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Attention Regulation, Emotion Regulation, and Cognitive Flexibility as Mediators of the Relationship Between Mindfulness and Academic Achievement in High School Students

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Attention Regulation, Emotion Regulation, and Cognitive Flexibility as Mediators of the

Relationship Between Mindfulness and Academic Achievement in High School Students

(TITLE)

BY

Andrew Baginski

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Running Head: MINDFULNESS AND ACADEMIC ACHIEVEMENT

Attention Regulation, Emotion Regulation, and Cognitive Flexibility as Mediators of the
Relationship between Mindfulness and Academic Achievement in High School Students

Andrew Baginski

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Abstract

Mindfulness is defined as a process of purposefully paying attention to one's thoughts, feelings, and experiences in the present moment while taking a nonjudgmental stance on them (Kabat-Zinn, 2009). While originally an Eastern approach technique in spirituality and philosophy, mindfulness has been incorporated into or served as a basis for numerous psychological therapies and treatments (Segal, Williams, & Teasdale, 2002; Kabat-Zinn, 1982, 1990). Research into mindfulness has expanded to the context of learning, where studies have demonstrated that facilitative states of mindfulness can improve the abilities of students to focus, attend, and recall information in an educational setting (Langer, 1997).

The effects of mindfulness are well documented, however the mechanisms by which it works remain somewhat unclear. Shapiro, Carlson, Aston, and Freedman (2006) proposed a framework in which mindfulness acts upon psychological change through different mechanisms. They suggested that these mechanisms include self-regulation of attention, values clarification, cognitive, behavioral, and emotional flexibility, and exposure. Carmody, Baer, Lykens, and Olendzki (2009) tested this model and found some initial support for it.

The purpose of the present study was to test the framework proposed by Shapiro et al. (2006) with an academic outcome. One hundred two high school students responded to a battery of assessment instruments measuring mindfulness, attention control, emotion regulation, and cognitive flexibility. Results were then compared to student GPA and PLAN assessment scores. Mindfulness demonstrated a significant correlation with attention control, however did not show correlations with emotion

regulation or cognitive flexibility. Attention control, emotion regulation, and cognitive flexibility showed no relationship with either measure of achievement. Due to the lack of connections, the model was unable to be tested for mediation. Results suggest a more nuanced relationship between mindfulness and academic outcomes.

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Introduction

The purpose of this study was to test three potential mediators of the relationship between mindfulness and academic achievement in high school students. Specifically, it aimed at examining if being mindful is associated with higher levels of academic achievement, and if this relationship is mediated by attention regulation, emotion regulation, and cognitive flexibility. The results of this study could help researchers and educators understand the role that mindfulness plays in the academic processes and outcomes, and how it could serve as a tool for success in children and adolescents as they progress through school.

Mindfulness is commonly defined as a process of purposefully paying attention to one's thoughts, feelings, and experiences in the present moment while taking a nonjudgmental stance on them (Kabat-Zinn, 2009). It is easier to understand when contrasted with being mindless. We often spend our days operating on automatic pilot, not being aware of what is happening within and outside of ourselves, reacting to stimuli in a habitual mode, ruminating about the past, worrying about the future, being oblivious of the present. Mindfulness involves paying attention on purpose and in a nonjudgmental way. While eating, for example, one can be fully present by noticing the taste, smell, and texture of the food, being aware of one's thoughts and feelings while eating but not making judgments of them. There might be thought intrusions (e.g., 'I really should not be eating this') but these are observed and not rejected. One does not engage in self-recrimination, or is at least aware of doing so.

In the context of education, mindfulness is present when students are focused and engaged in the process of learning. Setting up the right conditions for mindfulness to

emerge in the classroom setting is critical. Richhart and Perkins (2000) highlight a case example in which such conditions were set up by the teacher. The teacher departs from covering math curricula in a traditional sense, and instead teaches students to understand the order of mathematical operations by presenting a problem and then discussing how the solution could be different in one way, and then pushes his students to think of how it could be different in other ways. Additionally, the teacher consistently points out other areas where mathematics can be learned and experienced. In this exploration of material students approach a problem from multiple perspectives and develop a better understanding of the possibilities and constraints. It also enables students to be more creative when they give solutions. The teacher models his own openness to the educational material and demonstrates the creation of new categories in order to break up habitual modes of learning (e.g., rote memorization). When the teacher sets up these instructional conditions, students' behaviors become less automatic and habitual, processing of information is deeper and more purposeful and involved, and thus, more mindful.

In its original form, mindfulness is cultivated through Buddhist mindfulness meditation. Elements of this ancient practice have caught the attention of Western psychotherapists and have been incorporated in Western psychotherapy because of its beneficial effects on well-being and other psychological outcomes. Teasdale, Segal, & Williams (1995) comment that a central benefit of utilizing mindfulness skills is in disrupting dysfunctional cognitive elaboration. When taking a mindful perspective, an individual essentially adopts a mindset that is incompatible with judgmental or ruminative cognitions that currently exist. It is one that is open and creative.

Mindfulness has demonstrated efficacy as a treatment, or part of a treatment, for several different clinical disorders. Interventions incorporating mindfulness as a primary component of treatment include mindfulness-based cognitive therapy (Segal, Williams, & Teasdale, 2002), and mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982, 1990). Other therapies that incorporate mindfulness as a major component of therapy include acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 1999), and dialectical behavior therapy (Linehan, 1993). Since its establishment as a tool in clinical psychological and psychiatric contexts, research have continued to demonstrate its benefits. Among others, these include boosting the immune system and altering the structure of the brain (Davidson et al., 2003), alleviating stress and chronic pain (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, Burney, & Sellers, 1986), enhancing social relationships (Carson et al., 2004), preventing relapse of depression (Teasdale et al., 2000), decreasing adverse health symptoms in the elderly (such as arthritis and alcoholism), and increasing longevity (Langer, 1989), increasing creativity and decreasing burnout in an organizational context (Langer, Heffernan, & Kiester, 1988), etc. See Baer (2003) and Brown, Ryan, and Creswell (2007) for comprehensive reviews of mindfulness and its effects on physical and mental health. A majority of the existing research on mindfulness, however, has been conducted on adult samples.

Mindfulness in Education

There has been interest in inculcating mindfulness in younger populations. Recently, it has been used to help children and adolescents with anxiety, depression, ADHD, autism spectrum disorders, and stress (Garey, 2011). Parents and teachers who frequently work with students before and after mindfulness training note significant

changes in behavior, enhancing abilities to control negative thoughts and behaviors. This training also improves the learning experience of students, suggesting that there is a place for mindfulness in school settings. Some schools have also already adopted the practice of mindfulness into special education classrooms (Garey, 2012). This has resulted in fewer problem behaviors, and students who are aware of and can avoid situations that might get them into trouble. A select number of schools have implemented mindfulness into their general education curricula, and similar results are demonstrated. It was reasoned that instructing students in stress management skills, such as mindfulness, at a young age, would reduce their reliance on others as they grew up (Garey, 2012).

Research-wise mindfulness has been investigated in a number of studies involving school-aged children. Napoli, Krech, & Holley (2005) identified stress as a large source of disruption for students within schools, causing anxiety and disrupting the learning process. They claim that mindfulness practices may assist in reducing stress, keeping students more fully involved in instructional material, and ultimately improving student performance. The authors hypothesized that after undergoing mindfulness training, students would be more alert and focused in the classroom. To test this, the authors utilized the Attention Academy Program. This is a program aimed at teaching mindfulness to students. Students were divided into experimental and control groups. A series of 12 bi-monthly meetings were used to work on mindfulness practices and techniques, such as paying attention to the breath or exercises focused on movement, with students in the experimental group. Results indicated that students in the experimental group had improved attention, decreased test anxiety, and more favorable ratings from teachers.

Another study (Flook et al., 2010), demonstrated the effect of mindfulness on Executive Functioning (EF). EF is characterized by a series of connected, however somewhat independent, processes such as goal-directed activity, working memory, and response inhibition. The authors posited that mindfulness can have a positive effect on EF. This was tested through the utilization of Mindful Awareness Practices (MAPs), which were activities or techniques that served to promote a state of heightened receptive attention (like brief meditation periods, or games tailored toward enhancing mindful awareness). The authors hypothesized that students with lower EF at baseline would demonstrate higher EF through the utilization of MAPs. MAPs were used in the classroom twice a week for eight weeks and emphasized awareness of the self, awareness of others, and awareness of the environment. Based on teacher and parent reports, the authors found improvements in behavior regulation, metacognition, specific EF components, and overall EF. The Napoli et al. (2005) and Flook et al. (2010) studies demonstrate how mindfulness can influence academic-related or academic-relevant processes (e.g., test anxiety, behavior regulation, working memory, etc.).

Ellen Langer (1997), however, is the pioneer of mindfulness studies in the educational setting, particularly when it comes to examining its effects on the process of learning itself. Her work was not drawn primarily from the Buddhist conceptualization of mindfulness, but rather emerged independently of the Western psychotherapeutic adaptations of mindfulness. Nonetheless, she also emphasizes its present moment character and the necessity of breaking from automatic and habitual modes of thinking. Her work on mindfulness stems from observations found in the social cognition literature about how we tend not to see things anew each time we see them. We rely on previous

categories and cognitive schemata that we have learned in the past and make premature cognitive commitments based on these prior schemata. We do not see things for what they are and how they present themselves to us in the moment. Mindfulness then, according to Langer, is a process of letting go of these preconceptions and being able to draw novel distinctions (Langer & Moldoveanu, 2000). Langer's mindfulness theory outlines these elements of mindfulness: openness to novelty, alertness to distinction, sensitivity to different contexts, implicit, if not explicit, awareness of multiple perspectives, and an orientation in the present. Actively drawing on distinctions or creating new categories helps to keep individuals situated in the present. This increased awareness of the context and perspective of our actions reduces the need to rely on distinctions and categories drawn in the past. When engaged in mindful thinking, individuals experience a heightened state of involvement and partake more in the present.

Numerous studies have been conducted by Langer and her colleagues to examine the effects of inducing mindfulness in the classroom setting. Anglin, Pirson, and Langer (2008), for example, applied mindfulness practices specifically to mathematics classrooms. There is a wealth of evidence demonstrating that males outperform females in mathematics. In an attempt to eliminate gender differences seen in traditional mathematics instruction the researchers used mindful learning practices. Classrooms in this study were classified as providing absolute instruction (instruction emphasizing traditional approaches) or conditional instruction (instruction emphasizing a mindful approach). Conditional instruction included "high leverage" practices such as looking closely at the current learning material, exploring multiple possibilities and perspectives, and increasing ambiguity by teaching in an open manner. In congruence with the

researchers' hypotheses, results demonstrated that classrooms using a conditional form of presenting material showed no difference in the performance of males and females. This illustrates Langer's conceptualization of mindfulness through open and inclusive review of material to increase the learning potential of the student.

Another example varied the novelty of a situation to enhance learning and memorization of locations on a map. Carson, Shih, and Langer (2001) compared grade school students in three different conditions. Students were selected from a traditional school that used standard instruction for memorizing locations, or a nontraditional school where students were encouraged to view the map from multiple angles in learning the material. The authors hypothesized that movement involved while learning locations on a map would increase the student ability to retain information because it is consistent with an approach to keep learning material as novel as possible (viewing a map from new perspectives as students learn). Students were placed in three conditions, one allowing movement when memorizing locations from a map, one not allowing movement (children were seated during the task), and one where students were instructed to sit and shuffle their feet while completing the task (to control for the motor movement involved in walking). Results demonstrated that students from traditional schools (those that were used to the traditional instruction for memorizing locations) were able better recall locations and their spatial relationship to each other when they were allowed to move. Students from nontraditional schools (those that were used to viewing maps from various angles) did not show this effect, suggesting that these students may have internalized this form of learning already and possibly were able to take different perspectives during the task even when just sitting.

Through these types of experimental research, Ellen Langer, her colleagues, and other researchers who have extended her theory of mindfulness have been able to enumerate and demonstrate various ways instruction and the learning environment can be manipulated to make students mindful (e.g., asking students to take different perspectives, practicing drawing distinctions, etc.). However, according to Ritchart and Perkins (2000), these interventions tend to create mindfulness states that are limited and short-term. They simply induce a temporary facilitative state. They discuss mindfulness as a consistently enabling trait and a medium to apply mental resources and activate behavior. This is useful in an educational setting due to the requirements of information intake and retention, as well as the necessity to retrieve and apply that information. A worthwhile goal of education would be to develop a sense of mindfulness for the long run, i.e., to nurture mindfulness as a disposition or a consistent trait. Ritchart and Perkins' intent echoes somewhat Sternberg's (2000) views of mindfulness as a cognitive style, a particular mode of thinking about one's surroundings and experiences. It is correlated with certain personality traits (Thompson & Waltz, 2007) and is loosely connected with cognitive abilities (Giluk, 2009), an interface between personality and cognition. Brown and Ryan (2003), pioneer mindfulness researchers in the clinical domain, conceptualize mindfulness as both a state that can be cultivated as well as a trait that may be associated with psychological process and outcomes. Given the potential role that trait mindfulness might play in education, the current study will examine if, indeed, individual differences in mindfulness are associated with academic performance. Are students who are more mindful more successful academically?

According to Howell and Buro (2011), very few studies have examined mindfulness as a trait or disposition and its relationship with academic outcomes or processes. Other than their own, they identify only three others. Shao and Skarlicki (2009) showed that mindfulness does predict grade point average in female but not male MBA students. The authors stated that this finding was consistent with current neuropsychological research, indicating that mindfulness can help females more than males in these domains. Evans, Baer, and Segerstrom (2009) showed a relationship between mindfulness and persistence in problem-solving as well as an inverse relationship between mindfulness and self-consciousness. Finally, Radel, Sarrazin, Legrain, and Gobancé (2009) demonstrated less susceptibility to non-conscious priming of intrinsic versus extrinsic motivation. The authors found that priming students for intrinsic motivation did not improve scores on a quiz regarding the material covered in a class. However, when low in mindfulness, students who received intrinsic priming behaved as if they had consciously adopted their own intrinsic motivation. Howell and Buro (2011) revealed inter-correlations between mindfulness, achievement-related self-regulation, and achievement motivation among undergraduate students. It is important to note that all these studies were conducted in adult samples. The current study examined mindfulness as a trait or disposition and its relationship with academic performance in a younger sample of high school students.

Measuring Mindfulness

When measured as a trait, disposition, or tendency in research studies, mindfulness often come in two general forms of self-report measures. There are those that measure mindfulness as a single overarching construct and those that attempt to

identify separate factors or elements that together capture an individual's ability or tendency to engage in mindfulness.

Among the existing well-validated measures of mindfulness, the Mindful Attention Awareness Scale (MAAS) is the most frequently used (Cordon & Finney, 2008). It conceptualizes mindfulness as “the presence or absence of attention to and awareness of what is occurring in the present” (Brown & Ryan, 2003, p. 824). While it taps into the experience of mindfulness in various contexts, such as interpersonal relationships, and cognitive, emotional, and physical states, the MAAS treats the construct as a unidimensional structure obtaining one single score for each individual being assessed. The MAAS has several translations that have been validated (Catak, 2012; Deng et al., 2012; Jermann et al., 2009), and also has an adaptation for use with adolescents, the Mindful Attention Awareness Scale-Adolescent (MAAS-A; Brown, West, Loverich, & Biegel, 2011).

Other measures view mindfulness as having multiple facets or elements, interpreting these facets separately. Baer, Smith, and Allen (2004) created the Kentucky Inventory of Mindfulness Skills (KIMS) in an attempt to measure mindfulness as the sum of the components of observing, describing, acting with awareness, and accepting without judgment. This instrument was developed based on how mindfulness is conceptualized in Dialectical Behavior Therapy. Ultimately, Baer et al., (2004) did find support for a four-factor structure of the KIMS, allowing for this measure to break mindfulness down into sub-components.

On the other hand, there are measures that conceptualize mindfulness as having several elements or facets but suggest treating it as a unidimensional construct partly due

to high correlations between the various elements. The Southampton Mindfulness Questionnaire (SMQ) attempts to measure mindfulness by way of four related bipolar concepts: decentered awareness vs. reactivity, keeping attention with difficult cognitions vs. avoidance, accepting difficult thoughts vs. judging cognitions, and letting cognitions pass vs. rumination (Chadwick et al., 2008). The authors' recommendation for this measure, however, is to interpret it as a single factor. The Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) is another instrument that has taken a multi-faceted perspective on mindfulness. This measure includes the sub-factors of attention, present-focus, awareness, and acceptance (Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). Although it is possible to interpret the measure based on the sub-factors, the test creators suggest interpreting it as a total mindfulness score. This score is supported by higher internal consistency than the individual subscales.

It is to note that these existing measures of mindfulness were designed for adults. Due to an increase in interest in examining mindfulness in children and adolescents, however, two measures of mindfulness have been developed to make assessments in these younger populations. Greco, Baer, and Smith (2011) developed the Child and Adolescent Mindfulness Measure (CAMM). This was intended to be a single factor measure of mindfulness that was designed specifically to be used to assess the mindfulness abilities of children and adolescents. In addition to the CAMM, Brown, West, Loverich, & Biegel (2011) developed the MAAS-A for use in adolescent normative and clinical populations. The current study used this measure because it better fits the theoretical model and the target sample of adolescents. Details about its conceptualization and properties are discussed in the method section of this write-up.

Mechanisms of Action of Mindfulness

How does mindfulness produce beneficial outcomes? Does it do so directly or indirectly? In the clinical setting, two models of mindfulness have been developed to describe how mindfulness interventions operate by affecting other psychological processes that, in turn, produce the beneficial outcomes. In other words, these models suggest possible mediators of the relationship between mindfulness and these outcomes that can be tested empirically. These mediators are alternatively called mechanisms of action in these models.

In their model of mindfulness, Shapiro, Carlson, Astin, & Freedman (2006) identified the following potential mediators: self-regulation (maintaining system stability, function, and adaptability to change), values clarification (recognition of what is meaningful to the individual), cognitive, behavioral, and emotional flexibility (CBEF; facilitation of a more adaptive response to environmental stimuli), and exposure (less reactivity in the experience of emotion). In a mindfulness-based intervention, Shapiro et al. would posit that the acquisition of mindfulness skills influences some of these identified mechanisms, which subsequently promote outward and identifiable growth in well-being. Carmody, Baer, Lykins, & Olendzki (2009) attempted to test the Shapiro et al., (2006) model using a mindfulness based stress reduction intervention. The study involved a minimum of six weekly sessions of a two and a half hour MBSR class and provided participants with two compact discs containing four 45 minute instructions for using mindfulness practices at home. Pre and post measurements of mindfulness were used to assess mindfulness, potential mediators, and outcomes. The researchers found that each potential mediator increased in a positive direction as a function of the

mindfulness intervention; however, evidence in support of full mediation was lacking. Instead, there was support for partial mediation suggesting that the mechanisms were essential components of psychological change, but mindfulness still retained a direct relationship with the outcome variables.

In another model of mindfulness, Hölzel et al., (2011) identified a different set of mechanisms of action or mediators. The model is based on the assumption that mindfulness meditation practice enhances self-regulation which can be differentiated into distinct but also interrelated components. These components are the proposed mechanisms of action. They are: attention regulation, body awareness, emotion regulation, and change in perspective on the self. Relationships between mindfulness and these mechanisms were supported both conceptually and neurologically by other research studies, but studies testing whether they fully or partially mediate the relationship between mindfulness and psychological outcomes still need to be conducted.

It is to note, however, that these models of mindfulness were created primarily to account for the relationship between mindfulness and clinical or mental health outcomes (e.g., anxiety, depression, well-being, etc.) and do not directly address the domain of learning. The goal of the present study was to understand the form mindfulness might take in an educational setting where a common outcome of concern is academic achievement or success. Achievement in the realm of education is consistently a topic of national discussion. Educational outcomes are highly important as they are a measure of individual success and potential as students grow and develop. They are particularly relevant as students in secondary education transition to college and careers. Typically, a student's academic achievement is summarized by means of a grade point average

(GPA), or through scores obtained on standardized testing. In the current study, GPA and composite ACT scores were used as the measures of academic achievement.

The goal of the present study was to examine if certain mechanisms of action mediate the relationship between trait mindfulness and academic performance. Although the Shapiro et al., (2006) and Holzel et al., (2011) models were used as sources of potential mediators for the current study, the specific mechanisms selected were generally chosen for their relevance to academic achievement. Among those found in the two models, the following were tested in the current study: attention regulation, emotion regulation, and cognitive flexibility. They were chosen because they either bore a conceptual or empirically validated relationship with mindfulness and academic-related processes or outcomes. It was also important that there was at least one existing measure of the mechanism that can be found that is appropriate for the intended younger sample of high school students.

Attention Regulation

Attention regulation and academic performance. Attention regulation is a popular topic because of an increased awareness of disorders affecting attention, such as ADHD (Rezazadeh, Wilding, & Cornish, 2011). Attention is conceptualized on both cognitive and behavioral levels. On a cognitive level, it involves: 1) being able to attend to specific stimuli while ignoring other stimuli (selection); 2) having the ability to attend to stimuli for long periods of time in an unchanging situation (maintenance or sustained attention); and 3) being able to respond to stimuli attended to, execute a response or responses, and switch what is attended to. Responses and outward actions that result from

cognitive attention are the behavioral manifestations of attention regulation or control (Rezazadeh, Wilding, & Cornish).

Typically developing children develop stronger attentional abilities as they grow. However, others struggle with the increased attentional demands of activities such as school. Here, inattentive and impulsive behaviors are disruptive to their learning experience and the experience of other students. Students with limited attentional capabilities, such as those with a diagnosis of attention-deficit hyperactivity disorder (ADHD), are placed at a disadvantage due to the level of attention that is required for academic material to be learned (Rogers, Hwang, Toplak, Weiss, & Tannock, 2011).

Students with attention problems are typically found to be deficit in skills that allow them to make the most of classroom instruction. Langberg et al., (2011) found that homework management and classroom performance were significant predictors of academic success in adolescent with ADHD. Demarary and Jenkins (2011) found that children who experienced higher levels of inattention, hyperactivity, and impulsivity exhibited lower levels of academic enablers (attitudes and behaviors that “enable” students to learn in an academic setting) than children in the control group. Finally, it has been hypothesized that stress holds some form of influence over the exhibition of inattention symptoms. Logically, the families with higher stress levels (urban, low income) demonstrate higher prevalence of attention problems (Basch, 2011).

Mindfulness and attention regulation. Mindfulness-based interventions have demonstrated efficacious results in the treatment of attentional problems, including those with a diagnosis of ADHD (Zylowska et al., 2008). Zylowska et al., (2008) specifically used mindful meditation practices to see if these methods could improve ADHD

symptoms in a combined adult and adolescent sample. The intervention included mindful meditation training (2.5 hours per week for eight weeks), and instruction on MAPs. In this study, MAPs were defined as activities or techniques that served to aid meditation or mindful awareness. Participants were asked to engage in MAPs for approximately 45 minutes per day as other daily routines and responsibilities were conducted. They found that this treatment was both effective in producing higher scores on measures of attention and well-being.

Individuals with ADHD make for a convenient target population to test new techniques, but cultivating mindfulness in an educational setting targets all students. In a Danish study, mindfulness-based stress reduction was used in a sample of young, healthy meditation novices (Jensen, Vangkilde, Frokjaer, & Hasselbalch, 2012). This study also incorporated a 2.5 hour per week training session for the duration of the study (8 weeks) to instruct and cultivate appropriate mindfulness practices. In addition, participants were instructed to use their skills at home for a minimum of 15 minutes each day. Those in the treatment group exhibited higher scores on an assortment of attentional tasks and also reported significantly lower levels of stress than in the control conditions. Studies such as these demonstrate the power of mindfulness on attention regulation, even outside of clinical contexts.

Higher levels of attention and the ability to avoid distractions have typically been a characteristic of mindful individuals, while mind-wandering is characterized by unrelated thoughts causing task interruptions (Mrazek, Smallwood, & Schooler, 2012). Research has demonstrated that behavioral indications of mind-wandering have a mindless quality to them, and in turn, are things that hinder academic learning. For

example absent minded forgetting has been identified as a mind-wandering activity (Smallwood, Baracaia, Lowe & Obonsawin, 2003). Such simple errors are commonplace at school even among students with mastery of the material they are working on.

Thinking and approaching education in a mindful way could serve to eliminate some of these errors among other mindless methods of thinking that do not benefit students attempting to learn.

Emotion Regulation

Emotion regulation and academic performance. The ability to control one's emotions is highly relevant to the school setting. Much research focuses on the experience of middle school and adolescent emotion regulation, however there is research supporting the notion that emotion regulation plays a large role in the educational experience of all children (Graziano, Reavis, Keane, & Calkins, 2007). Graziano et al. defined emotion regulation as "efforts to modulate emotional arousal in a way that facilitates adaptive functioning". Emotion regulation itself is neither good nor bad, but contributes to the ability of children to organize their attention, responses, and actions in different social exchanges (Cole, Martin, & Dennis, 2004). Students who have difficulty controlling their emotions, such as individuals with externalizing or behavior problems, suffer academically due to their lack of ability to attend to the presented information (Blair, 2002). When students struggle with emotional regulation, other characteristics such as working memory, attention, and planning are psychologically inhibited and have severe implications for academic outcomes (Blair, 2002).

In terms of school readiness, poor emotional regulation is indicative of many future challenges for the student, including aggressive behavior problems, conduct

problems, and substance abuse (Eisenberg et al., 1995; Frick et al., 2003). In addition these students are put at a disadvantage socially. Poor emotion regulation places students at risk of being rejected by their peers because of their inability to manage their external reactions to some stimuli (Shields & Cicchetti, 2001). By contrast, students with strong emotion regulation are more socially competent and feel better about their school experiences (Eisenberg, 2000). This more adaptive transition to school is very important for positive academic outcomes (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). The ability of students to persist at work, stay on task, attend to learning goals, and participate in learning are all impacted positively by stronger emotional regulation. These factors, in turn, are indicative of higher academic successes.

Mindfulness and emotion regulation. When considering the relationship between mindfulness and emotion regulation, certain characteristics of the way individuals experience emotion are important to bear in mind. Some of the relationships between mindfulness and emotional outcomes concerning individuals with psychopathology have been investigated, such as the emotional distress experienced before and after participants with borderline propensities participated in a Dialectical Behavior Therapy (DBT) intervention (this intervention includes a strong mindfulness component). It was found that the participants experienced less emotional distress in the domains of depression, anger, and anxiety (Bohus et al., 2004). In another study, it has also been found that MBCT training can have a positive impact on the emotional experience and fluctuation of depression, anxiety, and anger (Schroevers & Brandsma, 2010).

One study attempted to measure how mindfulness affects emotion lability, emotion dysregulation, and emotion differentiation in a sample of undergraduates (Hill &

Updegraff, 2012). Participants' experience of mindfulness was assessed using the Five Facet Mindfulness Questionnaire. Emotions were recorded through the Difficulties in Emotion Regulation Scale and use of palm pilots scheduled to prompt participants to record their emotions at specified times throughout the day. The authors found that overall, self-reported mindfulness is related to emotion regulation. Higher mindfulness was indicative of lower levels of emotional reactivity, emotion dysregulation, and emotional lability. It was also related to higher levels of emotion differentiation.

Mindfulness in the traditional sense helps to improve emotion regulation through a number of different faculties. MSBR has demonstrated efficacy in improving attentional deployment by improving the ability to exercise cognitive control of ruminative behaviors (Ramel et al., 2004). Goldin and Gross (2010) suggest, in a sample of individuals with social anxiety disorder, that patients who underwent MBSR experienced fewer negative emotional experiences at follow up. This indicates that these patients were better able to manage their emotions after implementing mindfulness practices and gaining experience. Feldman et al. (2011) found that individuals higher in mindfulness, attempted fewer emotional escape behaviors (measured as a function of texting while driving). In sum, these findings indicate a strong relationship between mindfulness and more robust emotional regulation abilities.

Cognitive Flexibility

Cognitive flexibility and academic performance. The construct of cognitive flexibility refers to the ability to be aware of and open to options and alternative ways of thinking or behaving in different situations. It also involves belief in one's abilities to adapt to the environment (Chung, Su, & Su, 2012). It is contrasted with cognitive

rigidity, which is a resistance to considering other perspectives and perseverating in the use of mental sets (Schultz & Searleman, 2002). Cognitive flexibility on its own has been well researched, particularly in younger populations (Chevalier & Blaye, 2008) and suggests involvement in a number of academic skills, such as activation and inhibition of response sets and maintenance of response rules in working memory. It has also been found to play a role in many areas closely related to educational outcomes, such as leadership (Reiter-Palmon, 2003), social competence (Nigg, Quamma, Greenberg, & Kusché, 1999), and fewer behavior problems (Riggs, Blair, & Greenberg, 2003).

When assessing the effect of cognitive flexibility on school readiness in a preschool sample, Vitello, Greenfield, Munis, & George (2012) found that attention and persistence positively mediated this relationship in an early childhood sample. Based on these results, the authors suggest that cognitive flexibility is part of a system that includes attention and progress monitoring of goals. Vitello et al. also discovered in their analyses that cognitive flexibility was significantly associated with children's attitudes toward learning. This was described as connected to frustration tolerance in the academic environment and the kind of interactions that students have with teachers and peers with regard to learning.

Lower stress levels have also been found to be linked to the ability of individuals to think in a flexible manner. Induced acute psychological stress does not necessarily impair cognitive functioning, but was found to limit participant's ability to think flexibly (Plessow, Fischer, Kirschbaum, & Goschke, 2011). This is particularly relevant to educational settings because stress is a factor in education, whether it is desirable or not. The work involved at school and/or testing situations often causes stress or anxiety for

students. In their research, Plessow et al. found that mindfulness improved the ability of participants to think flexibly under the induced stress of stress. This principle could be applied to the school setting by developing the ability of students to think flexibly even under stress.

Mindfulness and cognitive flexibility. In the research literature, cognitive flexibility is synonymous with category creation or openness to alternative solutions. Many studies address the link between these constructs. For example, an assessment of the effect of mindfulness on participant's ability to complete the Einstellung water jar task (a measure of cognitive rigidity) was conducted by Greenberg, Reiner, & Meiran (2012). They found that individuals experienced in mindful meditation performed better on the water jar task than individuals who were not experienced.

Another study assessed the link between regular mindful meditation practice and cognitive flexibility. Moore and Malinowski (2009) compared 25 individuals who regularly practiced mindful meditation, with 25 individuals who did not. The authors reasoned that if mindfulness produces known benefits in related areas of attention and cognitive processing, it also likely improves cognitive flexibility. Cognitive flexibility was measured as reduced interference during the Stroop task while mindfulness was assessed with the KIMS. Moore and Malinowski found that mindful meditation practices did produce higher levels of cognitive flexibility. Based on their results, the authors reasoned that automatic processes could be brought back under cognitive control through the use of mindful meditation.

Other research suggests that mindless states are characterized by an overreliance on categories and previous distinctions, whereas mindful states promote openness to

novel ways of thinking or the ability to think flexibly (Langer, 1992). From this perspective, there is a clear pathway between mindfulness and cognitive flexibility. This has been tested through the introduction of interventions that increased the ambiguity of learning material, that looked closely at learning material, and explored different perspectives (Anglin, Pirson, & Langer, 2008). These practices have yielded positive results in the learning and retention of material and can be fostered through mindful approaches to learning.

The Present Study and its Significance

The present study was concerned with assessing the relationship between trait mindfulness and academic achievement as mediated by attention control, cognitive flexibility, and emotion regulation. Are individual differences in mindfulness associated with academic achievement? Are students who are more mindful tend to have higher GPA's? If so, is the relationship between mindfulness and academic achievement a direct one or is it indirect? Is it mediated by attention control, cognitive flexibility, and emotion regulation?

Research by Ellen Langer and her colleagues has consistently demonstrated support for the short term benefits of facilitating mindfulness on learning. Ritchart and Perkins (2000) assert, however, that mindfulness cultivated as a trait or disposition is important and a worthwhile education goal. The current study provides a way of validating that assertion by investigating the relationship between trait mindfulness and academic achievement. Secondly, although there is a surge of interest in using mindfulness in a younger population, most of the research and writing on the topic have still been on adults. The current study could contribute to the burgeoning literature on

mindfulness in children and adolescents. Thirdly, most of the studies on mindfulness have focused on its beneficial effects on physical and mental health or well-being, particularly in clinical contexts. There is movement to extend those towards daily life outcomes and processes such as learning. The current study addresses mindfulness in the education setting. Lastly, the Shapiro et al., (2006) and Holzel et al., (2011) empirical models of mindfulness assert that mindfulness may not necessarily act directly on outcome variables, but rather can function through mediators which then act on an outcome variable. By testing whether attention regulation, emotion regulation, and cognitive flexibility mediate the relationship between mindfulness and academic achievement, the current study could provide an opportunity to understand the role that trait mindfulness might play in the academic setting.

The present study's research questions and hypotheses were as follows:

Research question 1: Are higher levels of mindfulness associated with higher levels of academic achievement? It was hypothesized that a statistically significant positive relationship will be found between mindfulness and academic achievement (as measured separately by the GPA and PLAN composite score).

Research question 2: Are higher levels of mindfulness associated with higher levels of attention control, emotion regulation, and cognitive flexibility? It was predicted that statistically significant positive relationships will exist between mindfulness and each of these variables.

Research question 3: Are higher levels of attention control, emotion regulation, and cognitive flexibility associated with higher levels of academic achievement? It was

predicted that each of the variables will be correlated positively with academic achievement.

Research question 4: Do the proposed mechanisms (attention, cognitive flexibility, and emotion regulation) mediate the relationship between mindfulness and academic achievement? The study hypothesized that each identified mechanism will mediate the relationship between mindfulness and academic achievement. However, given the partially exploratory nature of the study, no specific predictions were made as to whether any of the observed mediations are partial or full mediations. Full mediation is indicated when the relationship between mindfulness and academic achievement becomes nonsignificant following the inclusion of the mediator variables in the analysis. Partial mediation occurs when the relationship between mindfulness and academic achievement weakens, but remains significant following the inclusion of the mediator variables.

Figure 1 presents a diagram of the proposed mediation pathways.

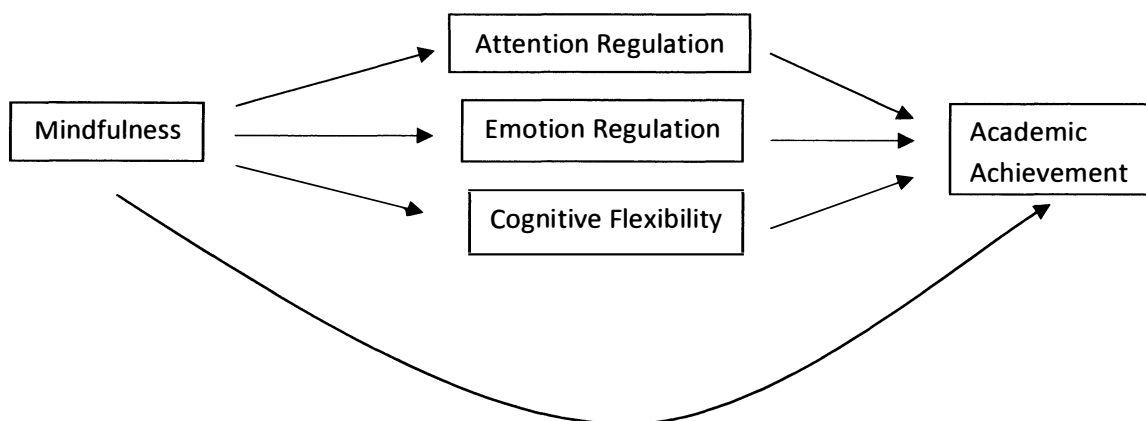


Figure 1. Mindfulness and academic achievement as mediated by attention regulation, cognitive flexibility, and emotion regulation.

Method

Participants

One hundred eight high school sophomores enrolled in a Chicago suburban high school during the 2013-2014 school year were asked to participate in the current study. Parental consent and student assent was obtained before students were permitted to participate.

The study sample was primarily Caucasian (60%) and Hispanic (15%). The remaining 25% identified themselves as Black/African, Asian, Multi-ethnic, or Other. There was also one individual who identified as Hawaiian/Pacific Islander. The age of the participants varied from 14 to 18 years old. Given the class standing and time of sampling, the few individuals who identified as being 14 years old would soon be 15. The mean age of students who participated in the study was 15.46 (S.D. = .66).

Materials

Mindful Attention Awareness Scale-Adolescent (MAAS-A). As mentioned in the introduction section, the Mindful Attention Awareness Scale (MAAS), developed by Brown and Ryan (2003), is the most frequently used measure of mindfulness in studies on adults. Due to the growing popularity of the construct, Brown, West, Loverich, & Biegel (2011) refined the MAAS to ensure its appropriateness in adolescent normative and clinical populations. The MAAS-A is a 14-item self-report measure of mindfulness intended to measure mindfulness as a single component. The items on the MAAS-A are scored on a 6-point scale, ranging from one (almost always) to six (almost never). All items are reverse scored. For example, an individual endorsing a lower score on the item "I tend not to notice feelings of physical tension or discomfort until they really grab my

attention” or on the item “I rush through activities without being really attentive to them” demonstrates a higher level of mindfulness. The MAAS-A attempts to measure mindfulness as a trait, matching the purposes of the present study. In the validation study, Brown et al. (2011) found high internal consistency (alpha coefficients ranged from .85 to .88). Four week test-retest reliability was also high (.79). An overall score will be obtained for each participant by adding the scores across all items. The higher the overall score the higher the levels of mindfulness. For the full scale, see appendix A.

Academic Achievement. Academic Achievement was assessed using midterm grades and test scores on the PLAN assessment. Students were assessed by multiple teachers in different classes and assigned a letter grade corresponding with their performance (A, B, C, D, and F). This typically involves six academic courses. The assigned grades were converted to interval data where A = 4, B = 3, C = 2, D = 1, and F = 0. The mean grade for each student will be calculated, resulting in the grade point average (GPA). In addition to GPA, student PLAN composite scores were collected as an objective measure of current English, Math, Reading, and Science abilities. The PLAN assessment is part of ACT’s educational planning and assessment system (EPAS) and is a partner test to the ACT. Kuder-Richardson formula 20 (KR-20) coefficients were used to assess the reliability of raw scores on the PLAN assessment. The estimated reliability of the scaled scores of the grade 10 normative sample were .87, .80, .85, and .82 for the English, Math, Reading, and Science sections respectively. The PLAN also utilizes an overall composite score, which functions as a global measure of a student’s academic achievement on a scale ranging from 1 (low) to 36 (high). The estimated scaled score reliability of this composite for the current version of the PLAN is .95 (ACT, 2010).

Attentional Control Scale. The Attentional Control scale was designed to measure two main components of voluntary attention, attention focusing and attention shifting (Derryberry & Reed, 2002). The authors suggest interpreting attentional control as one factor. The Attentional Control Scale includes 20 items scored on a 4-point scale ranging from 1 (almost never), to 4 (always). Examples of items include “It’s very hard for me to concentrate on a difficult task when there are noises around” (reverse scored) and “It is easy for me to alternate between two different tasks”. An overall score will be obtained for each participant by adding the scores across all items. Higher scores indicate that the individual has a higher level of attention control. Analyses indicated that the Attentional Control Scale had a coefficient alpha of .88 and test-retest coefficients for each item ranged from .45 to .73. While the Attentional Control Scale was originally designed for adults, the items are all relevant to high school students and the Fleisch-Kincaid grade level equivalent is 7.5. This suggests a required reading level of about eighth grade. For the full scale, see appendix B.

Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA).

Participants’ emotion regulation were assessed using the ERQ-CA (Gullone & Taffe, 2012). It is a two-factor measure of emotion regulation involving six ‘cognitive reappraisal’ items that tap into the ability to redefine a situation deemed as emotion-eliciting so that the emotional impact is changed, and ‘four expressive suppression’ items that assess the ability to control the ongoing expression of emotion. Items are rated on a 5-point scale ranging from 1 (strongly disagree), to 5 (strongly agree). Higher scores indicate greater use of the associated strategy. An example of a cognitive reappraisal item is “When I want to feel happier I think about something different”. An example of an

expressive suppression item is “I keep my feelings to myself”. This measure has demonstrated high internal consistency with coefficient alphas of .79 (for cognitive reappraisal items) and .73 (for expressive suppression items). For the purposes of this study, emotion regulation will be measured as a one-dimensional construct where an overall score will be obtained for each participant. For the full scale, see appendix C.

Cognitive Flexibility Inventory (CFI). The CFI assesses levels of cognitive flexibility by tapping into components of cognitive flexibility that enable individuals to think adaptively during stressful events (Dennis & Vander Wal, 2009). The CFI was originally developed to measure cognitive flexibility gains when individuals participated in cognitive-behavioral therapy. This scale was intended for use with adults. However the authors found the Flesh-Kincaid grade level of the CFI to be 5.5 requiring about a sixth grade reading level. The mean age of the normative population was 20.2. Based on these observations, the CFI was deemed appropriate for use in a high school sample. This is a 20-item self-report scale that is divided into two factors, alternatives (13) and control (7). An example of an alternatives item is “I consider multiple options before making a decision”. An example of a control item is “When I encounter difficult situations, I feel like I am losing control”. Each item is assessed on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The CFI demonstrated strong internal consistency (coefficient alpha = .90) and test retest reliability $r = .81$. Convergent validity was established through a strong correlation ($r = .73$) with the Cognitive Flexibility Scale (Martin & Rubin, 1995). For the purposes of this study, an overall score will be obtained for each participant by adding the scores across all items. Higher scores suggest that the individual has a greater degree of cognitive flexibility. For the full scale, see appendix D.

Procedure

Participants were administered all scales through the Google Forms web application, utilizing the student's accounts at the suburban high school where the study took place. Prior to data collection, participants were informed of the risks and benefits of participation and given the option to withdraw without repercussions. They were assured of confidentiality and encouraged to respond as honestly as possible. Finally, students were provided a cover letter describing the study in detail and providing contact information for any additional questions. Parental consent was obtained before participants were selected for inclusion in the study.

Participants were brought in to a computer room during their driver's education class and were shown a series of five forms; one demographic questionnaire, and the series of scales measuring mindfulness and the proposed mechanisms of action. Once all the measures were completed, the participant were allowed their choice of a number of snacks and allowed to leave the computer area to return to class.

Results

The present study investigated whether mindfulness was predictive of academic achievement and whether the relationship was mediated by attention control, emotion regulation, and cognitive flexibility. The dependent (predicted) variable of academic achievement was measured by GPA and the composite score on the PLAN assessment. The independent variable (predictor), mindfulness, was measured as the disposition or trait of being aware of and attentive to one's environment. The proposed mechanisms of action (attention control, emotion regulation, and cognitive flexibility) were tested as mediating variables between mindfulness and academic achievement.

Internal Consistency of the Measures

Scores on negatively worded items were reversed prior to analysis. Cronbach's alpha coefficients were calculated for each of the measures in the study. Except for the ERQ-CA, each measure used in the study exhibited an adequate to high internal consistency as shown in Table 1.

Table 1
Internal Consistency of the Various Measures (N = 102)

<i>Measures</i>	<i>Cronbach's α</i>
MAAS-A	.83
Attention Control Scale	.74
ERQ-CA	.66
CFI	.85

Characteristics of the Study Sample

Of the 108 participants who completed measures, one was excluded from the analysis for not exhibiting variations in responses to the items. Additionally, five were excluded because their PLAN test scores were not available in the school database.

While the scores from each of the composite measures of the PLAN assessment were reviewed in the analyses, the composite score was the most important figure when attempting to find a connection between the mechanisms of action and academic achievement. This is because it is an overall measure of achievement spanning several domains of. The mean scores and standard deviations of each measure are found in Table 2.

Table 2
Means and Standard Deviations (N = 102)

<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>Possible Range of Scores</i>
MAAS-A	3.92	.80	1-6
ACS	2.52	.37	1-4
ERQ-CA	3.41	.54	1-5
CFI	4.72	.77	1-7
GPA	4.05	.79	0-5
PLAN Composite	18.80	3.30	1-36

In general, the participants' self-reported abilities were just above the midpoint of the scale across all measures. The mean score of participants' abilities to control and direct their attention ($M = 2.52$), regulate their emotions ($M = 4.72$), and think flexibly ($M = 3.41$) all followed a similar trend of being very close to the midpoint. Standard deviations for the measures were low, falling within about one point on each scale, with some scales exhibiting even less deviation from the mean.

Mindfulness assessment results using the MAAS-A were very similar to those obtained in the validation study by West, Loverich, and Biegel (2011). They found the mean scores on the MAAS-A fell also slightly below 4 ($M = 3.93$, $SD = .74$; $M = 3.72$, $SD = .75$ for males and females respectively). In the current study, and West, Loverich, and Biegel's study, participants indicated that their ability to be mindful was close to the middle of the scale of 3.50 ($M = 3.92$). This indicates that the sample believed themselves

to have at least a minimal understanding and ability to keep attention focused in the present moment.

Attention control assessment utilized the Attention Control scale. Responses on this measure fell almost exactly on the midpoint of the scale of 2.50 ($M = 2.52$) and the standard deviation was very small ($SD = .37$). Adolescents are typically aware of their ability to control and direct attention (Rogers et al., 2011), so this result is reflective of the sample. However, extreme responses on the Attention Control scale are worded in absolutes (Always and Never). It is likely that participants did not endorse those responses as frequently, instead choosing a less extreme response.

Participants self-analysis of emotion regulation using the ERQ-CA also yielded scores close to the midpoint of the scale of 3.00 ($M = 3.41$). The standard deviation was ($SD = .54$). The evaluation study conducted by Gullone and Taffe (2012) found that mean responses tended to surround the mean of the scale, with preadolescent children rating themselves slightly below the mean and adolescent children rating themselves slightly above the mean. A similar trend was found in this sample of adolescent participants.

In general, participants rated their cognitive flexibility as above the midpoint of the scale of 4.00 ($M = 4.72$). Given the background of the participants and their level of academic achievement, it is unsurprising that students rated themselves relatively higher on this scale than on the scales pertaining to the other mechanisms of action. The standard deviation of this scale, was higher than that of the other mechanisms of action ($SD = .77$). This makes sense because cognitive flexibility is a separate and distinct construct from achievement (Vitiello, Greenfield, Munis, & George, 2011).

Academic achievement, as assessed by GPA, yielded interesting results. The mean GPA of participants was 4.05 (the school where the sample was collected used a 5 point scale), and the standard deviation of the sample approached a whole point on the scale ($SD = .79$). This was very close to the top of the scale and many students did actually reach the 5.0 mark. Academic achievement as assessed by the PLAN assessment did not demonstrate this trend. The composite mean for the PLAN assessment fell at 18.80 which is close to the midpoint of the scale. The standard deviation of the composite score was 3.30, and no student reached the top end of the scale (36). Essentially, the PLAN was better able to measure the academic abilities of participants because of the wider range of scores and abilities that it accommodates. The PLAN assessment scores exhibited more variation than GPA.

The Relationship between Mindfulness, the Potential Mechanisms of Action, and Academic Achievement

Correlations between mindfulness, each mechanism of action, and academic achievement, were examined using Pearson's r tests. The raw correlations are shown in Table 3.

Table 3
Correlations Between Variables (N = 102)

Variable	Mindfulness	Attention Control	Emotion Regulation	Cognitive Flexibility	GPA	PLAN Composite
Mindfulness	--	.28**	-.17	.13	.15	.08
Attention Control		--	.04	.19	-.03	.13
Emotion Regulation			--	.25*	-.06	.18
Cognitive Flexibility				--	.00	.06
GPA					--	.43**
PLAN Composite						--

* $p < .05$, ** $p < .01$

The first research question inquired about the relationship between mindfulness and academic achievement. Contrary to what was predicted, mindfulness was not found to be significantly correlated with GPA and the PLAN composite scores. Likewise, the second research question asked about whether mindfulness was predictive of the potential mechanisms of action. Mindfulness was also not found to have any significant correlations with any of the mechanisms of action except for attention control ($r = .28, p < .01$). As the students' levels of mindfulness increased, their levels of attention control also increased. In the third research question, it was predicted that each of the potential mechanisms of action would be positively correlated with academic achievement. Results indicated that none of these variables was correlated with GPA or the PLAN composite scores. In sum, mindfulness and each of the potential mechanisms of action were not predictive of academic achievement. As such, the fourth research question, which asks whether attention control, emotion regulation, and cognitive flexibility mediate the

relationship between mindfulness and academic achievement could not be tested. Step 1 of the Kenny and Baron approach to mediation testing requires that the proposed causal variable (mindfulness) be associated with the outcome variable (GPA or PLAN composite score). Likewise, Step 2 requires that proposed causal variable should also be correlated with the potential mediator (attention control, emotion regulation, or cognitive flexibility). These two initial requirements were not met.

Discussion

The study aimed to assess the relationship between mindfulness and academic achievement, and to examine if the impact of mindfulness had on academic achievement is by way of enhancing attention control, emotion regulation, and cognitive flexibility. Do the three latter variables mediate the relationship between mindfulness and academic achievement? It was hypothesized that higher levels of mindfulness would be associated with higher levels of academic achievement, as well as higher levels of each of the three potential mediators. It was also predicted that higher levels of each mediator would be correlated with higher levels of academic achievement. Lastly, it was anticipated that attention, cognitive flexibility, and emotion regulation would each mediate the relationship between mindfulness and academic achievement.

The relationship between mindfulness and academic achievement

Was there a relationship between mindfulness and academic achievement? No significant correlation was observed between mindfulness and the two measures of academic achievement (GPA and the PLAN composite scores). This result is not consistent with a significant amount of research that has been conducted. As stated in the literature review of this study, mindfulness has demonstrated an effect on achievement,

among other educational outcomes, in numerous studies. Most of the studies that investigated this relationship utilize MAPs to facilitate an improvement in achievement (e.g. Anglin, Pirson, & Langer, 2008; Carson, Shih, & Langer, 2001). Several though, investigate how trait mindfulness affects achievement outcomes (Shao & Skarlicki, 2009; Evans, Baer, & Segerstrom, 2009; Radel et al., 2009; Howell & Buro, 2011).

There are a number of reasons why the current study did not find a similar relationship to the previous studies mentioned. While research has found that mindfulness can be connected to achievement outcomes, this result has only been applied directly to academic achievement a handful of times (Shao & Skarlicki, 2009). It is possible that trait mindfulness (i.e., mindfulness as a disposition or a trait) does not have a more direct and observable effect on academic achievement that MAPs or other mindfulness practices (i.e., those that induce mindful states) are able to accomplish.

Secondly, studies that have produced significant results when examining the relationship between mindfulness and achievement have more typically been aimed at outcomes that are related with achievement (e.g., cognitive processes such as metacognition or executive functioning), but not necessarily at specific academic performance (i.e., grades). A prime example involves Evans, Baer, and Segerstrom (2009), who demonstrated a relationship between mindfulness and persistence in problem solving. While persistence in problem solving is a highly desirable achievement related trait, it is not academic achievement per se. Perhaps the influence of mindfulness on more global academic outcomes such as grades or general subject matter like English, Math, Reading, or Science is weaker, less direct, more distal, or even non-existent. This is not to say that there is no relationship, but rather to say that this relationship has not yet been

clearly defined or modeled for more adequate empirical testing. Perhaps investigating the relationship between mindfulness and an achievement related outcome, like persistence in problem solving or achievement motivation, would have produced significant results.

Another reason that mindfulness may not have yielded the effects that were expected involves the nature of the relationship itself. If the effects of mindfulness on academic achievement are more distal (i.e., longer causal pathway is involved) than proximal, it is likely that the mediation model constructed for the current study was not adequate. Given the results in the context of the aforementioned studies, this is a likely explanation. Perhaps mindfulness has more distal effects on academic performance, influencing several intermediate variables first before affecting academic achievement outcomes in form of grades. It is also very likely that the relationship between mindfulness and academic achievement is not only mediated by these intermediate variables but also moderated by other variables. For instance, mindfulness might prove to be beneficial for certain groups but not for others. Thus, modeling a causal relationship between mindfulness and academic achievement should specify mediators and moderators, specifying which variables influence other variables in the causal pathway.

The relationship between mindfulness and attention control, emotion regulation, and cognitive flexibility

Were there relationships between mindfulness and each of the potential mediators? Only attention control was found to be significantly correlated with mindfulness. Numerous studies have found and documented the beneficial effects mindfulness has on attention. Typically this is done through a mindfulness training or

intervention which results in an increase in ability to sustain attention. For example, Jha et al. (2015) found that mindfulness based training directly increased performance of military cohorts on a sustained attention task. However, the MAAS-A was designed to detect trait levels of mindfulness (Brown et al., 2011), which enables researchers to compare trait characteristics. The measures used in the current study detected a similar result as to what would be found in a study utilizing a mindfulness intervention. Those high in trait mindfulness seem to also have higher levels of attention control.

Clearly, a core component of mindfulness involves attention. Most (if not all) definitions of mindfulness highlight that attention is central to being able to practice mindfulness effectively. Additionally, measurement tools that have been developed to investigate mindfulness tend to emphasize attention as well. The Mindful Attention Awareness Scale involves a heavy attention component, and the five-facet model of mindfulness includes awareness and observing as two of the factors, which are conceptually akin to attention. It is likely that because of this core connection between mindfulness and attention that it was able to be detected in the study.

The other study results on the relationship between mindfulness and emotion regulation and between mindfulness and cognitive flexibility, however, were not consistent with previous studies cited. To begin, the connection between mindfulness and emotion regulation is fairly well documented. Schroevers and Brandsma (2010) indicated that MBCT training had a positive impact on the emotional experience of depression, anxiety, and anger. Bohus et al. (2004) found that individuals who participated in a Dialectical Behavior Therapy intervention (involving a strong mindfulness component) experienced less emotional distress. Finally, self-reported mindfulness was found to be

related to emotion regulation. Higher mindfulness meant lower levels of emotional reactivity, emotion dysregulation, and emotional lability (Hill & Updegraff, 2012).

Of all the selected mediators, the connection between mindfulness and cognitive flexibility is the least well-documented, but research has established a connection. Individuals who were more mindful have been found to be better able to complete a measure of cognitive rigidity (Greenberg, Reiner, & Meiran, 2012). Moore and Malinowski (2009) also found that mindful meditation practices produced higher levels of cognitive flexibility.

Additionally, the theoretical frameworks that served as a basis for this study theoretically and empirically demonstrated relationships between mindfulness and the selected mediators. As stated previously, Shapiro et al. (2006) proposed mediation as a way for mindfulness to influence other large constructs (the construct used in their article was growth in well-being). Using this model, Carmody et al. (2009) found partial mediation in their analyses using self-regulation, values clarification, cognitive, behavioral, and emotional flexibility, and exposure. Hölzel et al. (2011) also found significant partial mediation using attention regulation, body awareness, emotion regulation, and change in perspective on the self. While the mediators selected in the present study are not identical, there is a great degree of overlap. This posits the question: why were the results not replicated in the current study?

The relationship detected between mindfulness and attention unfortunately does not explain the lack of a relationship between mindfulness and emotion regulation and between mindfulness and cognitive flexibility. One trend that seemed to permeate the current study was a lack of variance in most of the measures. This is a possibility,

however the measures varied enough for a significant correlation to be found between emotion regulation and cognitive flexibility. The ability to think flexibly about one's emotions enables better emotional control and regulation. The undetected relationships between mindfulness and emotion regulation as well as between mindfulness and cognitive flexibility might indicate that these relationships simply do not hold true in the specific study sample of high school sophomores. Having a second or third alternative measure of mindfulness for the study could clarify the picture better. Would these alternative measures arrive at the same results?

The relationship between attention control, emotion regulation, cognitive flexibility and academic achievement

Were there relationships between the three potential mediators and academic achievement? There were no significant correlations between each of these three variables and academic achievement. This is surprising given the wealth of evidence that supports this connection. Attention and the influence it has on academic achievement is very well documented due to the difficulties presented when children exhibit hyperactive or inattentive behaviors associated with ADHD (Rogers et al., 2011). These behaviors inhibit these students ability to learn and perform well in academic settings because they have a more difficult time absorbing material presented in the classroom. As stated previously, students with attention difficulties such as ADHD (Langberg et al., 2011). Demarary and Jenkins (2011) also found that higher levels of inattention, hyperactivity, and impulsivity in children resulted in lower projected academic potential.

Students who exhibit difficulty with emotion regulation have typically demonstrated poorer school performance due to difficulty utilizing metacognitive

components such as working memory, attention, and planning (Blair, 2002). This is particularly important in adolescent populations (Graziano et al., 2007). As previously stated, Chevalier and Blaye (2008) indicated that emotion regulation influences other educational outcomes in tandem with achievement, such as leadership (Reither-Palmon, 2003), social competence (Nigg et al., 1999), and fewer behavior problems (Riggs et al., 2003).

Lack of evidence found in support of a connection between cognitive flexibility and achievement was also surprising due to the documentation of evidence to the contrary. Vitello et al. (2012) suggested that cognitive flexibility was associated with attention and progress monitoring of goals. Vitello et al. also found that cognitive flexibility was connected to attitudes toward learning, such as frustration tolerance in the academic environment and the type of interactions had between teachers and peers with regard to learning.

Much like the earlier explanations offered for the lack of observed relationship between mindfulness and academic achievement, it is possible that the attention control, emotion regulation, and cognitive flexibility are more strongly related with variables that parallel academic achievement, rather than academic achievement per se. Academic components such as leadership, academic enablers, attitude toward learning, monitoring of goals, working memory, and planning have all been directly connected to either attention, emotion regulation, or cognitive flexibility (Blair, 2002; Demarary & Jenkins, 2011; and Reiter-Palmon, 2003). The effects of these latter variables on grades might also be distal, involving intervening variables in between.

There is also the possibility, similar to the notion that mindfulness has distal effects on academic achievement, that the influence of the mediators on academic achievement is more distal than proximal. The aforementioned studies that document the effect attention control, emotion regulation, and cognitive flexibility hint that this might be so. For example, Bryan et al. (2012) found that several components of school bonding had a strong effect on academic achievement. The authors suggested that interventions in the school setting aimed at building student and family relationships with the school could potentially have a direct effect on bonding. Their results, in turn, indicate interventions of this nature could have a distal effect on academic achievement. This line of inquiry allows for the possibility that multiple stages of mediators may be involved when plotting a path between mindfulness and academic achievement.

Given the absence of relationships between the proposed causal variable (mindfulness), the potential mediators (attention control, emotion regulation, and cognitive flexibility), and the outcomes (academic achievement), the proposed simple mediation model could not be tested in this study.

Limitations of the Study

The methodology employed by this study relied almost exclusively on self-report measures. The MAAS-A, Attention Control Scale, ERQ-CA, and CFI all require participants to report their own feelings and experiences. By using self-report measures, participants may have indicated higher or lower levels of each trait than they may actually exhibit. Also, participants may have inferred the objectives of the study and may have attempted to answer in a manner that fit the inferred goals of the study.

Some of the scales used in this study may not have been the best measures to assess connections between mindfulness and academic achievement in adolescents. Two of the four self-report measures (the Attention Control Scale and CFI) were created and standardized with adults (Derryberry & Reed, 2002 and Dennis & Vander Wal, 2009 respectively). Despite having the requisite education and reading ability, the student participants in this study may not have fully understood the content of some of the questions on the Attention Control Scale and the CFI. As such, it is possible that the participants' true levels of attention control and cognitive flexibility are not accurately and adequately represented. Additionally, other measures may be more sensitive to differences between participants.

Participants tended to provide answers on measures that were less extreme. A possible explanation involves the limited span of Likert-type scaling used on certain measures, in conjunction with the extreme ends of some scales using absolute terminology (i.e. always, never). In their review of Likert-type scaling, Hodge and Gillespie (2003) note several limitations involved in using measures that employ this technique and the problems associated with differences in the number of responses available to participants in addition to the dilemma in using measures with absolute terminology versus strong but not absolute terminology. It is possible that the true opinions of the research sample were constrained by the measures used resulting in the lack of correlations between variables.

While the measure of mindfulness that was used in this study was quite robust, geared toward the adolescent population, and presented good psychometric outcomes, it still retained the limitation of measuring mindfulness only in trait form. Much of the

literature utilizes MAPs to induce higher levels of mindfulness to compare with controls (e.g. Napoli et al., 2005; Flook et al., 2010). Utilizing a study structure that allows for the measurement of the selected predictor, mediators, and academic achievement in state format may yield different results.

Future Studies

Future research into mindfulness and academic achievement would likely require modifications of the current study in one of two ways. If a more ambitious and comprehensive approach is desired, a more complex causal pathway should be specified wherein mindfulness influences academic achievement through a string of intervening variables. These mediating variables could be multiple and even possibly interacting with each other. Likewise, moderators could be specified. Multiple measures of the variables (including mindfulness) could be incorporated and more sophisticated modes of analyses such as structural equation modeling can be utilized.

Smaller and more manageable studies could take a slice from the more complex causal pathways, examining the effects of mindfulness on more proximal variables that are known to be empirically related to academic achievement. These might include outcomes such as leadership in the academic setting, goal-setting, time management, etc.. This type of study design might be more likely to produce significant results due to the smaller scope, and existing research provides direct support for connections between the mediators used in this study and outcome variables that bear some connection to academic achievement (Blair, 2002; Chevalier & Blaye, 2008; Demarary & Jenkins, 2011; Langberg et al., 2011; Nigg et al., 1999; Reither-Palmon, 2003; Riggs et al., 2003; Rogers et al., 2011; Vitello et al., 2012).

Another possibility for future research involves a longitudinal design.

Longitudinal studies involving mindfulness have been attempted in the past. MacCoon, MacLean, Davidson, Saron, and Lutz (2014) attempted to look at attentional outcomes. While their research did not produce significant results, they did show some promising data with regard to visual discrimination. Borders, Earleywine, and Jajodia (2010) found evidence in their research on the relationships between mindfulness, rumination, and aggression that could support longitudinal studies involving mindfulness in this domain. Research delving into the effect of trait mindfulness on academic related variables over time may assist in the understanding of how exactly mindfulness connects with academic outcomes.

Conclusion

Research involving the benefits of mindfulness within the context of education has been gathering momentum since Ellen Langer began to investigate its properties in the late 80's and early 90's. Since then, developments in the understanding of mindfulness have led to systems of support that allow students to better focus and learn material in the school setting. The current study attempted to test a proposed model of mindfulness within an academic context, one that inquired about whether mindfulness influenced academic achievement through enhancing attention control, emotion regulation, and cognitive flexibility. Mindfulness was not found to correlate with academic achievement, so no tests of mediation could be conducted. Mindfulness was found to have a significant correlation with attention, but was not found to correlate with other variables (emotion regulation and cognitive flexibility). Previous studies, however, have provided evidence for the connection between mindfulness and the selected

mediators, attention control, emotion regulation, and cognitive flexibility, as well as how these relate to academic variables. Additional research into the benefits of being more mindful, as a way to facilitate more effective learning, using a more complex specification of causal pathways is needed.

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Appendices**Appendix A. Demographic Information****Instructions:** Please provide a response to the following statements.

1. Age: _____

2. Gender: Male or Female

3. Ethnicity (can select more than one):

_____ White/Caucasian

_____ Black/African

_____ Hispanic

_____ Native American

_____ Asian

_____ Hawaiian or Pacific Islander

_____ Multi-ethnic

_____ Other

Appendix B. Mindful Attention Awareness Scale – Adolescent (MAAS-A)

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

Almost Always 1	Very Frequently 2	Somewhat Frequently 3	Somewhat Infrequently 4	Very Infrequently 5	Almost Never 6
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___ 1. I could be experiencing some emotion and not be conscious of it until some time later.

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

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

___ 4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.

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

___ 6. I forget a person's name almost as soon as I've been told it for the first time.

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

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

___ 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.

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

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

___ 12. I find myself preoccupied with the future or the past.

___ 13. I find myself doing things without paying attention.

___ 14. I snack without being aware that I'm eating.

Appendix C. Attentional Control Scale (ACS)

Almost Never
1

Sometimes
2

Often
3

Always
4

___ 1. It's very hard for me to concentrate on a difficult task when there are noises around. (R)

___ 2. When I need to concentrate and solve a problem, I have trouble focusing my attention. (R)

___ 3. When I am working hard on something I still get distracted by events around me. (R)

___ 4. My concentration is good even if there is music in the room around me.

___ 5. When concentrating, I can focus my attention so that I become unaware of what's going on in the room around me.

___ 6. When I am reading or studying, I am easily distracted if there are people talking in the same room. (R)

___ 7. When trying to focus my attention on something, I have difficulty blocking out distracting thoughts. (R)

___ 8. I have a hard time concentrating when I'm excited about something. (R)

___ 9. When concentrating I ignore feelings of hunger or thirst.

___ 10. I can quickly switch from one task to another.

___ 11. It takes me a while to get really involved in a new task. (R)

___ 12. It is difficult for me to coordinate my attention between the listening and writing required when taking notes during lectures. (R)

___ 13. I can become interested in a new topic very quickly when I need to.

___ 14. It is easy for me to read or write while I'm also talking on the phone.

___ 15. I have trouble carrying on two conversations at once. (R)

___ 16. I have a hard time coming up with new ideas quickly. (R)

___ 17. After being interrupted or distracted, I can easily shift my attention back to what I was doing before.

___ 18. When a distracting thought comes to mind, it is easy for me to shift my attention away from it.

___ 19. It is easy for me to alternate between two different tasks.

___ 20. It is hard for me to break from one way of thinking about something and look at it from another point of view. (R)

Appendix D. Cognitive Flexibility Inventory (CFI)

Please use the scale below to indicate the extent to which you agree or disagree with the following statements.

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

- ___ 1. I am good at “sizing up” situations.
- ___ 2. I have a hard time making decisions when faced with difficult situations. (R)
- ___ 3. I consider multiple options before making a decision.
- ___ 4. When I encounter difficult situations, I feel like I am losing control. (R)
- ___ 5. I like to look at difficult situations from many different angles.
- ___ 6. I seek additional information not immediately available before attributing causes to behavior.
- ___ 7. When encountering difficult situations, I become so stressed that I can not think of a way to resolve the situation. (R)
- ___ 8. I try to think about things from another person’s point of view.
- ___ 9. I find it troublesome that there are so many different ways to deal with difficult situations. (R)
- ___ 10. I am good at putting myself in others’ shoes.
- ___ 11. When I encounter difficult situations, I just don’t know what to do. (R)

- ___ 12. It is important to look at difficult situations from many angles.
- ___ 13. When in difficult situations, I consider multiple options before deciding how to behave.
- ___ 14. I often look at a situation from different viewpoints.
- ___ 15. I am capable of overcoming the difficulties in life that I face.
- ___ 16. I consider all the available facts and information when attributing causes to behavior.
- ___ 17. I feel I have no power to change things in difficult situations. (R)
- ___ 18. When I encounter difficult situations, I stop and try to think of several ways to resolve it.
- ___ 19. I can think of more than one way to resolve a difficult situation I'm confronted with.
- ___ 20. I consider multiple options before responding to difficult situations.

Appendix E. Emotion Regulation Questionnaire for Children and Adolescents
(ERQ-CA).

Strongly Disagree	Disagree	Half and Half	Agree	Strongly Agree
1	2	3	4	5

___ 1. When I want to feel happier I think about something different.

___ 2. When I want to feel less bad (e.g., sad, angry, or worried), I think about something different.

___ 3. When I'm worried about something I make myself think about it in a way that helps me feel better

___ 4. When I want to feel happier about something, I change the way I'm thinking about it.

___ 5. I control my feelings about things by changing the way I think about them.

___ 6. When I want to feel less bad (e.g., sad, angry, or worried) about something, I change the way I'm thinking about it.

___ 7. I keep my feelings to myself.

___ 8. When I am feeling happy. I am careful not to show it.

___ 9. I control my feelings by not showing them.

___ 10. When I'm feeling bad (e.g., sad, angry, or worried) I'm careful not to show it.