THE NEUROPSYCHOLOGY OF MINDFULNESS: ATTENTIONAL ASPECTS

DISSERTATION SUBMITTED TO THE FACULTY OF THE ADLER SCHOOL OF PROFESSIONAL PSYCHOLOGY

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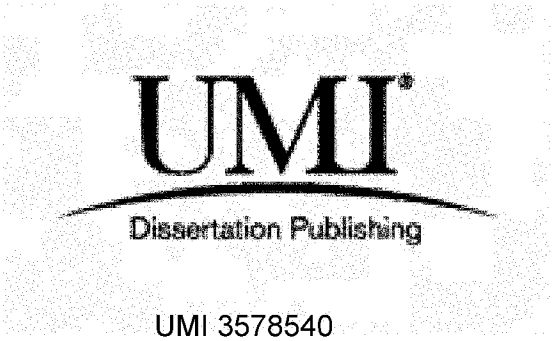
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PSYCHOLOGY

Chicago, IL May 2012



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Acknowledgements

First and foremost, I would like to thank my committee for their support and assistance with my dissertation. In particular, Drs. Castro Blanco, McNeilly, and Whiteside took on additional responsibility for which I am very grateful. A special thank-you to Dr. Ji who assisted me with the data analysis and who patiently answered all my questions. I am also thankful for Dr. Bylsma's help with data interpretation as I neared completion of this project.

I appreciate the support I received from my friends as well. The efforts of Jorden Cummings, Tracee Francis, Stacey Lipson, and Lola White should be highlighted due to their help with reviewing drafts and answering questions.

Finally, I would like to thank my family for their support not only for this dissertation but throughout graduate school. In particular, I would not have completed my dissertation or my degree in the time I did without my wonderful grandparents. I would like to dedicate this dissertation to them and hope it will serve as a sign of their love, contribution, and accomplishment.

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Abstract

Mindfulness techniques require focused attention on the present moment and awareness of one's thoughts and feelings as they occur. Based on mindfulness theory, it is expected that dispositional mindfulness will be positively associated with cognitive flexibility, sustained attention, concentration, and capacity for attention switching. The purpose of this study was to explore the relationship between self-reported mindfulness and performances on standardized measures of attention and determine an underlying factorial structure of mindfulness. Seventy participants completed the following standardized measures: Kentucky Inventory of Mindfulness Skills (KIMS); Mindful Attention Awareness Scale (MAAS); and Mindfulness/Mindlessness Scale (MMS); and the following attention measures: FAS and Animals Test of Orthographic Verbal Fluency; Letter-Number Sequencing (LNS); and Trail Making Test. Animals Verbal Fluency was negatively correlated with KIMS Act with Awareness (r = -.28, p = .03) and Acceptance subscales (r = -.29, p = 0.03) even when controlling for education, gender, and age. Suppression effects were seen between Trails B and KIMS Act with Awareness when controlling for gender (r = -.27, p = .04) and age (r = -.31, p = .02) respectively. Another suppression effect was found for FAS and KIMS. Describe when estimated verbal intelligence was controlled (r = .33, p = .01). As such, objective attention was inconsistently related to self-reported mindfulness. Two-factor solutions were found for all questionnaires albeit with a high degree

of overlap between factors and some subscale item. A distinct 'attention' factor did not emerge.

Chapter I

Introduction

General Introductory Statement

Mindfulness techniques are derived from Buddhist practices (Hanh, 1976; Roemer and Orsillo, 2009) and their implementation incorporates focused attention on the present moment, awareness of one's thoughts and feelings, and adopting a non-judgmental attitude toward the self (Bishop, 2004; Brown, Ryan, & Creswell, 2007; Hayes & Shenk, 2004; Kabat-Zinn, 1994; Teasdale, Segal, & Williams, 1995). It is thought that mindfulness consists of the self-regulation of attention and adoption of an open, curious, and accepting awareness of current experiences (Bishop et al., 2004). To prevent thoughts from wandering, mindfulness emphasizes sustained attention, attention switching, non-directive attention, and inhibition of elaborative processing which serves to maintain focus on the present moment while avoiding rumination (Bishop et al., 2004; Martin, 1997). Specifically, attention-switching and openness lead to a shift in perspective called "re-perceiving" (Shapiro et al., 2006) or "psychological 1 freedom" which allows attentional processes to become limber and flexible (Martin, 1997). Langer (1989) suggests mindfulness consists of three main factors: creation of new categories; openness to new information; and awareness of multiple perspectives. The acceptance facet of mindfulness is proposed to alter the impact of and response to thoughts, feelings, and sensations and may have

utility in treating clinical populations. Mindfulness components have been studied in the context of interventions (Roemer & Orsillo, 2009), psychological (Tacon, McComb, Caldera, & Randolph, 2002; Tang et al, 2007), and physiological functioning (Carlson, Speca, Faris, & Patel, 2007; Tang et al., 2007), personality (Brown et al., 2007; Neff, Rude, & Kirkpatrick, 2007), and neuroanatomical correlates (Creswell, Way, Eisenberger, & Lieberman, 2007; Farb et al., 2007).

One area that has not been sufficiently studied is the relationship between mindfulness and attention. It is thought that for mindfulness to be effective, sustained attention or vigilance is required to maintain an awareness of the current moment and to detect thoughts, feelings, and emotions as they occur (Bishop, 2004; Brown, Ryan, & Creswell, 2007). Furthermore, the ability to shift attention (attention switching) is also important in anticipating future experiences without dwelling on previous ones and to return attention to the present moment (Anderson, Lau, Segal, & Bishop, 2004; Bishop, 2004). However, studies confirming these cognitive aspects of mindfulness have been inconsistent. While some studies have shown an improvement in object detection, concentration, and attention following mindfulness meditation training (Anderson, Lau, Segal, & Bishop, 2004; Chambers, Lo, & Allen, 2008; Kee & Wang, 2008; Valentine and Sweet, 1999; Zylowska et al., 2008), other studies have found no improvement in either attentional control nor attention switching following such training

(Anderson, Lau, Segal, & Bishop, 2004; Chambers, Lo, & Allen, 2008; Maupin, 1965; McMillan, Robertson, Brock, & Chorlton, 2002). Differences in findings could be related to amount of practice as one study found that experienced mediators had better performances than novices (Valentine & Sweet, 1999) although this is also unclear.

Mindfulness components have been studied in the context of interventions, psychological and physiological functioning, personality, and neuroanatomical correlates. This proposal will review these aspects of mindfulness as they relate to attention while addressing the limitations of the research that has been conducted thus far. This study will address some of the existing knowledge gaps in the relationship between dispositional mindfulness and attention which is relevant both theoretically and clinically.

Statement of the Problem.

The above findings are difficult to interpret because few studies have investigated the effects of mindfulness on cognitive processes using standardized assessment tools (Ivanovski & Malhi, 2007). Further, participants have been taught mindfulness skills in conjunction with other techniques, thus making it difficult to attribute the results solely to mindfulness meditation (Ivanovski & Malhi, 2007). In addition, most studies have focused on the effects of mindfulness meditation rather than examining the cognitive characteristics or mechanisms of being mindful, although one study did find that mindfulness

attention was predictive of anhedonic depressive symptoms (Zvolensky et al., 2006). This latter issue speaks to a fundamental problem of mindfulness being insufficiently operationalized and thus more difficult to study, test theoretical predictions, and to create associated assessment tools (Bishop et al., 2004). In fact, Bishop et al (2004) stated, "there has been no systematic efforts to establish the defining criteria of its various components or to specify the implicated psychological process, and general descriptions of mindfulness have not been entirely consistent across investigators" (p. 231). This is particularly concerning as the practice of mindfulness in clinical psychology has grown in the absence of methodologically sound empirical studies demonstrating effectiveness (Bishop, 2002; Bishop et al., 2004; Grossman, 2011).

Based on mindfulness theory (Anderson, Lau, Segal, & Bishop, 2004; Bishop et al., 2004; Martin, 1997), it is expected that being mindful and observant will be positively associated with scores of cognitive flexibility, sustained attention, concentration, and attention switching as these facets of mindfulness are required to maintain focus on the present moment and to attend to various thoughts and feelings as they occur. Specifically, it is hypothesized that self-reported scores on the Mindfulness/Mindlessness Scale (MMS; Bodner & Langer, 2001), Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith, & Allen, 2004) and the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) will be correlated with performances on the FAS and Animals Test of

Orthographic Verbal Fluency (Benton & Hamsher, 1976), Letter-Number Sequencing (LNS; Wechsler, 1997), and the Trail Making Test (TMT; Reitan, 1985).

Statement of Purpose

The primary purpose of the current study is to explore the relationship between self-reported mindfulness and performances on standardized measures of attention, as the relationship between dispositional mindfulness and attention remains to be properly delineated and assessed. To date, the majority of studies have only included self-report measures rather than using assessment tools and comparisons between the two would be useful to determine if they correlate (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The results of this study will address the question: what are the cognitive correlates of being mindful and what, if any, relationship is there between dispositional mindfulness and attentional abilities? This study is one of the first of its kind to use standardized measures of mindfulness to examine attention skills in adults. As such, this information will contribute to the literature regarding the utility of mindfulness-based measurement tools in cognitive assessment and provide new information on innate attention skills in relation to dispositional mindfulness. It is hoped this information will help us understand the mechanism of change following mindfulness training. If attention and mindfulness scores are found to be correlated, the results would contribute to the construct validity of several

mindfulness measures as they contain many items related to attention (i.e., Brown & Ryan, 2003).

A secondary purpose of this study is to examine the factorial structure of mindfulness using data from the self-report data. Because there are so many ways to conceptualize mindfulness (Bishop, 2004, Shapiro et al., 2006), I will conduct an exploratory factor analysis, rather than a confirmatory factor analysis, to determine which factors will emerge as important. However, I hypothesize that attention will be one of the factors because it is so important in mindfulness. This hypothesis is largely based on Bishop's (2004) proposed definition of mindfulness which posits a two-component conceptualization of mindfulness: a) self-regulation of attention and b) orientation to experience (curiosity, acceptance). This model was chosen because it was based on a series of consensus meetings with experts in the field for the purpose of refining the definition of mindfulness to develop testable hypotheses and serve as a standard definition within the field. An understanding of mindfulness components may lead to improved methods of validation and operationalizing mindfulness that can be used to evaluate the clinical utility of mindfulness-based meditation.

Assumptions and Limitations

In a clinical sample, it is assumed that attentional processes may be disrupted by the presence of psychopathology (i.e., depression, anxiety; Clark & Beck, 2010) and such individuals would be low on state or trait mindfulness

(McKee et al., 2007). In non-clinical samples, it is expected that self-reported state mindfulness would be positively and significantly correlated with a greater capacity for sustained, alternating, and cognitive flexibility because they were unencumbered by psychopathology or excessive stress. In contrast, those reporting less dispositional mindfulness would perform worse on objective measures of the aforementioned attention domains. However, based on natural aging processes, it is assumed that scores on attention will decrease as age increases. Given the restricted range of age in this sample, this is not expected to influence the results of this study.

A potential limitation of this study is the sample will largely be comprised of highly educated, Caucasian individuals which may limit the generalization of the results as formally educated people may differ from the general population in terms of attentional abilities. Previous exposure to or training in mindfulness meditation will not be assessed at the outset of this study. As such, this variable cannot be controlled for in the analyses. Further, the assessment tools chosen in this study are not pure tests of attention. As such, they may be influenced by the participants' other cognitive abilities such as processing speed and broader executive functioning skills. Finally, there is a question as to whether dispositional mindfulness is akin to learned mindfulness. This study deviates from the majority of the literature by not using mindfulness training as part of the methodology. As such, the generalization of this study may vary depending on

how others chose to operationalize and assess mindfulness and thus may not clarify the discrepancy in the literature regarding the effects of mindfulness on cognitive faculties. However, the findings will provide a unique contribution to the literature by examining mindfulness as a dispositional trait and whether it is associated with other positive strengths within an individual.

Hypotheses

The null hypotheses for this study are as follows: There will be no significant correlations between any self-reported mindfulness and any objective measures of attention. That is, there will be no difference in attention skills between those who report lower levels of mindfulness and those who report higher levels of mindfulness. The alternative hypothesis as follows: It is expected that there will be a significantly positive relationship between self-reported mindfulness and attention. Specifically, it is expected that higher levels of dispositional mindfulness on the MMS, KIMS and MAAS will be associated with: faster times on the TMT, higher scores on FAS and semantic fluency, and higher scores on LNS. Schmertz, Anderson, and Robins (2009) suggest that out of the four subscales on the KIMS, the subscale 'act with awareness' is expected to be particularly correlated to cognitive performance due to its emphasis on subjective experiences of attention on the items which comprise this scale (i.e., "When I am reading, I focus all my attention on what I'm reading").

Regarding the factor analysis, the null hypothesis is as follows: Data will not form clusters around attention and other factors proposed by theories of mindfulness. The alternative hypothesis is as follows: It is expected that attention will account for a significant amount of the variance within the dataset.

Chapter II

Literature Review

Citation of Key Primary Sources and References

Mindfulness Interventions. Mindfulness elements have been incorporated into several related meditation approaches that have some evidentiary support. For example, dialectical behaviour therapy (DBT) is an effective treatment for borderline personality disorder, suicidality, parasuicidal behavior, substance abuse, binge-eating disorder, and bulimia (Hayes & Shenk, 2004; Robins & Chapman, 2004). Both acceptance and commitment therapy (ACT) and mindfulness-based cognitive therapy (MBCT) combine elements of mindfulness and cognitive-behavior therapy and are useful for treating chronic pain, psychosis, obsessive-compulsive disorder, substance abuse (Forman, Herbert, Moitra, Yeomans, & Geller, 2007; Hayes & Shenk, 2004) and relapse of major depression (Coelho, Canter, & Ernst, 2007; Huss & Baer, 2007) respectively. However, further research is needed to confirm these findings (Coelho, Canter, & Ernst, 2007; Forman, Herbert, Moitra, Yeomans, & Geller, 2007). Mindfulness is also a central component of mindfulness-based stress reduction (MBSR) and it is the only approach to use meditation-based strategies to enhance awareness (Brown et al., 2007; Hayes & Shenk, 2004). MBSR has demonstrated effectiveness in reducing distress and mood disturbance while increasing affect regulation (Brown et al., 2007).

Mindfulness and Psychological Functioning. Attention in and of itself has been thought of as curative and is viewed as a core element of mindfulness. Correlational studies have found the presence of mindfulness skills such as willful detachment of thoughts has been linked to decreased rumination and worry (Ramel, Goldin, Carmona, & McQuaid, 2004; Sugiura, 2004) while self-compassion (similar to adopting a non-judgmental attitude) was related to self-reports of happiness, optimism, and positive affect (Neff, Rude, & Kirkpatrick, 2007). High self-reports of mindfulness have also been associated with specific mental abilities such as emotional control in addition to a decreased sense of self-consciousness (Kee & Wang, 2008). In contrast, lower levels of self-reported mindfulness facets have been linked to emotional distress such as depression and anxiety (Zylowska et al, 2008) while related studies found decreases in depression, anxiety, anger, and fatigue immediately following mindfulness-based interventions (Tacon, McComb, Caldera, & Randolph, 2002; Tang et al, 2007). In particular, a lack of self-compassion was associated with negative affect (McKee, Zvolensky, Solomon, Bernstein, & Leen-Feldner, 2007; Neff, Rude, & Kirkpatrick, 2007) and lower rates of awareness, acceptance, and the ability to describe one's feelings was associated with higher rates of anxiety sensitivity (McKee, Zvolensky, Solomon, Bernstein, & Leen-Feldner, 2007).

Acceptance may be integral to the treatment of anxiety-based disorders in which avoidance and intolerance of affect is often prominent (Bishop, 2004). It is

also thought that mindfulness training is effective for the treatment of depression because purposefully turning one's attention inward allows for earlier detection of depressive symptoms while a non-judgmental attitude may avoid rumination (Bishop, 2004; Teasdale et al., 1995). Similarly, increased awareness may aid in the detection of triggers of substance abuse relapse (Anderson, Lau, Segal, & Bishop, 2004). However, a recent review of controlled studies on mindfulness has yielded equivocal results indicating mindfulness training may not have reliable effects on depression and anxiety (Toneatto & Nguyen, 2007).

Mindfulness training may be useful in improving cognition with a two-step process: mindful awareness and attentional control. To be aware of one's emotional state, attention must be directed toward one's consciousness in the present moment. Then, attention can be directed away from depressive or anxious thoughts toward the present moment (Posner and Petersen, 1990). Studies suggest the interaction between mindfulness and anxiety sensitivity may be useful in predicting agoraphobic thoughts related to panic symptoms (Vujanovic, Zvolensky, Bernstein, Feldner, & McLeish, 2007). Further, a preliminary study suggests that formerly depressed individuals had an increase in specific memory recall and a decrease in generic memory recall for autobiographic information following mindfulness-based cognitive therapy (Williams, Teasdale, Segal, & Soulsby, 2000). It is thought these findings are due to the mindful approach of allowing thoughts to occur without avoidance or suppression. As well, one study

found improvement in the adoption of adaptive mental skills such as setting goals and improved self-talk (Kee & Wang, 2008). Although these findings are encouraging, the effects of mindfulness training on cognition, particularly attention, are still unclear in the literature.

Further, Bishop et al. (2004) theorized that mindfulness improves mood and other psychological distress by decreasing "secondary elaborative processes" by redirecting attention back to one's breath after a thought has been experienced. By inhibiting further elaboration, ruminative processes are interrupted which normally give rise to distressing thoughts, feelings, and sensations. It is also predicted that over time, attention skills will improve during training to facilitate the above process. In this way, mindfulness can be described as a metacognitive skill because the individual is encouraged to regulate attention so one may non-judgmentally observe the stream of consciousness and become more aware of how thoughts, feelings, and sensations are inter-related. As noted by Bishop et al. (2004), mindfulness is a state-based process; as long as attention is regulated in the above manner, mindfulness will be in effect and vice versa.

Mindfulness, Personality, and Cognitive Style. Mindfulness can be conceptualized holistically as a style rather than the integration of separate abilities (Brown et al., 2007). In this way it straddles the intersection of personality and cognition. When compared to the five-factor theory of personality, mindfulness appears to be negatively related to neuroticism and

positively related to openness to experience which may reflect one's ability to allow thoughts to occur without judgment (Brown et al., 2007; Neff, Rude, & Kirkpatrick, 2007; Sternberg, 2000). In addition, mindfulness bears some resemblance to conscientiousness although future studies need to empirically validate this impression. However, greater self-compassion, a component of mindfulness training related to non-judgmental thoughts, has been linked to increased conscientiousness, agreeableness, and extroversion (Neff, Rude, & Kirkpatrick, 2007). Mindfulness also bears some resemblance to several of Carroll's main cognitive styles, particularly scanning, reflexivity versus impulsivity, and constricted versus flexible control (Sternberg, 2000). However, mindfulness does not match any of these styles exactly and may be a style in its own right. In terms of cognition, aspects of mindfulness are similar to cognitive domains such as alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, and orientation to the present. Related factors include attention to simultaneous tasks, auditory-vigilance, and carefulness (Sternberg, 2000).

Mindfulness and Physiological Functioning. The effects of mindfulness training have also been implicated in various physiological changes. There are tentative results that suggest mindfulness may decrease diastolic and systolic blood pressure (Carlson, Speca, Faris, & Patel, 2007; Kingston, Chadwick, Meron, & Skinner, 2007) and stress-related cortisol (Tang et al., 2007) while

increasing immune responses (Davidson et al., 2003; Tang et al., 2007). In addition, several EEG studies have demonstrated the neurophysiological effects of mindfulness. Specifically, mindfulness meditation created greater delta, theta, alpha, and beta activity compared to relaxation and concentration-based meditation (Dunn, Hartigan, & Mikulas, 1999). Zen meditation has been associated with alpha blocking, indicating a greater awareness of one's surroundings (Lo, Huang, & Chang, 2003), and frontal theta activity seen only in experienced participants (Murata et al., 1994). However, due to a paucity of research in this area and frequent methodological flaws, further investigation is warranted to confirm the physiological effects of mindfulness (Ivanovski & Malhi, 2007).

Mindfulness and Neuroanatomy. Mindfulness has also attracted attention in the field of neuropsychology and recent research has attempted to identify its neuroanatomical basis. Most studies have focused on the effects of affect labelling on the frontal lobes. Consistently, the right ventrolateral prefrontal cortex, an area involved with symbolic processing of emotions, has been activated during affective labelling. Further, this increase in activity is significantly associated with decreased bilateral amygdalae activity (Creswell, Way, Eisenberger, & Lieberman, 2007; Hariri, Bookheimer, & Mazziotta, 2000; Lieberman et al., 2007; Lieberman, Hariri, Jarcho, Eisenberger, & Bookheimer, 2005). This effect was more prominent in those high in dispositional mindfulness

(Creswell et al., 2007). These findings suggest the verbal identification of feelings may alleviate or reduce emotional reactivity. Further, a study by Farb et al. (2007) found decreased medial prefrontal cortex activation, an area related to self-awareness, when novice and experienced individuals redirected attention to the present moment, suggesting elaborative cognitive processes were inhibited during mindfulness meditation. In addition, the more experienced meditaters concurrently demonstrated increased activation in the right lateral prefrontal cortex, insula, secondary somatosensory cortex, and inferior parietal lobule. These results suggest that by using attention training, one can separate their awareness of the self across time from the self in the current moment. In contrast, left activation was seen in novices, suggesting they had not yet acquired the skills necessary to dissociate these two aspects of the self.

In a related study (Davidson et al., 2003), mindfulness training was associated with increased activity in the left-sided anterior activation. Given this brain region is associated with reduced anxiety and negative affect and increases in positive affect, mindfulness training may influence brain function in this area to ameliorate negative emotional reactivity (Tang et al., 2007). Other studies have found increased activity (as measured by increased blood oxygenation during meditation) in the left frontal, paracentral, inferior parietal lobe, right temporal lobe, superior right gyrus paracentralis, prefrontal cortex, hippocampus, and the anterior cingulated cortex in experienced Zen meditators (Baerentsen, Hartvig,

Strodkilde-Jorgensen, & Mammen, 2001). In addition, meditation may create structural changes with the brain. For example, experienced Vipassana meditators had thicker regions in the right anterior insula, and right middle and superior frontal sulci compared to controls (Lazar et al., 2005). Further research is needed to validate and clarify these findings.

Citation of Literature Addressing Strengths or Weaknesses of Proposed Study

In some respects, the current study's methodology is a weakness in that it lacks another pure measure of sustained attention, such as the Conners' Continuous Performance Task (CPT-II). Although Trails A can be considered a measure of sustained attention, there is an upper time limit of 300 seconds. In contrast, the CPT-II lasts 20 minutes, which is closer to the length of time one would practice mindfulness. However, strength of the current study lies in the remaining selection of assessment tools. Schmertz, Anderson, and Robins (2009) only included two measures of sustained attention, of which one also assessed cognitive flexibility. This study builds upon this methodology by including more assessment tools which cover a broader range of attention-related skills, namely sustained, alternating, and divided attention. In this way, these results will contribute significantly to the burgeoning evidence base concerning the relationship between self-reported mindfulness and attention. Likewise, this study uses a variety of self-report measures to assess dispositional mindfulness,

with each questionnaire contributing a different perspective or component of mindfulness which may elucidate which components of mindfulness are most related to attention.

Along those lines, it should be noted that other than the Schmertz, Anderson, and Robins (2009) paper, there are no known studies measuring dispositional mindfulness and its association with objective measures of attention. Further, some of the inconsistent findings in the literature may be due to varying degrees of mindfulness training participants receive before they are tested. Assessing dispositional, rather than acquired mindfulness may eliminate those inconsistencies, particularly when individuals rate themselves on mindfulness rather than relying on a set amount of training. This is a new area of mindfulness research which underscores the importance of this research.

Synthesis of the Literature to Support the Proposed Study

Mindfulness theory has incorporated aspects of attention to explain part of the underlying mechanism of the effectiveness of mindfulness-based intervention (Bishop et al., 2004; Martin, 1997; Roemer and Orsillo, 2009). Specifically, Kabat-Zinn espouses three axioms of mindfulness: *on purpose* or intention; *paying attention* or attention; *in a particular way* or attitude in the present moment (1994). However, it has only been in recent years that research has sought to empirically validate this aspect of the theory. The evidence has been inconsistent but suggestive of the integral role of attention in the ability to engage

in mindfulness meditation. Several studies have found that attention and working memory improved in individuals following mindfulness training (Anderson, Lau, Segal, & Bishop, 2004; Chambers, Lo, and Allen, 2009; Kee & Wang, 2008; Valentine & Sweet, 1999; Zylowska et al., 2008). Mindfulness training has also been associated with decreasing rumination, a process thought to be related to repeated redirection of attention to the present moment (Ramel, Goldin, Carmona, and McQuaid, 2004). Further, the relationship between improved self-reported mindfulness and improved attention following this training has also been made (Chambers, Lo, and Allen, 2009). However, the results are mixed regarding the effects of mindfulness on attention switching (Anderson, Lau, Segal, and Bishop, 2007; Chambers, Lo, and Allen, 2009; Waters et al., 2008). McMilland, Robertson, Brock, and Chorlton stated that mindfulness meditation was contraindicated for persons with traumatic brain injury precisely because attention was impaired in this population, thus implying that the regulation of one's attention is a necessary component of mindfulness. Since self-reported mindfulness and attention improve following training, it would follow that those with higher self-rated levels of dispositional mindfulness would perform better on measures of attentional control. Given the inconsistent and as of yet, unexplained findings regarding mindfulness and attention switching, this study would provide some clarity and fill a knowledge gap in this new area of research.

Bishop (2004) has stated there has been paucity of research conducted on the effectiveness of mindfulness-based interventions and the evidence thus far does not strongly endorse the use of these approaches. It is imperative research focuses on a more basic level to assess the validity of mindfulness theory. More work in determining the underlying mechanisms and operationalization of mindfulness may explain the inconsistent findings regarding the association of mindfulness and attention (Anderson, Lau, Segal, and Bishop, 2007; Waters et al., 2009). This study will assess important and fundamental aspects of mindfulness which have not thoroughly been assessed in the past. The results may lead to improvements in self-report measures and the development in more precise ways to manage improvement over time following mindfulness training in clinical populations.

Chapter III

Methodology

Specific Type of Study. This will be a quantitative empirical study of archival data. The study will use a correlational design using self-reported and objective data. This design is consistent with previously published studies investigating similar variables (i.e., Schmertz, Anderson, and Robins, 2009) and uses established methods of assessing mindfulness (i.e., KIMS; Baer, Smith, & Allen, 2004). It also elaborates on previous research by including the assessment of variables which have not been sufficiently measured in mindfulness studies thus far (i.e., alternating attention). A factor analysis of each self-report measure will be conducted to determine whether there is supportive evidence for various mindfulness theories which posit attention is a significant component of meditation.

This study is part of a larger study on mindfulness and psychological mindedness. The overall study included the Psychological Mindedness Scale (PM scale; Conte, Ratto, and Karusa, 1996) as well.

Cite the Particular Variables or Theoretical Arguments Under Investigation.

The independent variable under investigation is mindfulness. Mindfulness theory states that it consists of the following components: focused attention on the present moment, awareness of one's thoughts and feelings, adopting a non-

judgmental attitude toward the self (Bishop, 2004; Brown, Ryan, & Creswell, 2007; Hayes & Shenk, 2004; Kabat-Zinn, 1994; Teasdale, Segal, & Williams, 1995). At the same time, there is a conscious attempt to prevent thoughts from wandering and to inhibit elaborative processing of these thoughts (Bishop et al., 2004; Martin, 1997).

According to this theory, attention is inextricably linked to the conceptualization and operationalization of mindfulness (Bishop, 2004). Attention, which is the dependent variable in this study, is a multi-faceted construct and can be defined as how the brain selects specific information that requires additional processing (Banich, 2004). Sustained attention, or vigilance, is the "ability to maintain alertness continuously over time" while selective attentive is "the selection of information essential to a task" from all possible stimuli at a given time (Banich, 2004). It is thought that sustained attention is a basic cognitive skill that underlies many higher order cognitive function including more complex forms of attention (Luria, 1981). Mindfulness emphasizes sustained attention, attention switching, non-directive attention, and inhibition of elaborative processing which serves to maintain focus on the present moment while avoiding rumination (Bishop et al., 2004; Martin, 1997). These attention skills, particularly alternating attention, allows attentional processes to become limber and flexible (Martin, 1997) which is necessary to mentally shift from one thought to another while inhibiting elaborative processing.

The rationale behind combining these two constructs in the same study stems from the fact that there has been little empirical investigation linking mindfulness to attention. Despite its popularity, it is unknown whether the capacity for attention switching and sustained attention is an integral component of mindfulness. Further, most research has focused on the effects of mindfulness training on psychological well-being and attention. Little work has been done on dispositional mindfulness without participation in a mindfulness training program. As such, this study will not offer any training or guidance in improving mindfulness. Instead, it will serve to fill the knowledge gap in the relationship between dispositional mindfulness and objective attention skills.

Define Units of Measurement. This study seeks to find differences among the participants based on varying levels of self-reported mindfulness. The group will not be divided at the outset of the study for the primary analyses. However, any results will be investigated further to determine if age and/or education influence the results. Mindfulness scores will not be dichotomized into "high" and "low" but will be treated as a continuous variable.

Sample Characteristics. This study is using archival data which was collected from 2008-2009. Seventy participants from this dataset will be utilized. There were 47 women and 23 men in this sample. The mean age of the sample was 32.49 years (SD =12.24). The majority of the sample was Caucasian (84.3%); the remainder of the sample was black (7.1%), Asian (2.9%), Latino

(2.9%), and 2.9% described themselves as "other." Mean level of education was 17.3 years (*SD*=2.07). The majority of participants (94.3%) reported English was their first language.

Sample Recruitment. Participants were recruited from a professional graduate school via email in Chicago and the community at large in both Canada and the United States. There was no compensation for participation. Data were collected as part of a larger study on mindfulness and psychological mindedness. The data were housed at the Adler School of Professional Psychology in a locked filing cabinet and entered into SPSS (version 20). Informed consent was obtained at the outset of the study for each participant. They read and signed a consent form which explained the details of the study which is appended to this document. In addition, they had an opportunity to ask questions. Permission to use these data was obtained from Dr. Larry Maucieri who is the custodian of the study data.

Inclusion and Exclusion Criteria. Exclusion criteria included non-fluency in English (defined as English being a second language); previous training in neuropsychological testing; and the presence of a persisting neurological and/or psychiatric impairment which may compromise one's cognitive abilities. The latter was assessed via clinical interview and a demographics questionnaire. Inclusion criteria consisted of fluency in English, naiveté in neuropsychological assessment, and age > 18 years.

Instruments and Measures to be Used

Demographics measures. Several questions were administered regarding health-related events and issues in the lives of the participants that could potentially interfere with the results such as medication use and the presence of head injuries and seizures. The questionnaire had two sections, each containing multiple items. The first section collected sociodemographics and the second was a brief medical history.

American version of the Nelson Adult Reading Test (AMNART; Grober & Sliwinski, 1991). This 45-item measure is used to estimate Verbal IQ (VIQ). It consists of words that cannot be pronounced simply by sounding them out (e.g., pugilist, ache) which increase in difficulty. Years of education and errors on the AMNART are used to calculate estimated VIQ. The AMNART is a modification of the National Adult Reading Test (NART; Nelson, 1982). This measure was included to determine if education was a confound of our dataset. The AMNART predicts WAIS-R VIQ well but not PIQ (Lezak, 2004) and has moderate to high correlation (.4 - .8) to general intelligence (Sprauss, Sherman, & Spreen, 2006).

Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith, & Allen, 2004). The KIMS is a 39-item measure designed to assess mindfulness skills. It contains four subscales which each reflect mindfulness skills: observing, describing, acting with awareness, and accepting without judgment. Responses are recorded using a 5-point Likert scale (1= *never or very untrue*; 5 = *very often*

or always true). This scale has adequate to good internal consistency (alpha coefficients range from .76 to .91) and adequate to good test-retest reliability (correlations range from .65-.86). Scores on each subscale are summed. This measure was chosen due to its inclusion of theoretical facets of mindfulness, because it is established and used in the mindfulness literature via factor analysis, and specifically measures trait, not state mindfulness.

***Mindful Attention Awareness Scale* (MAAS; Brown & Ryan, 2003).** The MAAS is a single factor 15-item scale that assesses an individual's attention to and awareness of present moment experiences. Responses are scored on six-point Likert scales ranging from 1 (*almost always*) to 6 (*almost never*) with higher scores indicating more mindfulness. According to Brown and Ryan, this measure has good test-retest reliability and internal consistency (alpha=.82) in addition to demonstrated convergent and discriminant validity. Scores range from 15 to 90. This measure was chosen because it has been validated and due to its emphasis on attention and specifically measures trait, not state mindfulness.

Mindfulness/Mindlessness Scale (also known as Personal Outlook Scale; MMS; Bodner, & Langer, 2001). The MMS is a 21-item self-report measure which assesses one's propensity for mindfulness. It consists of four domains: novelty seeking; novelty producing; flexibility; and engagement with each item rated on 7-point Likert scales. Cronbach's alpha for this measure was originally assessed by Bodner and Langer (2001) with values of .54, .83, .63, and

.74 for the Flexibility, Novelty Producing, Engagement, and Novelty Seeking subscales respectively. Cronbach's alpha was .83 and .85 for the overall scale in two previous studies (Bodner and Langer, 2001).

***FAS and Animals Test of Orthographic Verbal Fluency* (Benton & Hamsher, 1976).** This timed test involves verbally listing as many words as possible beginning with "F", "A", and "S" and animal names each within one minute. The total number of appropriate responses in each category are summed and used as an indicator of executive functioning, attention, and information processing. Inter-rater reliability is .98 and test-retest reliability using a six-month interval was .74 (Mitrushina, 2005). This assessment tool was used because it measures aspects of attention which are particularly relevant to this study: shifting cognitive set and divided attention. Participants must shift their attention from generating word lists from one letter to another. Difficulty completing this task manifests itself as providing words, for example, for 'F' after being instructed to provide words beginning with 'A.' Further, the participant must remember a set of rules presented at the outset of the test while generating words as quickly as possible.

WAIS-III Letter-Number Sequencing (LNS;* The Psychological Corporation , 1997*). The LNS requires an individual to retain random letters and numbers in their working memory, reorder them with numbers first in ascending order followed by the letters in alphabetical order, then to verbalize the

sequence. This test measures the executive component of working memory. Reliability of this measure ranges from .75 to .88 depending on the age of the sample. The average test-retest reliability is .75 across all age groups and this test has fairly good stability (The Psychological Corporation, 2002). Selection of this measure was based on its relation to mental flexibility and working memory which are theoretically necessary for engaging in mindfulness.

Trail Making Test (TMT; Reitan, 1985). The TMT Trails A and B measure a variety of cognitive abilities such as divided attention, executive functioning, and visuospatial tracking. Trails A consists of the numbers 1-15 within circles scattered on a piece of paper. The participant must draw lines to connect the circles in numerical order. Trails B is composed of circles containing numbers 1-13 and letters A-L that are randomly scattered on a page. The participant must connect the numbers and letters in an alternating pattern (e.g., 1-A-2-B, etc). Two scores are obtained based on the total time in seconds it took to complete each task. Test-retest reliability is .79 for Test A is and .89 for Test B (Mitrushina, 2005). Trails A was included in this study because it measures sustained attention which is a basic requirement for mindfulness practice. In addition, Trails B assesses one's capacity for alternating attention which is necessary for shifting focus from one thought to another and decreasing elaborative rumination during mindfulness meditation.

Data Collection and Management Procedures. This study received approval by the Institutional Review Board at the Adler School of Professional Psychology. Seventy-two participants were recruited in total. Participants read and signed the consent form and were asked demographic questions by the research assistant. Then participants independently completed the package of questionnaires. Once completed, the research assistant administered the battery of neuropsychological measures. One participant was concerned about her performance on the measures of attention and was referred to Dr. Larry Maucieri for feedback.

Data were collected primarily at the Adler School of Professional Psychology. In rare cases, data were collected in participants' homes if they were unable to travel to the school. Every precaution was taken to ensure a quiet and controlled testing environment. Hardcopies of the protocols were stored in a locked room at the Adler School of Professional Psychology. Data were entered into SPSS on a password-protected computer with no identifying information present in the database. Participants were each assigned an identification number so that data could be de-identified. Protocols will be stored in a locked filing cabinet in the office of Dr. Maucieri for seven years after which time the data will be destroyed. All data consist of paper questionnaires and forms. As such, the data will be shredded.

Scoring procedures for the data used in this study are as follows. AMNART scores were used to calculate estimated VIQ. The MAAS yields one score which is an aggregate of responses on all 15 items of the scale. Scores for each subtest from the KIMS are summed. Scores from the phonemic and semantic fluency task yield both raw total scores (i.e., FAS total, Animals total) as well as t-scores for both total scores.

Data Analysis and Results

To determine overall mindfulness levels, scores on the respective subscales from the MAAS and KIMS are summed with higher scores indicating higher levels of self-reported mindfulness. Scores for each of the subscales on the MMS will be averaged. A Pearson correlation will be conducted to assess the strength of the relationship between measures of mindfulness (MMS, MAAS and KIMS) and sustained attention (Trails A). Separate correlations will be conducted for each subscale of the MMS and KIMS as there is no total score for either measure. An additional Pearson correlation will be conducted between mindfulness scales and tests of divided and alternating attention (Trails B, LNS, and semantic and phonemic fluency).

Potential confounding factors will also be discussed. Partial correlations will be conducted and the findings and their implications will be discussed below. Specifically, years of education, AMNART scores, gender, and age will be used in the partial correlation with the aforementioned scores on attention tasks.

An exploratory factor analysis with principal axis factoring extraction method and promax rotation will be used to determine if attention emerges as significant component of mindfulness. The promax rotation was chosen because it will keep the factors as unique as possible in absence of a theoretical structure. I will retain terms with factor loadings of about .30 and retain factors with Eigenvalues above 1.0 that were judged to be meaningful based on item content that loaded onto a particular factor.

Hypothesis Testing

This study will primarily investigate whether a relationship exists between attention and self-reported mindfulness. A Pearson correlation is the most appropriate statistical tool to apply to the data. According to Chase and Bown (2000), a linear correlation coefficient measures the degree and direction of linear relationship between the x and y values in a given sample. In this study, positive and strong correlations between self-reported mindfulness and objective measures of attention would support the existing assumption that there is an association between these two constructs. Based on mindfulness theory, innate mindfulness and attention are inextricably connected as attention is needed to be aware of the present moment and to shift one's focus to new thoughts (Bishop et al., 2004; Martin, 1997). One factor should reflect these attentional aspects while another should reflect other skills related to our understanding of mindfulness.

Other factors may have a strong association with performance on attention measures. To better understand the degree of relationship between attention and mindfulness, other factors which may influence the results must be statistically removed from the primary correlations of interest. To do this, a partial correlation will be used on the following variables: scores on attention measures, self-reported mindfulness, age, and estimated intelligence. A partial correlation is the most appropriate statistical approach to accomplish this, as it holds one variable constant (intelligence score) to prevent it from exerting an influence on the relationship between the other two variables (Cohen, 2007). Again, the direction of the relationship is not important. Only the degree and direction are related and relevant to the study topic.

Similarly, gender will be examined as a possible confounding factor due to possible differences in mindfulness (Shao and Skarlicki, 2009). The relationship between mindfulness and gender has been inconsistent in the literature but at least one study found that gender interacted with mindfulness to predict performance such that the association between mindfulness and performance was stronger for women. To assess for differences based on gender, the outcome data will be divided into two groups: males and females. Mean scores for attention and mindfulness data will be compared between these groups using a two sample t-test. This test assesses whether the means of two independent and normally distributed samples are statistically different from each other or not (Chase and

Bown, 2000). Should there be a statistically significant difference between the groups, it can be inferred that gender has some influence over the relationship between attention and mindfulness.

Expected Findings and Their Implications

It is expected that significant and positive correlations will be found between self-reported mindfulness and attention. Specifically, it is expected that higher levels of dispositional mindfulness on the MMS, KIMS and MAAS will be associated with: higher scores on the TMT, FAS and semantic fluency, and LNS. For each scale, the factor analysis is expected to yield one factor which primarily involves attention skills and at least one other factor associated with another theorized aspect of mindfulness.

The results of this study have implications for theoretical, methodological, and clinical work. First, verifying the components of mindfulness via factor analysis will lead to a better theoretical understanding of this construct. This may lead to better methods of validation and operationalizing mindfulness that can be used to develop better assessment tools, as mindfulness scales vary significantly in content. In addition, determining assessment tools for measuring attentional aspects of mindfulness may be of clinical and research use when tracking improvements in skills over time. Similarly, empirically validating cognitive correlates of mindfulness may lead to improvements in the development of self-assessment tools measuring mindfulness. Overall, it will bring clarity to the

definition of mindfulness to help standardize its use in theoretical and research endeavors.

Chapter IV
Results

Descriptive Data

No participant reported a history of stroke or psychosis. The following health concerns were endorsed once by various participants: seizure, TBI, vision loss, hearing loss, migraines, depression, ADHD, and substance abuse. One person was excluded from the study due to neurologic and psychiatric symptoms. Verbal intelligence was estimated using the AMNART. Average AMNART standard scores for this sample was 108 with a range of 91.5-117.31 (*SD* = 5.97).

Correlations

The means, standard deviations, and intercorrelations of all study variables of mindfulness and sustained attention as measured by Trails A, dual attention as measured by LNS t-scores, FAS, Trails B, and Animals fluency are presented in Tables 1, 2, 3, 4, and 5 respectively. There was no significant association between sustained attention and any measure of dispositional mindfulness. No correlations between LNS, FAS, or Trails B and attention measures were significant. Animals t-score was negatively correlated with KIMS – Act with Awareness, $r = -.28$, $p = .03$. Animals t-score were negatively associated with KIMS Acceptance $r = -.29$, $p = 0.03$. No other correlations were significant.

Partial Correlations

In order to determine whether confounding factors might have accounted for the significant correlations in the above analyses, partial correlations were conducted to control for age, gender, estimated intelligence, and years of education. After controlling for education, the following correlations remained significant: Animals T-Score remained significantly correlated with KIMS Act with Awareness, $r = -.30, p = .03$; Animals T-Score and KIMS Accept, $r = -.29, p = .03$.

After controlling for gender, the following relationships remained significant: Animals t-score was significantly correlated with KIMS Act, $r = -.31$, $p = .02$; Animals t-score and KIMS Accept without Judgment, $r = -.27, p = .04$. Trails B t-score and KIMS Act with Awareness became significant, $r = -.27, p = .04$. When age was controlled for, the following relationships proved to be robust: Animals t-score and KIMS Act, $r = -.37, p = .01$; Animals t-score and KIMS Accept, $r = -.31, p = .02$. A suppression effect was also seen for Trails B t-score and KIMS Act with Awareness became significant, $r = -.31, p = .02$.

Estimated verbal intelligence (AMNART) was found to be a significant factor between self-reported mindfulness and measures of attention as the aforementioned significant correlation between Trails B t-score and Act with Awareness became non-significant. A suppression effect was seen for FAS which

became significantly correlated with KIMS Describe when it was not previously, $r = .33, p = .01$ No other correlations were significant.

Factor Analysis

An exploratory factor analysis was conduced on the 39 items of the KIMS. The analysis initially used a principal axis factoring extraction with principal oblique rotation (promax). Regarding the suitability of the covariances among the items for a factor analysis, Tabachnick and Fidell (2004) recommend using the Kaiser-Meyer-Olkin (KMO) and Barlett's test of sphericity. The KMO statistic .58 and above recommended levels of .5 thereby verifying the minimum sampling adequacy for the analysis. A significant Barlett's test of sphericity indicates that the sizes of the correlations among items were sufficiently large and suitable for factor analysis and this test was confirmed (χ^2 (741) = 1486.93, $p < .01$).

The initial factor solution indicated that there were eleven factors that had eigenvalues over the Kaiser's criterion of 1. The utility of the factor solutions were examined by the scree plot and determining if the items that loaded on each of the factors conformed to theoretical expectations (Bishop, 2004). The two-factor solution was the best fit, matched existing subscales of the KIMS (Accept without Judgment and Act with Awareness), and accounted for 33.02% of the variance. Because inter-factor correlation was low ($r = .32$), indicating that the factors were not related, the oblique rotation was changed to an orthogonal rotation (varimax). Both rotational approaches yielded similar results. Further,

the following items from the Describe subscale were deleted due to cross-loading on both factors: I'm good at finding the words to describe my feelings; It's hard for me to find the words to describe what I'm thinking; I have trouble thinking of the right words to express how I feel about things; When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words; Even when I'm feeling terribly upset, I can find a way to put it into words.

Items that loaded onto factor 1 were primarily from the subscales Accept without Judgment and Act with Awareness. This factor had items that reflected the secondary and elaborative processes of mindfulness and complex multi-tasking (Cronbach's $\alpha = .90$). Items that loaded onto factor 2 were primarily from the subscales Observe and Describe (Cronbach's $\alpha = .80$). This factor had items that reflected the affective labeling and basic attention skills of mindfulness. After removing cross-loading variables and re-running the analyses, more factors from the Describe cross-loaded on both factors: I can easily put my beliefs, opinions, and expectations into words; it's hard for me to find the words to describe what I'm thinking. The following items had correlations lower than .30 for both factors: Observe: I notice changes in my body, such as whether my breathing slows down or speeds up; Act with Awareness: I drive on "automatic pilot" without paying attention to what I'm doing; Act with Awareness: When I do things, I get totally wrapped in them and don't think about anything else.

Table 6 lists the eigenvalues, percentage of variance accounted by each factor, and the item factor loadings for the KIMS.

Another exploratory analysis was conducted on the 21 items of the MMS using a principal axis factoring extraction with principal oblique rotation (promax). The KMO statistic was .82 and above recommended levels of .5 thereby verifying adequate sampling adequacy for the analysis. A significant Barlett's test of sphericity indicates that the sizes of the correlations among items were sufficiently large and suitable for factor analysis and this test was confirmed (χ^2 (210) = 609.315, p <.01). The initial factor solution indicated there were five factors that eigenvalues over the Kaiser's criterion of 1. The utility of the factor solutions were examined by determining if the items that loaded on each of the factors conformed to theoretical expectations. The two-factor solution was the best fit because the items that load on each factor were similar to the subscales of the MMS. The following items were deleted because they cross-loaded on both factors: I generate few novel ideas; I make many novel contributions; I like to be challenged intellectually; I like to figure out how things work. After removing cross-loading variables and re-running the analyses, the two-factor solution for the MMS accounted for 40.70% of the variance. Items that loaded onto factor 1 were primarily from the subscales Novelty Seeking and Novelty Producing and contained items related to avoiding of engaging in novel tasks (α = .89). Items that loaded onto factor 2 were primarily from the subscales Flexibility and

Engagement ($\alpha = .68$). This factor had items that reflected the experience of the present moment and cognitive flexibility which are related to mindfulness. Interfactor correlation was large ($r = .51$) indicating a strong relationship between the factors and reflects the overlap in related items. Table 7 lists the eigenvalues, percentage of variance accounted by each factor, and the item factor loadings for the MMS.

A third exploratory analysis was conducted on the 15 items of the MAAS. The analysis used a principal axis factoring extraction with principal oblique rotation (promax). The KMO statistic was .82 and above recommended levels of .5 thereby verifying good sampling adequacy for the analysis. A significant Barlett's test of sphericity indicates that the sizes of the correlations among items were sufficiently large and suitable for the factor analysis and this test was confirmed (χ^2 (105) = 410.28, $p < .01$).

The initial factor solution indicated that there were three factors that had eigenvalues over the Kaiser's criterion of 1.0. The utility of the factor solution was examined by determining if the items that loaded on each of the factors conformed to theoretical expectations. The two-factor solution was the best fit and accounted for 41.19% of the variance. Most variables loaded onto factor 1 and reflected aspects of mindfulness pertaining to awareness and attention focused on the present moment during task completion ($\alpha = .83$). Aside from one variable which involves rumination, the remaining variables which loaded onto

factor 2 were very similar in content to factor 1 ($\alpha = .77$). The interfactor correlation was strong ($r = .74$) which reflects the similarity in content among the factors. Table 8 lists the eigenvalues, percentage of variance accounted by each factor, and the item factor loadings for the MAAS.

Chapter V

Discussion

The purpose of this study was to investigate the relationship between dispositional mindfulness and attention. It has long been theorized that aspects of attention such as sustained and alternating attention are necessary to adequately perform mindfulness meditation, as one is required to stay focused on the present moment while acknowledging, then discarding thoughts as they appear in consciousness. Many studies have attempted to study acquired mindfulness via training but have been hampered by methodological errors and a lack of theoretical cohesion among researchers and self-report measures. The current study attempted a more basic approach to understanding mindfulness as it sought to provide evidentiary support for an underlying theory of mindfulness.

Overall, there was no meaningful pattern along correlations of attention and mindfulness. Of the significant findings, only the relationship between a test of categorical fluency and one subscale from the KIMS, Acceptance without Judgment, proved to be robust after controlling for confounding variables. However, the relationship was negative such that better performance on this test was associated with less awareness and acceptance of one's thoughts. This finding is in direct contrast to all mindfulness theories which invoke attention as a core feature. The results may be an artifact of the study as there were many

variables which were analyzed which may have resulted in a Type I error. Several suppression effects were found; when controlling for gender and age, a measure of alternating attention became significantly related to being aware of oneself in the present moment. This finding is likely due to the known relationship between age and gender and performance on Trails B, such that performance time is positively associated with age and is slower for women compared to men (Lezak, 2004). Despite not being directly related to awareness, these variables added irrelevant variance to the aforementioned correlation. Although this relationship is intuitive, the correlation was also negative, indicating an unexpected relationship between these variables. Again, this result may be an artifact of the number of analysis conducted in this study rather than a true finding. Another suppression effect was seen for verbal fluency and describing ones emotions when controlling for estimated verbal intelligence. It was not surprising that verbal fluency would be related to the KIMS Describe subscale and estimated verbal intelligence; it would follow that well developed verbal skills would be associated with a greater ability to find the words to name feelings. Indeed, verbal fluency is significantly related to verbal intelligence and can influence one's ability to perform well, such that those with lower VIQs can perform slightly less well than those with higher VIQs and neurological impairment (Lezak, 2004). Again, this relationship is intuitive and VIQ may have added irrelevant variance in the correlation between study variables which

masked their true association. Although the relationship is positive, thus supporting one of the study's hypotheses, it should be interpreted with caution given the methodological flaws discussed below.

A similar study found mixed support for the relationship between mindfulness and attention, with only the omission rates from the Conners' Continuous Performance Test (CPT-II) being related to mindfulness as measured by the MAAS (Schmertz, Anderson, and Robins, 2009). Other measures of sustained attention such as the Paced Auditory Serial Addition Test (PASAT; Gronwall, 1977) and other aspects of the CPT-II were not related to the MAAS. No attention measure was correlated significantly with the Act with Awareness subscale from the KIMS. The authors suggested that mindfulness relates to exaggerated lapses in attention which may go unnoticed by those without specific mindfulness training and are not captured adequately by the assessment tool used on the study. Neuropsychological assessment tools are generally designed to detect gross impairment due to acquired brain injury, not to detect subtle differences among individuals within the normal spectrum of cognitive functioning. Most people within this range are more than likely able to engage in mindfulness without difficulty. Similar research found no enhanced attention-related ability among those with high self-reported mindfulness who were also smokers; however, higher mindfulness scores were related to less engagement of negative stimuli (Waters et al., 2008) on an implicit association task. It may be

that only experienced mediators are able to detect small changes in attention in order to respond to questionnaires accurately (Grossman, 2011; Waters et al., 2008). For example, Chambers, Lo, and Allen conducted a pre-post test and found significant improvements in self-reported mindfulness and sustained attention/working memory after mindfulness training. Alternatively, perhaps individuals are prone to over-inflating estimates of their abilities. Grossman (2011) reported that not only are people poor at accurately rating their own attentional lapses (potentially due to psychological characteristics or confusion between actually versus aspired mindfulness), experienced meditaters and novices rated themselves similarly. Again, these issues relate to earlier criticisms of mindfulness research related to the varying degree of mindfulness training received in study protocols.

These thoughts are echoed by Grossman (2011) who criticized self-report measures such as the MAAS and KIMS in part because they ask novice meditaters to rate their mindfulness skills during periods of normal everyday consciousness. Further, the items on the MAAS and other questionnaires differ from original Buddhist teachings and exclude other aspects of aspects of mindfulness. Therefore, it is possible that high scores on the MAAS may reflect good attention but the individual could still be highly judgmental and non-accepting of their thoughts. The MAAS would not be able to assess this combination of scores. In contrast, the KIMS has four subscales; theoretically,

there should be elevations on all scales to indicate mindfulness. Grossman alerts us to the fact that there is no gold standard or external method of validating these questionnaires which puts internal validity in question. To illustrate this point, it is now known that the MAAS and KIMS do not correlate highly with each other or other measures of mindfulness. Similarly, the scales within the KIMS are also not highly correlated. If the subscales of the KIMS were indeed measuring mindfulness it would be expected that the subscales would correlate somewhat with each other but not to the point where they were essentially measuring a single factor. This was the underlying assumption at the outset of the factor analysis; hence an oblique rotation was initially employed. The rationale for this assumption stems from other studies on the psychometric properties such as the Beck Depression Inventory (BDI-II; Beck, Steer, and Brown, 1996). Factor analyses of the BDI-II have revealed multiple yet distinct factors which are correlated with each other which implies the factors represent separate but related aspects of a multi-faceted construct called depression (Storch, Roberti, and Roth, 2004).

Grossman (2011) raised other issues pertaining to construct validity. Specifically, he noted the discrepancy between the original Buddhist descriptions of mindfulness which include increasing one's capacity for compassion, optimism, and a greater sense of inner peace, to the Western definition of mindfulness that involves momentary lapses of judgment during normal activities

of daily living. Taken together, these criticisms suggest mindfulness measures do not accurately assess the actual construct of mindfulness as originally envisioned. Further, human error in self-appraisal limit the validity of such measures even if construct validity were not an issue However, it appears that the early success of neuroimaging in capturing changes within the brain during mindfulness meditation may circumvent many of the above limitations to mindfulness research (Creswell, Way, Eisenberger, & Lieberman, 2007; Hariri, Bookheimer, & Mazziotta, 2000; Lieberman et al., 2007; Lieberman, Hariri, Jarcho, Eisenberger, & Bookheimer, 2005). Perhaps these methods would be more effective in determining the neurocorrelates of mindfulness and detecting change over time, not only in terms of attention but also the purported benefits of mindfulness (i.e., reduction in psychopathology). Concurrently, using established measures of personality traits and psychological outcomes may be prudent to use as other outcome measures, such as measuring optimism, neuroticism, and empathy.

The factor analysis yielded a two-factor solution for all three scales of self-reported mindfulness. For the KIMS, each factor roughly corresponded to collapsing the four existing subscales on the measure, Describe and Observe as one factor, and Act with Awareness and Accept without Judgment as the second. There were a number of items which cross-loaded on to both factors which were removed before the final analysis was completed. These items were all on the Describe subscale, suggesting the items which comprise this scale are not specific

to either factor and share features. The overlap was not resolved with deleting cross-loading items which may also indicate issues pertaining to test construction (i.e., too many subscales), theoretical assumptions/hypotheses (mindfulness has fewer discrete components than previously thought), or restrictions on the sample (i.e., restriction of range for education, mindfulness scores, small sample size, low communalities; Costello and Osborne, 2005). However, the factor analyses for the two remaining scales showed a high degree of correlation between factors on both the MMS and MAAS, likely due to similar content. Items from the MMS, mostly related to novelty seeking and producing, were deleted before the final analysis was completed due to cross-loading. Similar issues were raised by Haigh, Kashdan, Moore, and Fresco (2011) who also found that a two-factor solution was the best fit for their first two studies; five items were deleted from the analysis because they failed to load onto a factor. Reliability of each of their two factors was very consistent with the results of this study. However, another study found more than four factors from this scale (Kee, 2006) and Haigh et al. (2001) later found that a one-factor model had a superior fit over a two-factor solution. Overall, it would appear that the items from the MMS are measuring the same aspect of mindfulness or that mindfulness as conceptualized by Bodner and Langer (2001) is a single-factor construct. In fact, all items from their previous study (Bodner and Langer, 2001) loaded into a single factor. The MAAS consists solely of questions which were of the same valence (i.e., all items indicated

mindlessness) implying that a negative response automatically meant mindfulness which is a false dichotomy (Grossman, 2011). As stated previously, there is great heterogeneity in the definitions of mindfulness and associated theories. However, almost all items from the MAAS relate to focused attention on the present moment. As such, the item content is homogenous and does not assess other suspected aspects of mindfulness as does the KIMS.

Similarly, the content of various self-reported mindfulness questionnaires differ greatly. For example, the MAAS focuses almost exclusively on attention-related content where as attention is rarely mentioned in the items which comprise the MMS. Taken together, test construction issues present formidable challenges to mindfulness research of any kind and offer significant threats to construct validity. These issues underscore the need and importance of basic research addressing the theoretical underpinnings of mindfulness and may explain the conflicting findings in the literature pertaining to the relationship between mindfulness and attention.

There were a number of other limitations to this study which may explain the lack of significant results. Primarily, the sample largely consisted of graduate students in psychology who are likely more mindful than the general population Further, they were generally white and highly educated which restricted the range of scores and generalizability of the findings. Further, the size of the population, although adequate for the correlation analyses, was too small for a factor analysis.

Technically, the appropriate sample size for a factor analysis should be approximately 5-10 participants per variable up to 400 participants total (Kass and Tinsley, 1979). Comrey and Lee (1992) classify a sample size of 300 as 'good', 100 as 'poor' and 1000 as 'excellent.' Although the minimum requirements of a factor analysis were met, more people are generally recommended to increase the precision of the results, to better the quality of the analysis, and to improve the strength of the relationships between variables. Similarly, for communalities lower than .5, a sample size of approximately 500 would be required for factor loadings to be meaningful (MacCallum, Widaman, Zhang, and Hong (1999). This issue in combination with questionable methodology in some of the questionnaires resulted in null results. In the same vein, the high interfactor correlations underscore this issue and highlight the need to better develop distinct theoretical facets of mindfulness and translate these nuances into improved assessment tools.

In addition, the choice of neuropsychological measures which measure attention may not have been adequately sensitive to the types of attention which are theorized as being pertinent to mindfulness. For example, the duration of letter-number sequencing may not adequately mimic the length of time which one would take to meditate. Another measure such as the Conners' Continuous Performance Test, which is approximately 20 minutes in length, may be a more appropriate assessment tool (Conners, 1992). Similarly, some attention tests used

in this study may not adequately capture attention in general. For example, a good performance on Trails B is only modestly related to cognitive flexibility (Lezak, 2004) and may not fully assess the level of mindfulness which is theoretically necessary for meditation. As such, it may not be a sensitive enough measure as it is also highly correlated with Trails A which does not require a significant amount of cognitive flexibility.

Although the current study did not find support for the association between attention and mindfulness, the results contribute to the literature in several ways to define avenues of future research. Given the number of methodological issues which arose when examining mindfulness questionnaires, it is recommended that future research focus on the clarification of theoretical underpinnings of mindfulness followed by the systematic investigation of these theories. With more evidence, perhaps self-report measures should be altered to reflect more aspects of mindfulness. In addition, researchers should use measures of attention which are of longer duration to better simulate the attention skills which are thought to be associated with mindfulness. If this relationship is found to be significant, objective measures of attention could be used to track progress over time. In light of the above findings, research concerning the nature and efficacy of mindfulness should be interpreted with caution as measures assessing improvements in mindfulness may not accurately reflect sufficient aspects of the construct.

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Appendix A: Study Materials

ADLER SCHOOL OF PROFESSIONAL PSYCHOLOGY
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Research Consent Form

Protocol: Cognitive Correlates of Psychological Mindedness and Mindfulness

Investigator: Larry Maucieri, Ph.D.

You are being asked to participate in a research study of cognitive skills, like attention span and problem solving, which looks at how these skills might differ among individuals by their level of personal insight and mindfulness. The specific purpose of our study is to investigate whether people with a higher level of reported psychological mindedness and mindfulness also perform better on tests of cognitive functioning than others do.

Procedures: As a participant, you will be asked to complete a few questionnaires about your world view and past experiences which reflect mindfulness and psychological mindedness. Next, you will be administered a series of brief tasks that are intended to measure areas of cognition, such as for instance, your attention span and ability to multi-task with multiple pieces of information at once. In sum, the questionnaires and tests should take about 45 minutes to complete. Some questions or test items might make you feel uncomfortable; if so, you are not required to answer any such questions or test items.

Risks: Your participation in our study does not involve physical risk. There are no known risks associated with completing the questionnaires and cognitive tests, beyond the possibility of mild distress in recollecting past life experiences and test anxiety while undergoing assessment of your current level of cognitive functioning. Supportive counseling is available for any participant experiencing such distress.

Rights: You have the option to not participate in or to withdraw from this study at any time by simply verbally indicating this alternative as your choice. This choice will not impact your present or current treatment at the Adler School of Professional Psychology.

Benefits: If interested, you are entitled to receive brief verbal feedback regarding your performance on the cognitive tests that were administered to you. Note that these tests were chosen to answer a specific research question and should not be construed for other diagnostic, intervention or other clinical purposes. Your participation in our study will more generally aid in understanding the relationship among psychological mindedness, mindfulness and certain cognitive functions among healthy participants.

Confidentiality: Participation in this research study may result in a loss of privacy, since persons other than the investigators might view your study records. However, unless required by law, only the study investigators and/or the Adler School of Professional Psychology

Institutional Review Board, will have authority to review your study records. They are required to maintain confidentiality regarding your identity.

Note that the results of this study might be used for other research, dissertations, publications or scholarly presentations. Findings will likely be presented and interpreted in aggregate. If your individual results are discussed, your identity will be protected by means of a study code number rather than your name or other identifying information (e.g., Social Security number, address).

Compensation: You will receive a small token item as compensation for your participation in our study.

Contact: Any questions or concerns should be directed to Dr. Larry Maucieri at 312-201-5900 extension 272. Questions about your rights as a research subject may also be directed to the attention of Dr. Mark Stone or Dr. Jerry Westermeyer, care of the Adler School of Professional Psychology Human Subjects Committee.

Consent: I have read this form and the research study has been explained to me. I have been given the opportunity to asked questions, and my questions have been addressed to my satisfaction. If I have any additional questions, I will contact Dr. Maucieri as noted above.

I agree to participate in the research study described above and will receive a copy of this consent form, after I have signed it.

_____ _____

Participant's signature Date

_____ _____

Signature of person obtaining consent Date

_____ _____

Investigator's signature Date

DEMOGRAPHICS SUMMARY

CASE: _____ Date: _____

Age _____ Handed: R___ L____ Amb____

Highest Ed: _____ yrs ___ degree

Marital: _____ S _____ M _____ D _____ W

First Lang: _____ Eng __ Other: _____

Sex: M ___ F ____

Prior History of ...			
Seizures	_____	Migraines	_____
TBI	_____	Depression	_____
Psychosis	_____	ADHD	_____
Visual loss	_____	LD	_____
Hearing loss	_____	Sub Abuse	_____
CVA	_____	Other?	_____

If yes, provide details: _____

_____

_____

_____

_____

_____

Medications? _____ If yes, please provide the details for possible SE:

_____

_____

_____

_____

AMNART

ACHE	CHASSIS
AISLE	CELLIST
CAPON	ALGE
DEBT	SUPERFLUOUS
CHORD	CHAMOIS
HEIR	THYME
DENY	APROPOS
BOUQUET	VIRULENT
CAPRICE	ZEALOT
GAUGE	FAÇADE
WORSTED	CABAL
DEPOT	ABSTEMIOUS
NAUSEA	DÉTENTE
NAÏVE	SCION
SUBTLE	PAPYRUS
PUGILIST	QUADRUPED
FETAL	PRELATE
BLATANT	EPITOME
PLACEBO	BEATIFY
HIATUS	HYPERBOLE
SIMILE	IMBROGLIO
MERINGUE	SYNCOPE
SIEVE	

Kentucky Inventory of Mindfulness Skills
Ruth A. Baer, Ph.D.
University of Kentucky

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

1	2	3	4	5
Never or very rarely true	Rarely true	Sometimes true	Often true	Very often or always true

____1. I notice changes in my body, such as whether my breathing slows down or speeds up.

____2. I'm good at finding the words to describe my feelings.

____3. When I do things, my mind wanders off and I'm easily distracted.

____4. I criticize myself for having irrational or inappropriate emotions.

____5. I pay attention to whether my muscles are tense or relaxed.

____6. I can easily put my beliefs, opinions, and expectations into words.

____7. When I'm doing something, I'm only focused on what I'm doing, nothing else.

____8. I tend to evaluate whether my perceptions are right or wrong.

____9. When I'm walking, I deliberately notice the sensations of my body moving.

____10. I'm good at thinking of words to express my perceptions, such as how things taste, smell, or sound.

____11. I drive on "automatic pilot" without paying attention to what I'm doing.

____12. I tell myself that I shouldn't be feeling the way I'm feeling.

____13. When I take a shower or bath, I stay alert to the sensations of water on my body.

____14. It's hard for me to find the words to describe what I'm thinking.

____15. When I'm reading, I focus all my attention on what I'm reading.

____16. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.

____17. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.

____18. I have trouble thinking of the right words to express how I feel about things.

____19. When I do things, I get totally wrapped up in them and don't think about anything else.

____20. I make judgments about whether my thoughts are good or bad.

____21. I pay attention to sensations, such as the wind in my hair or sun on my face.

1	2	3	4	5
Never or very rarely true	Rarely true	Sometimes true	Often true	Very often or always true

____22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words

____23. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.

____24. I tend to make judgments about how worthwhile or worthless my experiences are.

____25. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.

____26. Even when I'm feeling terribly upset, I can find a way to put it into words.

____27. When I'm doing chores, such as cleaning or laundry, I tend to daydream or think of other things.

____28. I tell myself that I shouldn't be thinking the way I'm thinking.

____29. I notice the smells and aromas of things.

____30. I intentionally stay aware of my feelings.

____31. I tend to do several things at once rather than focusing on one thing at a time.

____32. I think some of my emotions are bad or inappropriate and I shouldn't feel them.

____33. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.

____34. My natural tendency is to put my experiences into words.

____35. When I'm working on something, part of my mind is occupied with other topics, such as what I'll be doing later, or things I'd rather be doing.

____36. I disapprove of myself when I have irrational ideas.

____37. I pay attention to how my emotions affect my thoughts and behavior.

____38. I get completely absorbed in what I'm doing, so that all my attention is focused on it.

____39. I notice when my moods begin to change.

PERSONAL OUTLOOK SCALE

Instructions: Below are a number of statements that refer to your personal outlook. Please rate the extent to which you agree with each of these statements. If you are confused by the wording of an item, have no opinion, or neither agree nor disagree, use the "4" or "NEUTRAL" rating. Thank you for your assistance.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree

	Disagree						Agree
I like to investigate things.	1	2	3	4	5	6	7
I generate few novel ideas.	1	2	3	4	5	6	7
I am always open to new ways of doing things.	1	2	3	4	5	6	7
I "get involved" in al most everything I do.	1	2	3	4	5	6	7
I do not actively seek to learn new things.	1	2	3	4	5	6	7
I make many novel contributions.	1	2	3	4	5	6	7
I stay with the old tried and true ways of doing things.	1	2	3	4	5	6	7
I seldom notice what other people are up to.	1	2	3	4	5	6	7
I avoid thought provoking conversations.	1	2	3	4	5	6	7
I am very creative.	1	2	3	4	5	6	7
I can behave in many different ways for a given situation.	1	2	3	4	5	6	7
I attend to the "big picture."	1	2	3	4	5	6	7
I am very curious.	1	2	3	4	5	6	7
I try to think of new ways of doing things.	1	2	3	4	5	6	7
I am rarely aware of changes.	1	2	3	4	5	6	7
I have an open-mind about everything, even things that challenge my core beliefs.	1	2	3	4	5	6	7
I like to be challenged intellectually.	1	2	3	4	5	6	7
I find it easy to create new and effective ideas.	1	2	3	4	5	6	7
I am rarely alert to new developments	1	2	3	4	5	6	7
I like to figure out how things work.	1	2	3	4	5	6	7
I am not an original thinker.	1	2	3	4	5	6	7

MINDFUL ATTENTION AWARENESS SCALE
(MAAS)

Please circle the number that best describes how frequently or infrequently you currently have each experience. Please answer according to what <u>really reflects</u> your experience rather than what you think your experience should be.

1. I could be experiencing some emotion and not be conscious of it until some time later.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

2. I break or spill things because of carelessness, not paying attention, or thinking of something else.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

3. I find it difficult to stay focused on what's happening in the present.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

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
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

ID _____ DATE _____ INTERVIEWER _____ PRE/POST

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
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

7. It seems I am "running on automatic' without much awareness of what I'm doing.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

8. I rush through activities without being really attentive to them.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

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
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

10. I do jobs or tasks automatically, without being aware of what I'm doing.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

11. I find myself listening to someone with one ear, doing something else at the same time.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

12. I drive places on "automatic pilot" and then wonder why I went there.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

13. I find myself preoccupied with the future or the past.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

14. I find myself doing things without paying attention.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

15. I snack without being aware that I'm eating.

1	2	3	4	5	6
almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never

Table 1

Correlations for Self-Reported Mindfulness and Sustained Attention.

	TA T-Score	MAAS TS	K-O	K-D	K-A	K-Ac	M-S	M-P	M-F	M-E
TA T-Score	1.00									
MAAS TS	.10	1.00								
K-O	.12	.51**	1.00							
K-A	-.13	.36**	.13	.20	1.00					
K-Ac	-.11	.28*	-.02	.40**	.41**	1.00				
M-S	.09	.07	.39**	.20	.02	.07	1.00			
M-P	.02	-.08	.45**	.35**	.03	.09	.68**	1.00		
M-F	.06	.11	.43**	.21	.05	.07	.52**	.63**	1.00	
M-E	-.12	.15	.34**	.19	.14	.16	.56**	.67**	.48**	1.00
M	46.86	4.13	3.59	3.77	2.98	3.27	6.07	5.27	5.28	5.61
SD	11.52	0.67	0.52	0.64	0.52	0.79	0.70	1.10	0.93	0.77

Note. M = Mean; SD = Standard Deviation; TA = Trails A; TS = Total Score; K-O = KIMS Observing; K-D = KIMS Describing; K-A = KIMS Acting with Awareness; KIMS-Ac = KIMS Accepting without Judgment; M-S = MMS Novelty Seeking; M-P = MMS Novelty Producing; M-F = MMS Flexibility; M-E = MMS Engagement. * $p < .05$; ** $p < .01$

Table 2

Correlation of Self-Reported Mindfulness and LNS.

	LNS T-Score	MAAS TS	K-O	K-D	K-A	K-Ac	M-S	M-P	M-F	M-E
LNS T-Score	1.00									
MAAS TS	-.12	1.00								
K-O	.04	.51**	1.00							
K-D	-.08	.42**	.44**	1.00						
K-A	-.28	.36**	.13	.20	1.00					
K-Ac	-.06	.28*	-.02	.40**	.41**	1.00				
M-S	.14	.07	.39**	.20	.02	.07	1.00			
M-P	.13	-.08	.45**	.35**	.03	.09	.68**	1.00		
M-F	-.03	.11	.43**	.21	.05	.07	.52**	.63**	1.00	
M-E	-.02	.15	.34**	.19	.14	.16	.56**	.67**	.48**	1.00
M	10.97	4.13	3.59	3.77	2.98	3.27	6.07	5.27	5.28	5.61
SD	3.04	0.67	0.52	0.64	0.52	0.79	0.70	1.10	0.93	0.77

Note. M = Mean; SD = Standard Deviation; LNS = Letter-Number Sequencing; TS = Total Score; K-O = KIMS Observing; K-D = KIMS Describing; K-A = KIMS Acting with Awareness; KIMS-Ac = KIMS Accepting without Judgment; M-S = MMS Novelty Seeking; M-P = MMS Novelty Producing; M-F = MMS Flexibility; M-E = MMS Engagement. * $p < .05$; ** $p < .01$

Table 3

Correlation of Self-Reported Mindfulness and FAS.

	FAS T-Score	MAAS TS	K-O	K-D	K-A	K-Ac	M-S	M-P	M-F	M-E
FAS T-Score	1.00									
MAAS TS	.06	1.00								
K-O	.09	.51**	1.00							
K-D	.21	.42**	.44**	1.00						
K-A	-.07	.36**	.13	.20	1.00					
K-Ac	-.11	.28*	-.02	.40**	.41**	1.00				
M-S	-.00	.07	.39**	.20	.02	.07	1.00			
M-P	.07	-.08	.45**	.35**	.03	.09	.68**	1.00		
M-F	-.06	.11	.43**	.21	.05	.07	.52**	.63**	1.00	
M-E	.00	.15	.34**	.19	.14	.16	.56**	.67**	.48**	1.00
M	45.32	4.13	3.59	3.77	2.98	3.27	6.07	5.27	5.28	5.61
SD	11.39	0.67	0.52	0.64	0.52	0.79	0.70	1.10	0.93	0.77

Note. M = Mean; SD = Standard Deviation; TS = Total Score; K-O = KIMS Observing; K-D = KIMS Describing; K-A = KIMS Acting with Awareness; KIMS-Ac = KIMS Accepting without Judgment; M-S = MMS Novelty Seeking; M-P = MMS Novelty Producing; M-F = MMS Flexibility; M-E = MMS Engagement. * $p < .05$; ** $p < .01$

Table 4

Correlation of Self-Reported Mindfulness and Trails B.

	TB T-Score	MAAS TS	K-O	K-D	K-A	K-Ac	M-S	M-P	M-F	M-E
TB T-Score	1.00									
MAAS TS	-.02	1.00								
K-O	.03	.51**	1.00							
K-D	-.11	.42**	.44**	1.00						
K-A	-.23	.36**	.13	.20	1.00					
K-Ac	-.08	.28*	-.02	.40**	.41**	1.00				
M-S	-.13	.07	.39**	.20	.02	.07	1.00			
M-P	-.10	-.08	.45**	.35**	.03	.09	.68**	1.00		
M-F	-.10	.11	.43**	.21	.05	.07	.52**	.63**	1.00	
M-E	-.21	.15	.34**	.19	.14	.16	.56**	.67**	.48**	1.00
M	47.43	4.13	3.59	3.77	2.98	3.27	6.07	5.27	5.28	5.61
SD	11.35	0.67	0.52	0.64	0.52	0.79	0.70	1.10	0.93	0.77

Note. M = Mean; SD = Standard Deviation; TB = Trails B; TS = Total Score; K-O = KIMS Observing; K-D = KIMS Describing; K-A = KIMS Acting with Awareness; KIMS-Ac = KIMS Accepting without Judgment; M-S = MMS Novelty Seeking; M-P = MMS Novelty Producing; M-F = MMS Flexibility; M-E = MMS Engagement. * $p < .05$; ** $p < .01$

Table 5

Correlation of Self-Reported Mindfulness and Animals.

	Animals T-Score	MAAS TS	K-O	K-D	K-A	K-Ac	M-S	M-P	M-F	M-E
Animals T-Score	1.00									
MAAS TS	.10	1.00								
K-O	.11	.51**	1.00							
K-D	.01	.42**	.44**	1.00						
K-A	-.29*	.36**	.13	.20	1.00					
K-Ac	-.29*	.28*	-.02	.40**	.41**	1.00				
M-S	.02	.07	.39**	.20	.02	.07	1.00			
M-P	.05	-.08	.45**	.35**	.03	.09	.68**	1.00		
M-F	-.03	.11	.43**	.21	.05	.07	.52**	.63**	1.00	
M-E	.12	.15	.34**	.19	.14	.16	.56**	.67**	.48**	1.00
M	45.86	4.13	3.59	3.77	2.98	3.27	6.07	5.27	5.28	5.61
SD	11.39	0.67	0.52	0.64	0.52	0.79	0.70	1.10	0.93	0.77

Note. M = Mean; SD = Standard Deviation; TS = Total Score; K-O = KIMS Observing; K-D = KIMS Describing; K-A = KIMS Acting with Awareness; KIMS-Ac = KIMS Accepting without Judgment; M-S = MMS Novelty Seeking; M-P = MMS Novelty Producing; M-F = MMS Flexibility; M-E = MMS Engagement. * $p < .05$; ** $p < .01$

Table 6

Factor Analysis Results for the KIMS

	Loadings	
	Factor 1 Multitasking	Factor 2 Awareness
Eigenvalue	7.58	5.04
% of Total Variance	19.33	13.31
Alpha Coefficient	.90	.80
Accept Without Judgment:		
I think some of my emotions are bad or inappropriate and I shouldn't feel them	.80	--
I tell myself that I shouldn't be thinking the way I'm thinking	.81	--
I criticize myself for having irrational or inappropriate emotions	.78	--
I tend to make judgments about how worthwhile or worthless my experiences are	.72	--
I believe some of my thoughts are abnormal or bad and I shouldn't think that way	.74	--
I make judgments about whether my thoughts are good or bad	.69	--
I disapprove of myself when I have irrational ideas	.70	--
I tell myself that I shouldn't be feeling the way I'm feeling	.66	--
I tend to evaluate whether my perceptions are right or wrong	--	-.32

Act With Awareness		
When I'm working on something, part of my mind is occupied with other topics, such as what I'll be doing later, or things I'd rather be doing	.70	--
I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted	.48	--
When I'm reading, I focus all my attention on what I'm reading	.50	--
When I do things, my mind wanders off and I'm easily distracted	.39	--
I tend to do several things at once rather than focusing on one thing at a time	.46	--
When I'm doing something, I'm only focused on what I'm doing, nothing else	.36	--
I get completely absorbed in what I'm doing, so that all my attention is focused on it	.37	--
When I'm doing chores, such as cleaning or laundry, I tend to daydream or think of other things	.31	--
Observe		
I notice the smells and aromas of things	--	.62
I pay attention to sensations, such as the wind in my hair or sun on my face	--	.65
I pay attention to how my emotions affect my thoughts and behavior	--	.59
When I'm walking, I deliberately notice the sensations of my body moving	--	.62
I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow	--	.52
When I take a shower or a bath, I stay alert to the sensations of water on my body	--	.59
I notice how foods and drinks affect my thoughts, bodily sensations, and emotions	--	.52
I notice when my moods begin to change	--	.45
I pay attention to whether my muscles are tense or relaxed	--	.54
I intentionally stay aware of my feelings	--	.36
I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing	--	.33

Describe		
I'm good at thinking of words to express my perceptions, such as how things taste, smell, or sound	--	.62
My natural tendency is to put my experiences into words	--	.50

Note. Interfactor correlation = .32. A dashed line (--) indicates that factor loadings were < .30.

Table 7

Factor Analysis Results for the MMS

	Loadings	
	Factor 1: Novelty	Factor 2: Flexibility/Engagement
Eigenvalue	6.09	1.91
% of Total Variance	32.72	7.98
Alpha Coefficient	.89	.68
I like to investigate things	.80	--
I am always open to new ways of doing things	--	.92
I do not actively seek to learn new information	.48	--
I stay with the old tried and true ways of doing things	--	.63
I seldom notice what other people are up to	.46	--
I avoid thought provoking conversations	--	--
I am very creative	.66	--
I can behave in many different ways for a given situation	.63	--
I attend to the big picture	--	.43
I am very curious	.74	--
I like to think of new ways of doing things	.60	--
I am rarely aware of changes	.68	--
I have an open mind about everything, even things that challenge my core beliefs	--	.51

I find it easy to create new and effective ideas	.66	--
I am rarely alert to new developments	.69	--
I am not an original thinker	.62	--

Note: Interfactor correlation = .51. A dashed line (--) indicates that factor loadings were < .30.

Table 8

Factor Analysis Results for the MAAS

	Loadings	
	Factor 1	Factor 2
Eigenvalue	5.93	1.41
% of Total Variance	36.09	5.10
Alpha Coefficient	.83	.77
I could be experiencing some emotion and not be conscious of it until some time later	.74	--
I break or spill things because of carelessness, not paying attention, or thinking of something else	--	.47
I find it difficult to stay focused on what's happening in the present	--	.49
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way	.75	--
I tend not to notice feelings of physical tension or discomfort until they really grab my attention	.75	--
I forget a person's name almost as soon as I've been told it for the first time	.39	--
It seems I am "running on automatic" without much awareness of what I'm doing	.73	--
I rush through activities without being really attentive to them	.59	--
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	.43	--
I do jobs or tasks automatically, without being aware of what I'm doing	.58	--
I find myself listening to someone with one ear, doing something else at the same time	--	.69
I drive places on "automatic pilot" and then wonder why I went there	--	.37
I find myself preoccupied with the future or the past	--	.76

I find myself doing things without paying attention	--	.63
I snack without being aware that I'm eating	--	.53

Note: Interfactor correlation = .74. A dashed line (--) indicates that factor loadings were < .30.