training with regards to mindfulness.

The most recent examination of mindfulness and sport performance was conducted by De Petrillo et al. (2007). These authors investigated the efficacy of a new Mindfulness Sport Performance Enhancement (MSPE) workshop for distance runners. MSPE is based on mindfulness meditation, breathing, and eating exercises. It is a four week workshop, meeting two and a half hours per session once per week, and it is loosely structured after Kabat-Zinn's MBSR. Participants are taught sitting meditation, breathing meditation, mindful eating (raisin exercise), walking meditation, and the body-scan technique. Mindfulness was measured using the KIMS pre and post workshop and the TMS was administered post session to the experimental group as a manipulation check. The 25 participants were randomly assigned to either workshop or waiting list control groups. Though no significant improvement in actual running performance was found, significant decreases in measures of sport related worries and perfectionism in addition to increases in state (modal) mindfulness (De Petrillo et al., 2007) were observed. These findings support the general benefits of greater or improved levels of mindfulness found in other studies, but the lack of performance benefits potentially limits the value of this training.

One aspect that was not incorporated into the training was the addition of mindful running exercises. Mindful walking exercises were conducted, but it is possible that the effectiveness of such an exercise does not extend to the modality of running. Rejeski

(1985) suggests that when engaging in high levels of exercise intensity, fewer resources are available for attention to be directed on aspects other than immediate physical sensations, potentially limiting the runner's capacity to apply the mindful techniques in the running context. The runners in the study were all experienced athletes who presumably performed at high intensities while competing, the context in which their running performance was measured. If the workshop included exercises designed to increase mindfulness while running, performance differences may have been observed between MSPE runners and controls.

In sum, the literature supporting the efficacy of mindfulness training and enhanced athletic performance is very limited. This may be due to the lack of direct mindfulness training devoted specifically to the enhancement of attention and awareness within the specified sport context. As such, there may be an element relevant to sport performance that is missing in the approaches to trainings attempted thus far. This latter possibility introduces a wide body of relevant literature concerning the element of attentional focus strategies during running activities.

Attentional Focus

Runner's attentional focus strategies were first examined by Morgan and Pollock (1977) in a study of world class elite and collegiate runners. Participants were interviewed and the thoughts that they experienced while running were probed. The cognitive strategies reported by the runners were classified into two categories, associative and dissociative. Associative strategies were defined as a focus on bodily sensations (e.g., breathing, stride, foot strikes, etc…), whereas dissociative strategies were anything not associative (e.g., other runners, daydreaming, birds, etc…). Elite

athletes reported associative strategies much more often than did the collegiate athletes. The explanation the authors gave for this is that elite athletes can afford to associate due to their physical superiority whereas less elite runners needed to dissociate as a means of coping with the physical strain of running. This dichotomous classification of attentional focus strategies would come to dominate the literature on the topic.

Though association and dissociation are the dominant terms, they are not always conceptualized in the same way. Masters and Lambert (1989) described association as including both attention to bodily sensations and to performance relevant cues, whereas dissociation was conceptualized as a distraction from both. Pennebaker and Lightner (1980) introduced internal and external focus as the categories of attentional focus. These were operationalized as bodily sensations being internal and environmental information being external. However, in a literature review of attentional focus research, Masters and Ogles (1998) suggested the simple dichotomization could be ignoring or underestimating the complexity of attentional focus strategies and causing confusion due to the pathological connotation of the term "dissociation". They recommend that a term like "distraction" would be more appropriate. They also noted that dissociative or external strategies could be further classified into sub categories such as counting, problem solving, talking, daydreaming or fantasizing, in addition to environmental cues. These authors concluded that, despite the confusion and lack of clarity, associative strategies in general seem to lead to improved performance in athletic settings. These findings suggest that associative strategies may be worth cultivating as an aspect of any mental training program for athletes.

The idea that attentional focus strategies could be further subdivided was extended in a model proposed by Stevinson & Biddle (1998) who divided both association and dissociation into sub-categories. These authors suggested that all prior conceptualizations of attentional focus strategies were over simplistic and incomplete. They also noted that association can include performance relevant external and internal information and the external focus category ignores the cognitive aspects of dissociation outlined by Masters and Lambert (1989). Stevinson and Biddle (1998) proposed that attentional focus be divided into four distinct and mutually exclusive categories: internal task-relevant (bodily sensations, goals, and cadence), internal task-irrelevant (daydreaming, problem solving, fantasizing), external task-relevant (split times, route, and distance markers), and external task-irrelevant (scenery, spectators, cars). These four categories allow for the classification of nearly every thought or cognitive strategy available to athletes, specifically runners, while performing and training.

Stevinson and Biddle (1998) found that internal task relevant information is attended to more often by marathon runners and internal task irrelevant information was attended to the least. Though there was no statistical difference between the use of both external task relevant and irrelevant information, the authors argued that focus on internal and external task relevant stimuli are the best attentional focus strategies to employ for performance enhancement in running. Stevinson and Biddle also noted that dissociative tactics like internal and external task irrelevant foci serve little function in improving performance besides the distraction from pain, and may increase the risk of injury due to distractions from physiological sensations. This is a position first taken by Morgan and

Pollock (1977) when they claimed that association was a better strategy because of the risk of injury due to dissociation from physical sensations.

It is with the Stevinson and Biddle (1998) conceptualization of attentional focus that the concept of mindfulness can be fully applied in the enhancement of performance in non-scoring aerobic activity. With respect to running, the awareness and attention aspects of mindfulness serve to survey the entire landscape of present experience and bring focus to bear on specific aspects of that experience (Brown and Ryan, 2004). Attentional focus strategies, specifically task relevant internal and external focus, would serve to dictate what particular aspects of that experience are important to the task at hand and which are not. To return to the radar example above, awareness would be the range and the general sensitivity or alertness of the radar. Attention would dictate the ability of the radar to sustain contact with items of interest once detected. Attentional focus strategies would then serve the discrimination function of the radar, determining what an important blip on the screen is (strained muscles or road obstacles) and what is not (to do lists or the sounds of birds along the route). In this sense mindfulness and attentional focus strategies are inextricably linked in an exercise context, but what of the acceptance component of mindfulness in the context of running? This may be best explained by considering the suggestion that runner's primarily dissociate to avoid or overcome sensations of pain.

Leventhal and Everhart (1979) developed the parallel processing model of pain in which pain is considered to be processed as part of an affective schema that incorporates the physiology of pain and the context in which the pain was experienced. This schema dictates the reactions to the experience of pain in certain contexts. In a running activity,

persons with a pain-distress schema may readily dissociate as a means of coping with the pain associated with the physiological sensations experienced. In terms of Stevinson and Biddle's (1998) attentional focus model, such persons would engage more in external and internal task irrelevant focus strategies. However, the acceptance component of mindfulness may serve the purpose of overcoming the pain-distress schema altogether. If an accepting or non-judgmental attitude is employed then the pain stimuli could come to be viewed simply as information without the labels of pain or distress. In terms of running, viewing physiological sensations as biological informational feedback and not as pain may serve to prevent the athlete from engaging in task irrelevant foci to avoid pain. This would simultaneously eliminate the risk of injury due to dissociating from pain and increase runners' use of task relevant information possibly leading to enhanced performance by learning to optimally regulate pace.

It is this model of mindfulness and attentional focus and its relation to running performance enhancement that is the focus of the current study. It is the opinion of the author that a training program devoted to the cultivation of task relevant attentional focus has the potential to benefit runners with respect to performance outcomes.

However, a note of caution comes from an investigation of an associative mental training program similar to the Stevinson and Biddle (1998) conceptualization of attentional focus conducted by Schomer (1987). This study demonstrated that the effectiveness of this type of mental training to current athletes (marathon runners in this case) is predicated on a willingness on the part of the athlete to actively engage in the training. Schomer found that while the training was effective for eight of the ten participants, two demonstrated resistance to fully engaging in the training. This would

seem to indicate that care should be taken on the part of the researcher to ensure that appropriate manipulation checks are conducted.

Due to time and lab constraints, the current study seeks to implement a single session task-relevant attentional focus based intervention to enhance running performance. The intervention will consist of exercises designed to increase the use of task relevant attentional focus strategies that are easy to understand and practice with little experience. As a consequence of this training program, three hypotheses are expected to be supported.

Hypotheses

1.) Participants in the training group report more use of task relevant attentional focus strategies compared to the control group.

2.) Participants in the training group have faster two mile run times compared to a control group that does not receive such training.

3.) Scores on the Mindfulness Attention Awareness Scale (MAAS) as well as pre existing fitness levels of participants are significant covariates when examining the relationship between the intervention and two mile run times.

Methods

Participants

Participants were obtained from the WKU Psychology Study Board. All were undergraduate students who volunteered to participate in the study for course credit. All participants were qualified as low risk according to the American College of Sports Medicine (ACSM) risk assessment form. The ACSM risk assessment form measures familial and lifestyle risks as well as physiological signs of potential risks associated with exercise (American College of Sports Medicine, 2000). In addition to being qualified as low risk, only those participants who exercised some (but not "regularly") or regularly (30 minutes of exercise three times per week) were allowed to participate in the study. Exercise activity was measured using the exercise stages of change measure. There were 83 participants (42 control and 41 experimental) and of those 41 were male and 42 female. The number of participants in each stage of change was as follows: Preparation = 32, Action = 24, and Maintenance = 25, and two were missing. The median age of the participants was 19, (M = 19.78, SD = 2.52) with one participant not reporting.

Materials

Measure of attentional focus (MAF). The MAF (Wininger & Gieske, 2010) was employed as a situational measure of attentional focus and is consistent with the model of attentional focus presented by Stevinson and Biddle (1998). The four categories specified by Stevinson and Biddle are further broken down into six categories in this measure. The task relevant internal focus category is divided into a bodily sensations category, a task relevant thoughts category, and a self-talk category. The other

categories remain intact but have been renamed. The task relevant external focus category is renamed the task relevant external cues category. The task irrelevant internal focus category is renamed the task irrelevant thoughts category. The task irrelevant external focus is renamed the external distractions category.

The subdividing and renaming of the categories for the MAF serves to introduce clarity and transparency to the categories. Furthermore, there are exemplars following each category so participants have a point of reference if the categories may in any way seem ambiguous. Some of these exemplars include *breathing rate* (bodily sensations), pace (task relevant thoughts), "*I can do it*" (self-talk), *time elapsed* (task relevant external cues), *daydreaming* (task irrelevant thoughts), and *items in the environment* (external distractions). Participants indicate the percentage of time out of 100 that they focused on each category during a preceding run. Percentage choices for each category are at each 10 percentage points beginning at 0, to 10, to 20, etc… and all responses are required to sum up to 100 percent of the time they spent running (if participant chooses 50% for first category, they only have 50% more to divide among the remaining 5 categories). The scale has been found to negatively correlate with runners pace (r = -.20) and ratings of perceived exertion (RPE; r = -.19 to -.46; Wininger & Gieske, 2010).

Mindful attention awareness scale (MAAS). The MAAS consists of 15 indirect items on a 6 point scale (1 = *almost always*, 6 = *almost never*) and requires respondents to indicate how frequently they have the experience described by the item. The scale is based on the conceptualization of mindfulness as awareness and attention being the two separate components. The scale yields a single composite average score where higher scores indicate more mindfulness and ranges from 1 to 6. The MAAS shows good

internal consistency across multiple samples including a student sample (alpha = .82; Brown & Ryan, 2003), and a general adult sample (alpha = .87; Brown & Ryan, 2003). Other studies have shown the MAAS to positively correlate with scores on other mindfulness measures such as the Philadelphia Mindfulness Scale awareness subscale (r = .32) and acceptance subscale (r = .21; Cardaciotto, 2005), the Cognitive Affective Mindfulness Scale-Revised (r = .51; Feldman, Hayes, Kumar, Greeson, & Laurenseau, 2007), and the Kentucky Inventory of Mindfulness Skills (r = .51; Baer et al., 2004).

Borg ratings of perceived exertion (RPE) scale. The RPE scale is a single response scale that ranges from 6 to 20 with higher scores indicating greater levels of perceived exertion. The scale has verbal anchors beginning at 6 (*no exertion at all*), continuing on the odd numbers with 7 (*extremely light*) to 19 (*extremely hard*) ending at 20 (*maximal exertion*). There are strong correlations (*r* = .80 to .90) between heart rate and the scale. In fact, the scale's range is structured to correspond to heart rate with 6 being relative to a 60 beats per minute (bpm) heart rate and 20 being relative to a 200 bpm heart rate. The scale is considered to be reliable and valid (Borg, 1998).

Distress Scale. The distress scale is an eight-item seven-point likert scale ranging from 1 "*did not do at all*" to 7 "*did a lot*". Participants indicate the degree to which they focused on or thought about things such as "how much you want to quit" and "whether you will be able to finish the exercise" during a given exercise session. The eighth item is an "other" item where participants are free to indicate any other distressful thought they focused on during the exercise session and rate it according to the same likert type scale. A composite average response is then taken to obtain the participants overall distress

score. This scale is a subscale of the Attentional Focus Questionnaire developed for and used in a study by Brewer, Van Raalte, & Linder (1996).

Stages of change (SOC). The SOC measure contains five statements and participants then indicate the one that best describes themselves. Stages of change refer to the individual's level of readiness for participation in an exercise regimen based on their current exercise behavior. The five stages are pre-contemplation (I do not currently exercise and do not intend to start exercising in the next six months), contemplation (I do not currently exercise, but I am thinking about starting to exercise in the next six months), preparation (I do currently exercise some, but not regularly where regularly means exercising three or more times per week for at least 30 minutes per session), action (I do currently exercise regularly), and maintenance (I have been exercising regularly for the last six months or longer; Wininger, 2007). Test-retest reliability for the measure has been found to be .78 (Marcus, Selbey, Niaura, and Rossi, 1992) and Marcus and Simkin (1993) have demonstrated concurrent validity in that scores on the Seven Day Activity Recall differentiate between the various stages of the SOC. Participants not in the preparation, action, or maintenance stages were excluded from the study as they were considered at high risk for potential negative reactions to the level of exercise employed in this study.

Procedure

First session both groups. Upon arrival at the lab all volunteers read and signed an informed consent form in addition to the American College of Sports Medicine (ACSM) risk assessment form. The ACSM risk assessment is used to identify physically at risk participants. Only those deemed low risk were allowed to participate. Participants

then completed the exercise stages of change measure. After being qualified as low risk by the ACSM risk assessment form and the stages of change measure, all eligible participants were randomly assigned to one of the two conditions and then addressed individually by a member of the experimental team about the nature of the study. It was made clear that it was important that the nature of the training not be discussed between participants within or across groups because it may compromise the results of the study.

All participants completed a demographics questionnaire asking age, gender, exercise level, type of exercise in addition to questions regarding participants' prior experience with meditation, martial arts, yoga, Buddhism, or Zen, and the extent of that experience since prolonged study and practice of such disciplines associated with mindfulness and attentional focus may influence results. Participants were then allowed to review the instructions explaining the use and purpose of the RPE scale employed in this study in order to familiarize them with the instrument. Instructions for the session were then read to the participant by the experimenter based on their particular group assignment. The instructions were as follows.

No training control group. "Today you will be participating in an experiment on running performance. You will be asked to run on the treadmill at various intensities for three minutes per intensity. The intensities will be determined using this scale (show them the RPE scale) and correspond to 11 (light), 13 (somewhat hard), and 15 (hard/heavy). You will control the speed of the treadmill and adjust it to match your perception of each of these intensities when asked to do so. We will begin with the 11, moving up to the 13, then to the 15, and then return for a final three minutes at 13. Once the time on the treadmill is complete, you will fill out a couple of additional

questionnaires and that will conclude the session. Do you understand what the procedure will be?"

Training experimental group. "Today you will be participating in an experiment on running performance. You will be asked to run on the treadmill at various intensities for three minutes per intensity. The intensities will be determined using this scale (show them the RPE scale) and correspond to 11 (light), 13 (somewhat hard), and 15 (hard/heavy). You will control the speed of the treadmill and adjust it to match your perception of each of these intensities when asked to do so. We will begin with the 11, moving up to the 13, then to the 15, and then return for a final three minutes at 13." "The purpose of running at these contrasting intensities is so that you can learn to identify where your optimal intensity is which according to the research is 13-14 (explain ventilatory threshold and lactic acid buildup). Note, that optimal intensity for the last 1-2 minutes of a performance should exceed 13-14 as one kicks to finish at their maximum."

"While you are running at each intensity, I will ask you to focus your attention on your physiological sensations in order to correlate them with a given intensity. I will ask you to pay attention primarily to your breathing, your legs and your arms."

"Last I will ask you to identify some self talk statements that you feel will help you to remain motivated to keep going."

"Once the time on the treadmill is complete, you will fill out a couple of additional questionnaires and that will conclude the session. Do you understand what the procedures will be?"

Questions from participants were answered following the instructions to ensure understanding prior to conducting the rest of the experiment.

Participants were then lead to the treadmill where they received the assigned experimental manipulation after a two minute walking warm-up at 2.5mph.

Session one. Following the warm-up, participants were asked to increase the speed of the treadmill until they felt they had reached an RPE of 11. If participant was in the control group then they continued at this intensity for three minutes without further instruction. If participant was in the experimental group, then they were informed that this intensity was too low for optimal performance. They were led through focusing on their physical sensations relating to their breathing, legs, and arms. "Legs" were described to the participant as meaning the physiological sensations from the waist down. "Arms" were described as meaning the physiological sensations in the shoulders, arms, and neck. "Breathing" was described as meaning the physiological sensations of breathing, both the depth of breath and the breathing rate. At the 2 minute mark they were reminded to use their self talk to stay motivated. After 3 minutes at a RPE of 11, the participant was instructed to increase the treadmill speed to a RPE of 13. Instructions were repeated as they were for either group during the RPE of 11 but the experimental group was further informed that this is the optimum intensity for peak performance. After 3 minutes at a RPE of 13, the participants were asked to increase the treadmill speed to a RPE of 15. Instructions were repeated as before for each group, but the experimental group was informed that this intensity is too high and limits peak performance. After 3 minutes at a RPE of 15, the participants were asked to reduce the treadmill speed back to a RPE of 13. Instructions were repeated for each group as before and the experimental group was reminded that this is the optimum intensity for peak performance. After 3

minutes at a RPE of 13, participants were asked to reduce the treadmill speed to 2.5mph for a 2 minute cool down.

After the cool down each participant completed the MAF short form and was free to leave. Each participant was asked to return to the lab one week following the first session to complete a second session.

Session two. Participants were informed that their task during that session was to complete two miles as fast as possible on the treadmill. They were informed that when they completed two miles and a few questionnaires they would be free to leave. Therefore, the faster they finished, the faster they could leave. The experimental group was reminded to use their sensory cues to identify their peak intensity and to use their self-talk to stay motivated. The experimental group was also informed that the optimal intensity for the last 1-2 minutes of a performance should exceed a RPE of 13-14 as one kicks to finish at their maximum in order to obtain their best time. All participants were then led to the treadmill and the safety clip attached. All participants completed a warm-up at 2.5mph. After the warm-up the treadmill was stopped. Participants were informed that the time would start when they restart the treadmill. They were reminded that the faster they finished the faster they may leave and that the treadmill would be adjusted to display the distance they had completed. Participants were allowed to begin whenever they were ready. When they restarted the treadmill the time started. RPE estimates by the participant and the treadmill speed were recorded when participants reached .5, 1.0, 1.5, and 1.9 miles into the two mile run. At 2.0 miles the time was recorded. The speed was reduced by the experimenter to 2.5mph for a 2 minute cool-down.

Participants then completed the MAF and the MAAS following the cool-down. Participants were debriefed as follows:

"The study you have participated in was designed to examine running performance. We appreciate your participation and would like to answer any questions you have at this time." The participant's questions were answered and their psychology study-board credits were granted at that time.

Results

Hypothesis 1

An independent samples t-test was used to test the hypothesis that the experimental group would demonstrate more focus on task relevant strategies than the control group. Responses to the four task relevant strategies were collapsed into a single percentage of time engaged in those strategies for both groups. The t-test indicated that during training the experimental group did focus more on task relevant strategies than did the control group (t (81) = 2.97, p = .004, η^2 = .04).

Hypothesis 2

A single factor, between groups (2) ANCOVA was used to test the hypothesis that the two mile run time would be faster for the experimental group than for the control group, factoring out mindfulness scores and pre-existing fitness levels by using the average speed at the target RPE 13 from the training session across both groups. Mindfulness was not a significant covariate, F (1, 74) = 1.89, p = .173. Speed at the target RPE of 13 was a significant covariate, F (1, 74) = 92.93, p < .001, η^2 = .56. The intervention session did not have a significant effect on two mile run times, F (1,74) = 1.90 p = .172. Unadjusted means for each group were M = 21.29 minutes (SD = 5.17) for the experimental group and M = 20.23 minutes (SD = 4.67) for the control group. Pre-existing fitness levels as a significant covariate could be limiting the effectiveness of the intervention session by potentially affecting participants' attentional focus strategies. This possibility is examined in the exploratory analysis.

Exploratory Analysis

Following from Hypothesis 1, and given that Hypothesis 2 was unconfirmed, it was important to know if the manipulation employed in this study was effective for any or all four subcategories of attentional focus. Therefore, a 2 (group) by 4 (factor) mixed model ANOVA was performed on the participants' attentional focus responses with group (experimental versus control) representing a between subject factor and the individual subcategories of task relevant attentional focus (bodily sensations, task relevant thoughts, task relevant external cues, and self talk) representing the within subjects factor. The ANOVA yielded an interaction between factor and group, $F(1, 88) = 4.59$, $p = .035$, partial $\eta^2 = .05$. Examination of means revealed that the experimental group ($M = 34.15$, $SE = 1.9$) was more likely to endorse this strategy during the training session than the control group ($M = 24.64$, $SE = 1.9$), but there were no significant differences during the performance trial.

Because the manipulation only affected the bodily sensations subcategory, the question arose as to whether or not pre-existing fitness level would be related to participants use of that particular subcategory given that the seminal study by Morgan and Pollock (1977) indicated that higher level athletes tended toward that strategy in general. If this is true it would indicate that fitness levels of the participants were driving their adherence to the lessons of the intervention. Using their average speed from session one at the RPE of 13 as a measure of fitness level, correlations were then run on the use of bodily sensation strategies during both session one $r(81) = .11$, $p =$ ns and session two $r(81) = .19$, $p =$ ns. Neither of these correlations was significant.

Given that the manipulation generated higher levels of focus on the bodily sensations subcategory, but that that strategy was not related to the participants' fitness levels and did not result in better performance on the two mile run, the question then became to what was the resulting use of the bodily sensations category related? A potential answer was the participant's level of distress experienced during the training would be associated with their use of bodily sensations while running. Correlations between distress during session one and focus on bodily sensations during session one revealed that distress experienced during session one was positively related to the degree of focus on bodily sensations during the session, r (81) = .28, p = .012.

This finding in turn lead to the question of whether or not there are differences in the distress scores of the participants between the two groups? A 2 (group) X 2 (session) mixed model ANOVA was run to determine if distress ratings differentially varied for members of the two groups between the two running sessions. This test indicated that there were differences between the two groups in their distress scores across the two sessions, F (1, 78) = 4.35, p = .04, partial η^2 = .05 such that the experimental group (M = 16.79, SE = .97) showed higher levels of distress than did the control group (M = 13.94, SE = .97). This difference was limited to the first session.

Discussion

The main hypothesis that the training would lead to faster two mile run times was ultimately not supported, though differences were observed between the groups use of task relevant attentional focus strategies showing that at least the manipulation was adhered to by the experimental group. With respect to performance, the data suggests that the training group seemed to be trending toward slower two mile times than the control group. Mindfulness scores were not found to be a significant covariate and thus cannot be thought to play a role in affecting two mile run times. In light of these findings, it can be concluded that this specific form of training was ineffective in the current study with respect to improving participants' two mile run times, though fitness level of the participants was found to be a significant covariate.

Regarding the lack of performance differences between the two groups, as mentioned above, it became important to know if the manipulation generated higher use across all four subcategories of attentional focus or if one subcategory was influenced more than others. Those results indicated that only the bodily sensations attentional focus category was affected by the manipulation. Based on this information, it was reasonable to ask if pre-existing fitness levels played a part in affecting participants' use of this strategy since it was a significant covariate. This question was based on the evidence presented by Morgan and Pollock (1977) arguing that elite or higher level athletes tend to associate (focus on bodily sensations) and lower level athletes tend to dissociate (focus on anything else). However, fitness levels failed to correlate with participants' use of the bodily sensations subcategory. It appears that, existing fitness level notwithstanding, the experimental group adhered to the manipulation in only one specific aspect of their

attentional focus (bodily sensations) and were unsuccessful in outperforming the control group in a two mile run.

In light of this evidence, the new focus became exploring the data to find out what the manipulation ultimately affected and if that would help explain the lack of performance differences between the two groups. It was discovered that participants use of the bodily sensations subcategory overall were correlated with the participants' scores on the distress scale. This made sense given the discussion above concerning Leventhal and Everhart (1979) parallel processing model of pain. It is possible that the tendency for participants to focus on the bodily sensations associated with running would lead to an activation of a negative affective pain schema that would reveal itself through increases in participants reported distress scores. If this is true, then the key question became did the experimental group, because they do report higher levels of attention to bodily sensations, also report higher levels of distress than did the control group. The answer was, "Yes, they did."

Given this evidence, it is possible to construct an explanation of what may have produced the results observed in this study, suggest means of revising the manipulation and limitations, and discuss possible avenues for further research. Based on the results obtained here, it would appear that the manipulation employed ultimately resulted in higher levels of distress for the experimental group and not higher levels of performance. It is possible that participants' in the current study could have held negative pre-existing pain schemas regarding running. If this were true, then the manipulation employed here had the potential to hinder performance, and indeed the data was trending in that direction. It could be argued that the manipulation employed in this study was simply not

allowed enough time to train participants effectively enough to overcome their potential pre-existing pain schema regarding running. Training protocols such as the one employed in this study would best be conducted over a series of weeks or months to ensure comprehension and proper execution of the methods taught by those receiving the training. It is possible that had the manipulation been extended to a training program covering a course of weeks as opposed to a single intervention session, that ultimately differences in performance would have been found and that they would confirm the hypothesis that such training is effective at improving running performance in a middle distance such as the two mile run. In hindsight, measures of pre-existing pain schemas regarding running should have been conducted here and would be advised for future investigations into this area of study.

Due to lab and time constraints the training for the current study was necessarily condensed into a single session intervention. However, in a study by Sainting, et al., (1988), undergraduate physical conditioning class students were instructed to use either associative, dissociative, psyching-up, or no attentional focus strategies to improve their 1.5 mile run times. That manipulation was conducted over the course of an entire semester and resulted in the best improved run times for the associative group supporting the idea that associative strategies are most effective in improving middle distance run times. It remains to be seen whether a training protocol such as the one in this study, if conducted over a longer timeframe similar to that of Sainting, et al., (1988), would be effective in achieving the hypothesized results proposed in this study.

It is important to address the emphasis that the intervention employed in this study had towards promoting participants' focus on the bodily sensations attentional

focus subcategory. The structure of the protocol was to adapt as best as possible attentional focus training specifically to a running context. In hindsight, developing the protocol to rely heavily on manipulating participants focus toward predominantly the physical aspect of running appears to have been a limiting factor to the robustness of the training. This possibly promoted an over emphasis on bodily sensations. Future research into this arena should incorporate techniques that would explicitly relate to the promotion of the other three task relevant attentional focus subcategories. Options for accomplishing this are many, but should be thought of as part of a cohesive and complimentary task relevant protocol. In addition, future research might also want to consider measuring pre-existing affective biases with regards to focusing on bodily sensations. Persons with previous negative experiences may experience performance decrements as opposed to benefits from focusing on bodily sensations. They may not be able to use their bodily sensations as objective feedback for regulating intensity.

It may be prudent at this juncture to discuss a couple of the general limitations regarding this study while advancing with additional suggestions for future research. One already mentioned limitation is that of time, and will not be further discussed here. However, other limitations still remain and one of those is regarding participant incentive. Exercise, and especially running, is difficult to incentivize extrinsically given the very intrinsic nature of the benefits typically derived from such activities such as improved health. Participants in this study were given psychology study board credits for their participants that are directly incorporated into their introductory level psychology class grades. Although this study provided them with all the credits necessary for their course, the study still may have lacked a sufficient incentive to ensure participants try

their best at the task. The attempt made in the present study was to tell participants that the faster they run the sooner they can leave, though little reassurance that they actually tried to comply would be difficult to ascertain. Perhaps a study illuminating effective methods to incentivize exercise or running specifically would be beneficial to future investigations and to the knowledge of this author has not so far been explored empirically.

Additionally, it is possible that the incentive scheme employed in this study limited the effectiveness of the intervention. It is clear that participants were asked to employ the training they had received during the first session under very different conditions during the second session. The goal of session one was to learn how to apply the intervention tactics and was trained using a regimented time based course. The second session was run entirely at the participants own time and the goal was then to complete the run in as short a time as possible. It is possible that the participants in the experimental group were hindered in effectively applying the intervention during the second session because they may not have known when during the course of the run they should be using which tactics. Such confusion, if present, could have affected the results. In hindsight, this limitation could have been examined empirically, however no measure as to when, how, or even if accurately the tactics were employed was taken during the course of this study. Future investigations should methodologically resolve this conflict of goals between sessions, or at least in some way measure its effects on the results.

Another potential limitation is the self-report nature of the study. Nearly all variables in this study were self reported by the participant with the exceptions of two mile run times and speed of the treadmill. It is always possible that response bias exists,

and given the nature of the present study it may be possible that some of that bias was present though it would be difficult to obtain any evidence supporting that notion. It is stated here as a reminder that with this type of research, it may be beneficial to rely on objective measures whenever possible. That was done here with two mile run times being the target dependent variable and treadmill speed at RPE of 13 as a measure of fitness, but it is important to mention nonetheless.

A final limitation of the current study is the participant pool itself. In the seminal work conducted into this subject, Morgan and Pollock (1977) found that elite level athletes associate more while less experienced runners tended to dissociate. It may be the case that this particular intervention, due to the high emphasis on associative attentional focus strategies, is best suited for more experienced runners. The participants in the current study were average college students who predominantly do not exercise regularly and would not seem to be considered experienced runners or elite level athletes. Given that during our study the experimental group experienced greater levels of distress than did the control group, the argument could be made that the intervention is ill suited for those with little running experience and would best be applied to athletes of a higher caliber. Perhaps such a condensed intervention protocol would be effective in improving the running performance of collegiate or high school level cross-country or track athletes. This may prove to be a fruitful direction of future research concerning condensed athletic training protocols.

In summary, the goal of the current study was to investigate the effectiveness of a task-relevant attentional focus intervention on running performance and to determine if mindfulness mediated the effects of the training. Mindfulness was not a significant

mediator. The intervention did not result in the expected better running performance by the training group. This could have been in part due to the distress that the participants felt during the course of the training, the lack of effective incentives for peak performance, variance between the goals across the two sessions, or the idea that only higher level athletes are positioned to benefit from such an intervention. Any of these reasons are plausible given the results obtained, and each potentially provide fruitful avenues for future research. Only time and additional investigations will shed light on this particular area of study.

References

American College of Sports Medicine (2000). ACSM's Guidelines for Exercise Testing and Prescription (6th ed.). Philadelphia: Lippincott Williams & Wilkins.

Baer, R. A. (2003). Mindfulness Training as a Clinical Intervention: A Conceptual and Empirical Review. *Clinical Psychology Science and Practice*, 10, 125-143.

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of Mindfulness by Self-Report: The Kentucky Inventory of Mindfulness Skills. *Assessment*, 11(3), 191-206.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, …Devins, G. (2004). Mindfulness: A Proposed Operational Definition. *Clinical Psychology Science and Practice*, 11, 230-241.

Borg, G. (1998). Borg's Perceived Exertion and Pain Scales. Champaign, IL: Human Kinetics.

Brewer, B.W., Van Raalte, J. L., & Linder, D. E. (1996). Attentional Focus and Endurance Performance. *Applied Research in Coaching and Athletics Annual*, 11, 1-14.

Brown, K. W., & Kasser, T. (2005). Are Psychological and Ecological Well-Being Compatible? The Role of Values, Mindfulness, and Lifestyle. *Social Indicators Research*, 74, 349-368.

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), 822-848.

Brown, K. W., & Ryan, R. M. (2004). Perils and Promise in Defining and Measuring Mindfulness: Observations from Experience. *Clinical Psychology Science and Practice*, 11, 242-248.

Burpee, L. C., & Langer, E. J. (2005). Mindfulness and Marital Satisfaction. *Journal of Adult Development*, 12(1), 43-51.

Cardaciotto, L. (2005). Assessing Mindfulness: The Development of a Bi-Dimensional Measure of Awareness and Acceptance. *Thesis Submitted to the Faculty of Drexel University*.

Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2003). Mindfulness-Based Stress Reduction in Relation to Quality of Life, Mood, Symptoms of Stress, and Immune Parameters in Breast and Prostate Cancer Outpatients. *Psychosomatic Medicine*, 65, 571-581.

Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosencranz, M., Muller, D., …Sheridan, J. F. (2003). Alterations in Brain and Immune Function Produced by Mindfulness Meditation. *Psychosomatic Medicine*, 65, 564-570.

De Petrillo, L. A., Kaufman, K. A., Glass, C. R., & Arnkoff, D. B. (2007, November). Mindfulness for Long Distance Runners: A Controlled Trial Using Mindful Sport Performance Enhancement. *Poster Session Presentation at the Association for Behavioral and Cognitive Therapies 41st annual Convention*, Philadelphia, PA.

Dreyer, D., & Dreyer, K. (2004). ChiRunning: A Revolutionary Approach to Effortless, Injury Free Running. New York: Simon & Schuster.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. (2007). Mindfulness and Emotional Regulation: The Development and Initial Validation of the

Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology, Behavior, and Assessment*, 29, 177-190.

Gardner, F. L., & Moore, Z. E. (2004). A Mindfulness-Acceptance-Commitment-Based Approach to Athletic Performance Enhancement: Theoretical Considerations. *Behavior Therapy*, 35, 707-723.

Gardner, F. L., & Moore, Z. E. (2006). Clinical Sport Psychology. Champaign, IL: Human Kinetics.

Gross, C. R., Kreitzer, M. J., Russas, V., Treesak, C., Frazier, P. A., & Hertz, M. I. (2004). Mindfulness Meditation to Reduce Symptoms After Organ Transplant: A Pilot Study. *Advances*, 20(2), 20-29.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-Based Stress Reduction and Health Benefits: A Meta-Analysis. *Journal of Psychosomatic Research*, 57, 35-43.

Kabat-Zinn, J. (1982). An Outpatient Program in Behavioral Medicine for Chronic Pain Patients Based on the Practice of Mindfulness Meditation: Theoretical Considerations and Preliminary Results. *General Hospital Psychiatry*, 4, 33-47.

Kabat-Zinn, J. (1990). Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness. New York: Delta.

Kabat-Zinn, J. (1994). Wherever You Go There You Are: Mindfulness Meditation in Everyday Life. New York: Hyperion.

Kabat-Zinn, J., Lipworth, L., & Burney, R. (1985). The Clinical Use of Mindfulness Meditation for the Self-Regulation of Chronic Pain. *Journal of Behavioral Medicine*, 8(2), 163-190.

Leventhal, H., & Everhart, D. (1979). Emotion, Pain, and Physical Illness. In C. E. Izard (Ed.), *Emotions in Personality and Psychopathology* (pp. 263-298). New York: Plenum.

Levesque, C., & Brown, K. W. (2007). Mindfulness of a Moderator of the Effect of Implicit Motivational Self-Concept on Day-to-Day Behavior Motivation. *Motivation and Emotion*, 31, 284-299.

Marcus, B., Selby, V., Niaura, R., and Rossi, J., (1992). Self-Efficacy and the Stages of Exercise Behavior Change. *Research Quarterly for Exercise and Sport*, 63, 60-66.

Marcus, B., and Simkin, L. (1993). The Stages of Exercise Behavior. *The Journal of Sports Medicine and Physical Fitness*, 33, 83-88.

Masters, K. S., & Lambert, M. J. (1989). The Relations Between Cognitive Coping Strategies, Reasons for Running, Injury, and Performance of Marathon Runners. *Journal of Sport and Exercise Psychology*, 11, 161-170.

Masters, K., & Ogles, B. M. (1998). Associative and Dissociative Cognitive Strategies in Exercise and Running: 20 Years Later, What Do We Know? *The Sport Psychologist*, 12, 253-270.

Morgan, W. P., & Pollock, M. L. (1977). Psychologic Characterization of the Elite Distance Runner. *Annals of NY Academy of Science*, 301, 382-403.

Ortner, C. N. M., Kilner, S. J., & Zelazo, P. D. (2007). Mindfulness Meditation and Reduced Emotional Interference on a Cognitive Task. *Motivation and Emotion*, 31, 271-283.

Paramananda (1996). A Practical Guide to Buddhist Meditation. New York: Barnes & Noble.

Pennebaker, J. W., & Lightner, J. W. (1980). Competition of Internal and External Information in an Exercise Setting. *Journal of Personality and Social Psychology*, 39, 165-174.

Ramel, W., Goldin, P. R., Carmona, P. E., & McQuaid, J. R. (2004). The Effects of Mindfulness Meditation of Cognitive Processes and Affect in Patients with Past Depression. *Cognitive Therapy and Research*, 28(4), 433-455.

Rejeski, W. J. (1985). Perceived Exertion: An Active or Passive Process? *Journal of Sport Psychology*, 7, 371-378.

Robert-McComb, J. J., Tacon, A., Randolph, P., & Caldera, Y. (2004). A Pilot Study to Examine the Effects of a Mindfulness-Based Stress Reduction and Relaxation Program on Levels of Stress Hormones, Physical Functioning, and Submaximal Exercise Responses. *The Journal of Alternative and Complementary Medicine*, 10(5), 819-827.

Rosenzweig, S., Reibel, D. K., Greeson, J. M., Brainard, G. C., & Hojat, M. (2003). Mindfulness-Based Stress Reduction Lowers Psychological Distress in Medical Students. *Teaching and Learning in Medicine*, 15(2), 88-92.

Sainting, D. E., Richman, C. L., & Bergey, D. B. (1988). Effects of Three Cognitive Strategies on Long-Distance Running. *Bulletin of the Psychonomic Society*, 26(1), 34-36.

Schomer, H. H. (1987). Mental Training Programme for Marathon Runners. *International Journal of Sport Psychology*, 18, 133-151.

Simpson, T. L., Kaysen, D., Bowen, S., MacPherson, L. M., Chawla, N., …Larimer, M. (2007). PTSD Symptoms, Substance Use, and Vipassana Meditation Among Incarcerated Individuals. *Journal of Traumatic Stress*, 20(3), 239-249.

Slagter, H. A., Lutz, A., Greischar, L. L., Francis, A. D., Nieuwenhuis, S., Davis, J. M., & Davidson, R. J. (2007). Mental Training Affects Distribution of Limited Brain Resources. *PLoS Biology*, 5(6), 1228-1235.

Solberg, E. E., Ekeberg, O., Holen, A., Ingjer, F., Sandvik, L., Standal, P. A., & Vikman, A. (2004). Hemodynamic Changes During Long Meditation. *Applied Psychophysiology and Biofeedback*, 29(3), 213-221.

Stevinson, C. D. & Biddle, S. J. H. (1998). Cognitive orientations in marathon running and "hitting the wall". *British Journal of Sports Medicine, 32,* 229-235.

Tacon, A. M., McComb, J., Caldera, Y., & Randolph, P. (2003). Mindfulness Meditation, Anxiety Reduction, and Heart Disease: A Pilot Study. *Family and Community Health*, 26(1), 25-33.

Thera, N. (1962). The Heart of Buddhist Meditation: A Handbook of Mental Training Based on the Buddha's Way of Mindfulness. London: Rider & Company.

Wininger, S. R. (2007). 'Self-Determination Theory and Exercise Behavior: An Examination of the Psychometric Properties of the Exercise Motivation Scale', *Journal of Applied Sport Psychology*, 19(4), 471 – 486.

Wininger, S. R., & Gieske, D. (2010). Measure of Attentional Focus: Cognitive Interviews and a Field Study. *Athletic Insight*, 2(2), 125-146.

Witkiewitz, K., Marlatt, G. A., & Walker, D. (2005). Mindfulness-Based Relapse Prevention for Alcohol and Substance Use Disorders. *Journal of Cognitive Psychotherapy: An International Quarterly*, 19(3), 211-228.

APPENDIX A

Informed Consent Form

Informed Consent Form

Project Title: Examination of Mindfulness and Attentional Focus

Investigator: Anthony R. Atchley, Psychology Department, (270) 779-9083

---

1. The purpose of this study is to examine the effects of a mindfulness and attentional focused on running performance.

2. As a volunteer in this research project you will be asked to: **a)** engage in two 30 minute sessions across two consecutive weeks that will require you to run at various speeds up to 90% of your maximum heart rate no longer than 10 minutes per session **b)** provide demographic information, and **c)** complete a series of questionnaires.

3. Potential risks to your health and well-being because of your participation include 1) cardiovascular injury (heart attack or stroke), 2) severe acute fatigue, 3) light headedness, dizziness, nausea, 4) all other possible risks associated with engaging in low to high intensity exercise.

-The American College of Sport Medicine (2000) suggests the following regarding the potential risk/injury as the result of participating in *maximum intensity testing or testing in which intensity is contingent upon pre-existing health conditions*:

1 Risk of Death during or immediately after is less than 0.01% (1 in 10,000)
2 Risk of heart attack during or immediately after is less than 0.04% (4 in 10,000)
3 Risk of hospitalization as a result of testing is less than 0.2% (2 in 1,000)

- The ACSM goes on to state that the risk associated with **sub-maximal** physical fitness testing appear to be even lower. These statements are made for the general population. We will take every precaution to ensure your safety; an individual with CPR certification will perform testing. **It is very important that you fully disclose anything that would increase your risk for participating in low to high intensity exercise.**

- IF YOU FEEL ILL AT ANY TIME DURING, BEFORE, OR AFTER THIS STUDY LET THE INVESTIGATORS KNOW IMMEDIATELY! IF YOU MIGHT BE PREGNANT OR IF YOU ARE TRYING TO CONCEIVE CHILDREN, YOU SHOULD NOT PARTICIPATE IN THE STUDY!!

4. For your participation, you will be awarded 5 credits through the study board, which may be applicable to your course grades with your instructor's approval. You understand that there are no other direct benefits to you and that you will receive no monetary compensation for participation in this study.

5. You understand that your responses will be confidential. No identifying information, including your name, will be made available to anyone except those who work in this lab. The entire experiment should take approximately 1 hour divided across two sessions.

6. Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. **Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.**

If you fully understand what will be asked of you (should you participate), please read and sign the following:

I freely and voluntarily and without undue inducement or any element of force, fraud, or deceit, or any form of coercion, consent to be a participant in this research project. I have read and understood the screening questionnaires (PAR-Q & ACSM stratification) used to classify me as a low risk participant. I have been given the right to ask and have answered any questions that I may have regarding this research. I have read and understand all of the above.

I understand also that it is not possible to identify all potential risks in an experimental procedure, and I believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

_____ _____

Signature of Participant Date

_____ _____

Witness Date

Questions regarding Human Subjects Review Board issues should be directed to Dr. Phillip Myers at (270) 745-4652.

APPENDIX B

ACSM Risk Stratification Form

ACSM Risk Stratification (ACSM, 2000)

Name Date: / / Gender: Female or Male
Age:

Do you have any of the following conditions?

_____ 1. Family history of Heart disease: Heart attack, heart surgery, or sudden death before age 55 (father/brother/son) or 65 (mother/sister/daughter)
_____ 2. Cigarette Smoker: current or have quit within the past 6 months
_____ 3. High Blood Pressure: SBP $\geq$ 140 or DBP $\geq$ 90 (confirmed on 2 occasions or on Blood Pressure medication)
_____ 4. High cholesterol: total >200 (or HDL < 35, or > 130, or on medication for high cholesterol)
_____ 5. Diabetes (adult or juvenile) or Glucose Intolerance
_____ 6. Obesity (Body Mass Index $\geq$ 30, or waist circumference > 39 inches)
_____ 7. Sedentary Lifestyle (less than 30 minutes total "physical activity" most days)

Total risk factors =

Do you have any of the following?

_____ Pain, discomfort, tightness, or heaviness in the chest, neck, jaw, arms, or other areas
_____ Shortness of breath at rest or with mild exertion
_____ Dizziness or loss of consciousness
_____ Difficulty breathing when lying down or any difficulty breathing during physical exertion
_____ Swelling at the ankles
_____ Irregular or fast heart rate
_____ Intermittent leg pain or limping especially upon exertion
_____ Known heart murmur
_____ Unusual fatigue or shortness of breath with usual activities

Total signs/symptoms =

Stratification *(only persons considered as **low risk** may participate in this study)*

Low Risk	Younger individuals (males: younger than 45, females: younger than 55) who have no signs/symptoms and no more than 1 risk factor.
Moderate Risk	Older individuals (males: 45 and older, females: 55 and older) or those who have 2 or more risk factors.
High Risk	Individuals with 1 or more signs/symptoms or known cardiovascular, pulmonary or metabolic disease.

APPENDIX C

Stages of Change and Demographics Form

Exercise Stages of Change

1. Which of the following statements best describes you? Please read all 5 statements and then circle your response.

   a. I currently do ***not*** exercise and do not intend to start exercising in the next 6 months.
   b. I current do ***not*** exercise, but I am thinking about starting to exercise in the next 6 months.
   c. I currently exercise some, but not ***regularly*** (/regularly/ is defined as exercising 3 or more times per week for at least 30 minutes per session).
   d. I currently exercise ***regularly***.
   e. I have been exercising ***regularly*** for the past 6 months or longer.

Demographics

1. Name: _____ **2. Gender**: Female or Male **3. Age:** _____

*Refer to chart on the right to determine **intensity** rating or rate of perceived exertion (RPE)*

Use to rate intensity
6 No exertion at all
7
Extremely light (7.5)
8
9 Very light
10
11 Light
12
13 Somewhat hard
14
15 Hard (heavy)
16
17 Very hard
18
19 Extremely hard
20 Maximal exertion

4. What mode (s) of exercise do you normally engage in?

	Frequency? (per week)	Duration? (per session)	Intensity? (RPE)
1) _____	_____	_____	_____
2) _____	_____	_____	_____
3) _____	_____	_____	_____

5. Considering a 7-day period (a week) how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time?

a. Strenuous exercise (heart beats rapidly; vigorous running, swimming, cycling) per week: ____

b. Moderate exercise (not exhausting, light sweating; fast walking, easy swimming) per week: ____

c. Mild exercise (minimal effort, not sweating; yoga, bowling, easy walking) per week: ____

6. What is your fastest two mile? (if known) _____

7. Have you ever participated in meditation, yoga, martial arts (Judo, Karate, Kung Fu, Tae Kwon Do, Ninjitsu, etc..), or any other Eastern philosophical practice such as Buddhism, Confucianism, etc…?

Yes or No (if *yes*, continue to # 8)

8. If you answered ***yes*** to number 7, please indicate what you have practiced, how many years or months you have practiced and approximately how many times per week during that period. Also describe the extent of your experience with any of those traditions (i.e. how in depth or involved you were in such practices or how seriously you took it).

Traditions Practiced_____

Years _____ Months _____ Times per week _____

APPENDIX D

Measure of Attentional Focus Form

Measure of Attentional Focus (short form)

What percentage of the time did you focus on each of the six categories?

Note. The sum of the percentages across all six categories *must equal* 100%. If you checked "No" for a category then you should select "0" for the % of that category.

---

1) Bodily sensations (**heart rate, breathing rate, muscles, fatigue, pain, sweating, cramps**)?

0 10 20 30 40 50 60 70 80 90 100 _____

2) Task relevant thoughts (**strategies, goals, pace, injury concerns, thoughts about time**)?

0 10 20 30 40 50 60 70 80 90 100 _____

3) Self-talk (psyching up, for example, "**I can do it**")?

0 10 20 30 40 50 60 70 80 90 100 _____

4) Task relevant external cues (**time elapsed, the time display, listening to the treadmill**)?

0 10 20 30 40 50 60 70 80 90 100 _____

5) Task **ir**relevant thoughts (**daydreaming, problem solving, planning, recalling memories, meditating**)?

0 10 20 30 40 50 60 70 80 90 100 _____

6) External distractions (**sights and sounds in the environment**)?

0 10 20 30 40 50 60 70 80 90 100 _____

Please make sure percentages chosen for the 6 categories add up to 100%; ***Total %*** **=** ☐

Refer to chart on the right to determine ***intensity*** *rating or rate of perceived exertion (RPE)*
Please do not overestimate or underestimate the degree of work you experienced, but indicate your perception as accurately as possible.

Muscular Perceived Exertion (Ex: Muscle fatigue, aching, heaviness, pain, cramps or shaking.)
RPE = _____

Breathing Perceived Exertion (Ex: Shortness of breath, breathing rate, heart pounding, or chest pain.)
RPE = _____

Overall Perceived Exertion (Ex: how hard you think you have physically worked during this session.)
RPE = ____

Use to rate intensity
6 No exertion at all
7
8 Extremely light (7.5)
9 Very light
10
11 Light
12
13 Somewhat hard
14
15 Hard (heavy)
16
17 Very hard
18
19 Extremely hard
20 Maximal exertion

APPENDIX E

Mindfulness Attention Awareness Scale Form

Mindfulness Attention Awareness Scale

Below is a collection of statements about your everyday experience. Using the 1–6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be.

1 *almost always,*
2 *very frequently,*
3 *somewhat frequently,*
4 *somewhat infrequently,*
5 *very infrequently,* and
6 *almost never.*

1. I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
3. I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
6. I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
7. It seems I am "running on automatic" without much awareness of what I'm doing.	1	2	3	4	5	6
8. I rush through activities without being really attentive to them.	1	2	3	4	5	6
9. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	1	2	3	4	5	6
10. I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
11. I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
12. I drive places on "automatic pilot" and then wonder why I went there.	1	2	3	4	5	6
13. I find myself preoccupied with the future or the past.	1	2	3	4	5	6
14. I find myself doing things without paying attention.	1	2	3	4	5	6
15. I snack without being aware that I'm eating.	1	2	3	4	5	6

APPENDIX F

Distress Scale and Self Talk Form

Distress Scale:

Please circle the response that indicates how much you engaged in each of the following during the session today.

	Did not do at all						Did a lot
1. Focusing on how much you are suffering.	1	2	3	4	5	6	7
2. Wishing the exercise session would end.	1	2	3	4	5	6	7
3. Wondering why you are even exercising in the first place.	1	2	3	4	5	6	7
4. Getting frustrated with yourself over your performance.	1	2	3	4	5	6	7
5. Thinking about how much you want to quit.	1	2	3	4	5	6	7
6. Thinking about how much the rest of the exercise session will hurt.	1	2	3	4	5	6	7
7. Wondering whether you will be able to finish the exercise session.	1	2	3	4	5	6	7
8. Other. _____	1	2	3	4	5	6	7

Self-Talk:
Please list the self-talk statements that you used for motivation during this run.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

APPENDIX G

Experimental Recording Form

For Experimenter Use Only

First Session:

Speed @ RPE 13 _____

Notes:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Second Session:

RPE @ .5 miles _____ Speed @ .5 miles _____

RPE @ 1.0 miles _____ Speed @ 1.0 miles _____

RPE @ 1.5 miles _____ Speed @ 1.5 miles _____

RPE @ 1.9 miles _____ Speed @ 1.9 miles _____

2 Mile Time _____

Notes:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____