

The Effect of Mindfulness on Reappraisal, Attentional Control, and Hostile Attribution
Bias

by

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Certificate of Approval

This is to certify that the accompanying thesis by Alexandra Jo Davirro and Emily Lauren Johnson has been accepted in partial fulfillment of the requirements for graduation with Honors in Psychology.

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Table of Contents

Acknowledgements.....	iv
Abstract.....	v
List of Tables, Figures and Appendices.....	vi
Introduction.....	7
Mindfulness.....	9
Awareness and Reappraisal	9
Attention and Attentional Control	11
Hostile Attribution Bias	13
Impact of Willingness.....	15
Current Study	16
Methods.....	18
Participants.....	18
Procedure and Design.....	18
Measures	19
Results.....	21
Mindfulness.....	21
Reappraisal and Attentional Control.....	22
Hostile Attribution Bias	22
Willingness	23
Correlations.....	24
Discussion.....	25
Limitations	32
Implications.....	33
References.....	35

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Abstract

The goal of this study was to expand prior research that examines the potential psychological components within mindfulness, such as attentional control and reappraisal. This study examined the effect of a two-week long mindfulness intervention on levels of mindfulness and hostile attribution bias. Further, we proposed attentional control and reappraisal as the mechanisms behind this relationship. The sample consisted of high school students from a local, rural high school ($N = 115$; $M_{\text{age}} = 16.47$, $SD = 1.15$ years). The intervention did not cause any difference in the levels of mindfulness, attentional control, reappraisal, and hostile attribution bias. Results indicated, however, that attentional control was positively correlated with mindfulness and reappraisal and negatively correlated with hostile attribution bias. These results provide partial support for our theoretical model. Future research should further explore this theoretical framework in order to understand the ways in which attentional control contributes to mindfulness and how mindfulness can impact physical and psychological well-being.

Keywords: mindfulness, reappraisal, attentional control, hostile attribution bias, attention, awareness, meditation

List of Tables, Figures and Appendices

Table 1: Means and Standard Deviations for the Levels of Mindfulness, Reappraisal, Attentional Control, and Hostile Attribution Bias by Condition and Time.....	45
Table 2: Relations Among the Averages of Key Variables at Pretest and Posttest.....	46
Table 3: Means and Standard Deviations for the Levels of Mindfulness, Reappraisal, Attentional Control, and Hostile Attribution Bias by Willingness Group and Time....	47
Figure 1: Working Model of the Relationship between Mindfulness, Reappraisal, Attentional Control, and Hostile Attribution Bias.....	48
Figure 2: Correlations on Theoretical Model of the Relationship Between Mindfulness, Reappraisal, Attentional Control and Hostile Attribution Bias at Pretest.....	49
Appendix 1: Meditation for Working with Difficulties.....	50

The Effect of Mindfulness on Reappraisal, Attentional Control, and Hostile Attribution Bias

Mindfulness meditation, which is rooted in Buddhist practices, as well as other traditions that focus on contemplation, attention, and awareness, has gained recent traction in the psychological community (Brown & Ryan, 2003). The relatively newfound interest in mindfulness among psychologists is due in large part to Kabat-Zinn's (1982) Mindfulness-Based Stress Reduction (MBSR), which is a treatment program developed for managing chronic pain (Bishop et al., 2004). MBSR has been found to improve a large variety of everyday stressors and more serious psychological and physical conditions. For example, mindfulness has been shown to reduce anxiety, depression, and chronic pain (Brown & Ryan, 2003; Grossman, Niemann, Schmidt, & Walach, 2004).

Mindfulness has also been linked to decreased levels of aggression (Borders, Earleywine, & Jajodia, 2010; Heppner et al., 2008; Singh et al., 2007). For example, research shows a negative correlation between mindfulness and anger, such that those with higher levels of mindfulness have lower levels of anger and hostility (Borders et al., 2010). Furthermore, experimental research shows that individuals who participate in mindfulness react with less anger after given negative social feedback compared to individuals who do not participate in mindfulness (Heppner et al., 2008). Although research has been done on mindfulness and aggression (e.g., Choe, Lane, Grabell, & Olson, 2013; Dodge, Price, Bachorowski, & Newman, 1990; Gvion, & Apter, 2011; Hatfield & Dula, 2014; Orborio de Castro, Merk, Koops, Veerman, & Bosch, 2005; Vigil-Colet, Morales-Vives, & Tous, 2008), little research has been done on the effect

of mindfulness on hostile attribution bias. Research defines hostile attribution bias as the tendency to misinterpret a neutral social situation as hostile, and individuals who interpret neutral situations as hostile are more likely to respond with aggressive behaviors (Bosch & Monshouwer, 2002; Orborio de Castro, Veerman, Koops, Bosch & Monshouwer, 2002). Aggression is thought to be both a cause (Dodge et al., 1990; Orborio de Castro et al., 2005) and effect (Choe et al., 2013; Dodge et al., 1990) of hostile attribution bias. We propose that mindfulness will have a similar effect on hostile attribution bias as it does on aggression because of the strong link between the two.

Despite the positive outcomes of mindfulness, including the potential to decrease hostile attribution bias, there is limited research that examines the mechanisms of mindfulness that lead to these outcomes. The small body of research on mindfulness suggests that there are two potential psychological mechanisms within mindfulness: awareness and attention (Bishop et al., 2004; Brown & Ryan, 2004). We propose that awareness can be understood as the psychological mechanism of reappraisal and attention can be understood as the psychological mechanism of attentional control. Our study adds to the growing body of research on mindfulness by proposing two psychological mechanisms within mindfulness, reappraisal and attentional control, as well as examining the effects of mindfulness on hostile attribution bias.

In the current study, we implemented an intervention program with high school students in order to examine how mindfulness might influence hostile attribution bias; furthermore, we examined whether reappraisal and attentional control impact the

relationship between mindfulness and hostile attribution bias. We also looked at how variations of willingness to engage with the mindfulness influenced these relations. In order to conceptualize this model, reference Figure 1.

Mindfulness

Mindfulness is difficult to operationalize, but it is necessary to do so in order to uncover the psychological mechanisms at work and to understand how mindfulness functions as a psychological tool. In general, there are three different types of mindfulness: the practice of mindfulness, state mindfulness, and trait mindfulness (Brown & Ryan, 2004; Shapiro, Brown, Thoresen, & Plante, 2011). Previous research suggests that engaging in mindfulness practice increases levels of state mindfulness over time, which will ultimately lead to an increase in trait mindfulness (Davidson, 2010; Kiken, Garland, Bluth, Palsson, & Gaylord, 2015). One of the primary focuses of mindfulness practice and state and trait mindfulness is improving heightened consciousness, by targeting awareness and attention (Brown & Ryan, 2003). Awareness refers to the monitoring of an individual's internal and external environment, whereas attention refers to the process of bringing conscious awareness to focus (Brown & Ryan, 2003).

Awareness and Reappraisal

The first component of mindfulness involves being aware of the present moment. The awareness of the present moment involves being curious, open and accepting of one's experiences including thoughts, feelings, and sensations (Bishop et al., 2004). For example, those practicing mindfulness are encouraged to openly accept all thoughts, instead of dwelling on and judging thoughts, regardless of how the

thought may make one feel. In addition, individuals practicing mindfulness are encouraged to nonjudgmentally redirect one's awareness back to the present moment should an individual's thoughts stray (Bishop et al., 2004). Awareness as a psychological component of mindfulness is beneficial in recognizing the general features of mindfulness, but to fully understand the specific mechanisms at play, we propose that awareness can also be theoretically understood as reappraisal within emotional regulation.

Broadly, emotion regulation can be defined as the processes behind how an individual monitors, modifies and evaluates their emotional responses (Thompson, 1994). Further, emotion regulation refers to how individuals influence which emotions they have, when they have them, and how they express them (Gross, 1998a). Emotion regulation can be divided into two processes: reappraisal and suppression (Dennis, 2007; Goldin, McRae, Ramel, & Gross, 2008; Gross, 1998b; Gross & John, 2003). Reappraisal is defined as reinterpreting emotionally charged situations in order to alter the emotional impact (Gross & John, 2003), and is often associated with lower levels of self-reported psychological stress (Moore, Zoellner, & Mollenholt, 2008). Mindfulness can be understood through the reappraisal process of emotion regulation, as opposed to suppression, because prior research indicates reinterpreting situations within reappraisal is akin to reframing situations in mindfulness (Bishop et al., 2004, Coffey & Hartman, 2008, Desrosiers, Vine, Klemanski, Nolen-Hoeksema, 2013; Garland, Gaylord & Fredrickson, 2011; Hölzel et al., 2011). A small body of research has found a positive correlation between mindfulness and reappraisal, specifically that levels of reappraisal significantly increased for individuals who took part in an 8-week

long mindfulness intervention program (Garland et al., 2011; Garland, Gaylord, & Park, 2009; Garland, Hanley, Farb, & Froeliger, 2015).

The relationship between reappraisal and mindfulness can be understood by looking at how individuals cope (Garland et al., 2011). Past research on coping suggests reappraisal as a key coping mechanism that allows individuals to adapt to potentially stressful events (Garland et al., 2009). Furthermore, research suggests that in order to reappraise an event, one must first step back and decenter from their original affect resulting from a situation, in order to then reappraise the situation with a different affect, such as positive or neutral (Garland et al., 2009, Hayes-Skelton & Graham, 2013; Shapiro, Carlson, Astin, Freedman, 2006). So, in the example of coping, one may try to take a step back, in order to consider potential positive responses. Though researchers in mindfulness studies have focused on the relation between mindfulness and decentering (Shapiro et al., 2006), there is limited research on the relation between mindfulness and reappraisal. There is a small body of research that suggests that decentering is a component of both mindfulness and reappraisal (Hayes-Skelton & Graham, 2013). Due to this common link, our study focused on reappraisal as a component of mindfulness in order to further understand the key components of mindfulness.

Attention and Attentional Control

Mindfulness involves the self-regulation of attention, which includes non-elaborative awareness of an individual's thoughts, feelings, and sensations (Bishop et al., 2004). Elaborative thinking refers to a second level of stimulus recognition (Craik & Lockhart, 1972). After a stimulus is first recognized, individuals engage in

elaborative processing, which includes the cognitive triggering of associations, images, or schemas based off of an individual's prior experiences (Craik & Lockhart, 1972).

For example, when an individual engages in thoughts regarding a fight they had earlier that day, instead of simply objectively acknowledging that a fight occurred, the individual may start to think about the associations of that fight. This type of elaborative thinking can often lead to rumination because an individual may get caught up in the implications or associations of their experience (Bishop et al., 2004).

Mindfulness, however, encourages individuals to focus one's attention solely on the experience, as opposed to any implications or ruminative thoughts that may appear during elaborative thinking. Because of this, mindfulness is associated with the inhibition of elaborative processing due to the self-regulation of attention (Bishop et al., 2004).

The inhibition of elaborative processing, or self-regulation of attention, within mindfulness can be understood with regard to executive functions. Past research describes executive functions, or "executive control," as a group of cognitive processes that control and regulate an individual's thoughts and behaviors (Diamond, 2013; Friedman et al., 2006). Executive functions include mental shifting, updating information, and inhibiting robust responses (Miyake et al., 2000). Further, one uses executive functioning in situations where one cannot rely on automatic processing, such as when one engages in a new situation (Schneider & Chein, 2003). Attentional control, or the ability to focus on one stimulus and ignore another, is an example of an executive function (Astle & Scerif, 2008; Yantis, 1993). However, because executive functions are controlled processes, it takes more effort to engage in these processes

compared to automatic processes (Schneider & Chein, 2003; Schneider & Shiffrin, 1977). Though it takes more effort to engage in executive functions, such as attentional control, it is an ability that can change over time, especially through development (Astle & Scerif, 2008; Schneider & Chein, 2003).

Similar to attentional control, mindfulness encourages individuals to focus on one stimulus at a time. Because of this maintained focus, mindfulness can be challenging at first but, like attentional control, develop over time (Anderson, Lau, Segal, & Bishop, 2007; Brown, Ryan & Creswell, 2007; Grabovac, Lau, & Willett, 2011). The more individuals engage in state mindfulness, through the practice of mindfulness, the more the individual improves in trait mindfulness (Shapiro et al., 2011).

Not only do both mindfulness and attentional control individually improve over time, but research also suggests that mindfulness can also improve attentional control. Mindfulness improves attentional control by encouraging individuals to engage in controlled processing by focusing their attention on one thought at a time and being non-judgmental. The ability to be non-judgmental gives the opportunity for an individual to have better control over what they choose to what they pay attention (Malinowski, 2013).

Hostile Attribution Bias

Hostile attribution bias is defined as the tendency to inappropriately react to neutral or positive social situations as a response to atypical processing to social information (Choe et al., 2013; Crick & Ladd, 1993; Dodge & Somberg, 1987; Dodge et al., 1990; Oborio de Castro et al., 2008). For example, imagine that as you are

rushing to class, someone bumps into you. Many people would interpret the situation one of two ways: intentionally or on accident. How an individual answers this question can determine their level of hostile attribution bias. If one attributes an situation as intentional, they would likely have a high level of hostile attribution bias. Conversely, if one perceived this interaction to be an accident, they would likely have a low level of hostile attribution bias.

One way to understand why hostile attribution bias occurs is by looking at social information processing theory (Crick & Dodge, 1994). Social information processing theory posits that an individual's mental understanding of a social situation impacts how they respond (Dodge & Rabiner, 2004; Lemerise & Arsenio, 2000). Hostile attribution bias occurs when an individual incorrectly encodes and interprets a situation (Crick & Dodge, 1994; Lemerise & Arsenio, 2000). The misinterpretation of a neutral event into something negative affects the subsequent behaviors, which are often aggressive in nature (Dodge et al., 1990; Orborio de Castro et al., 2002). The aggressive behaviors can be both verbal (Dodge et al., 1990) and physical (Gvion, & Apter, 2011; Hatfield & Dula, 2014; Vigil-Colet et al., 2008).

Though little research has examined the effect of mindfulness on hostile attribution bias, mindfulness has been shown to have positive effects on a number of other phenomena related to hostile attribution bias, such as aggression. While there has not been much research on the direct connection between mindfulness and hostile attribution bias, there is a large body of research on reducing aggression with mindfulness (Borders et al., 2010; Heppner et al., 2008; Singh et al., 2007). Due to the

strong link between aggression and hostile attribution bias, we propose mindfulness will have similar effects on hostile attribution bias as it does on aggression.

Research shows that higher levels of impulsivity are related to higher levels of aggression (Hatfield & Dula, 2014; Heppner et al., 2008; Peters, Erisman, Upton, Baer, & Roemer, 2011). Aggression and impulsivity are highly correlated with hostile attribution bias (Bailey & Ostrov, 2008). Research has shown that mindfulness can decrease impulsive behavior and increase being non-judgmental, non-reactive, and aware (Lattimore, Fisher, & Malinowski, 2011). Furthermore, mindfulness could help lessen aggression by increasing attention and awareness (Heppner et al., 2008). This increase of attentional control can be related to decreasing the use of automatic processing in neutral or vague social situations, therefore decreasing hostile attribution bias (Glomb, Duffy, Bono, & Yang, 2011).

Generally, the population researchers have focused on with regard to hostile attribution consists of boys and children. Furthermore, most research on hostile attribution bias has focused on elementary-aged children, as opposed to high school-aged adolescents. A meta-analysis examining the relationship between hostile attribution bias and aggressive behavior found that out of 41 studies, 20 studies examined only boys, while only 1 study examined only girls. Further, out of the 41 studies, only 8 studies included children over 12 years of age (Orborio de Castro et al., 2002). We will add to this body of research by examining the ways in which hostile attribution bias manifests in coed high school students.

Impact of Willingness

The effects of practicing mindfulness are thought to be influenced by both the individual's intention and attitude (Shapiro et al., 2006). Generally, people who engage in mindfulness do so with an overt intention, such as to reduce stress (Olano et al., 2015; Shapiro et al., 2006). Further, when people are intentionally mindful, they gain insight into other intentions in their life, such as a desire to think more before speaking (Shapiro et al., 2006).

Additionally, an individual's attitude, whether positive or negative, about engaging in mindfulness is important (Grabovac et al., 2011; Shapiro et al., 2006). Individuals are more likely to enter and remain in a state of mindfulness when they approach the practice with an open and warm attitude of wanting to be mindful rather than a cold, critical mentality (Kabat-Zinn, 2003; Seligman & Schulman, 1968; Shapiro et al., 2006). This warm attitude is beneficial because it facilitates a sense of openness and acceptance in redirecting one's thoughts and being more attentive (Grabovac et al., 2011). Practicing state mindfulness to improve trait mindfulness is a lifelong endeavor that requires constant effort (Germer, 2005). The research suggests that mindfulness will be moderated by the extent to which people are willing to engage in mindfulness.

Current Study

The current study looked at the effect of mindfulness on hostile attribution bias. We used a pretest/posttest design that assessed whether high school students who participated in a 2-week mindfulness program (*mindfulness condition*) would respond differently than their peers who did not participate in a mindfulness program (*control condition*). As part of our study, we tested seven hypotheses (see Figure 1 for the

model). First, we hypothesized that there would be an interaction between time and condition, such that there would not be a significant difference in the level of mindfulness between conditions at the pretest, and there would be a difference in the level of mindfulness between conditions at the posttest. Specifically, we hypothesized that those in the mindfulness condition would have higher levels of mindfulness than those in the control condition at the posttest. Second, we hypothesized that there would be an interaction between time and condition with regard to reappraisal, such that individuals in the mindfulness condition would report higher levels of reappraisal at the posttest compared to the individuals in the control condition. Third, we hypothesized that there would be an interaction between time and condition with regard to attentional control, such that individuals in the mindfulness condition would report higher levels of attentional control at the posttest compared to individuals in the control condition.

Fourth, we hypothesized that there would be an interaction between time and condition with regard to hostile attribution bias, such that individuals in the mindfulness condition would report lower levels of hostile attribution bias at the posttest compared to individuals in the control condition.

Fifth, we hypothesized that the effect of mindfulness on attentional control, reappraisal, and hostile attribution bias would be moderated by student's willingness to engage in the mindfulness. Specifically, individuals who reported higher levels of willingness would report a larger decrease in hostile attribution bias and increase in attentional control and reappraisal, compared to individuals who reported lower levels of willingness.

Finally, we hypothesized that there would be support for our theoretical model such that there would be a (6) negative correlation between reappraisal and hostile attribution bias and a (7) negative correlation between attentional control and hostile attribution bias at the pretest. We chose to look at solely the pretest data in order to examine how our theoretical model exists in the world without any intervention.

Methods

Participants

The sample consisted of 115 participants from a local, alternative high school. Out of the 115 participants, 100 chose to give their demographic information. The participants ranged in ages from 14-19 ($M = 16.47$, $SD = 1.15$) and were 49% female. Overall, participants were 13% first-years, 32% sophomores, 28% juniors, and 27% seniors. Of the total participants, 62% identified as White, 16% as Hispanic/Latino, 6% as White and Hispanic/Latino, 2% as Black/African American, and 9% identified as mixed race/ethnicity and 5% identified as other. Overall, 90% of participants spoke English as their first language and 86% of participants speak English at home. With regard to mother education, 26% of participants had mothers who completed some high school or less, 17% graduated high school, 18% completed some college, 15% graduated from college, 5% completed graduate school and 18% did not know. With regard to father education, 30% of participants had fathers who completed some high school, 20% graduated high school, 16% completed some college, 7% graduated from college, 3% completed graduate school and 25% did not know.

Procedure and Design

We received permission from the high school principal and the school board to conduct research at a rural high school during their half-an-hour advisory periods. The students' parents and guardians signed a form if they did *not* want their child to participate. We then split up the participants by classroom. Six classrooms were randomly assigned to the experimental condition and six classrooms were randomly assigned to the control condition. Each classroom had between 12-16 students.

All participants completed four surveys as a pretest, which lasted about 45 minutes. These surveys included the CAMM (Greco, Baer, & Smith, 2011), the Attribution Measure (Crick & Dodge, 1996), the Attentional Control Scale (Derryberry & Reed, 2002), and the Emotional Regulation Questionnaire (Gross & John, 2003).

Next, the experimental group listened to the mindfulness focused on working with difficulties every day for two weeks (See Appendix 1). This mindfulness lasted 7 minutes and was recorded by a professional certified in mindfulness. We used a recording for the intervention to ensure the consistency of the students receiving the same, unaltered intervention. When the mindfulness ended, participants completed a short 3-measure questionnaire every day to examine their levels of willingness to engage in the mindfulness. The control group did not listen to anything in the first two weeks.

At the end of the two weeks, all participants took the posttest questionnaires, which consisted of the same measures as the pretest questionnaire. We used a mixed-factorial design, with time (pretest, posttest) as the within-group variable and condition (control, mindfulness) as the between-group variable.

Measures

Mindfulness. The Child and Adolescent Mindfulness Measure (CAMM; Greco, Baer, & Smith, 2011) measures the extent to which the individual's awareness is in the present moment and is non-judgmental and non-avoidant based on how true the statement is. This measure has 10 items ($\alpha_{pre} = .85$, $\alpha_{post} = .84$). The CAMM was used because it is more developmentally appropriate than an adult mindfulness measure (Greco, Baer, & Smith, 2011). The scale ranged from 0 (*never true*) to 4 (*always true*). Example items are "At school, I walk from class to class without noticing what I'm doing" and "I keep myself busy so I don't notice my thoughts or feelings."

Reappraisal. The Emotional Regulation Questionnaire (Gross & John, 2003) has 10 items ($\alpha_{pre} = .85$, $\alpha_{post} = .80$). This scale measures how individuals regulate their emotions with regard to reappraisal and suppression (1 = *strongly disagree*, 7 = *strongly agree*). Two example items are, "I keep my emotions to myself," and "When I want to feel less negative emotion, I change the way I'm thinking about the situation."

Attentional control. The Attentional Control Scale (Derryberry & Reed, 2001) measures the extent to which one has control over their attention (1 = *almost never*, 4 = *always*) and has 20 items ($\alpha_{pre} = .75$, $\alpha_{post} = .73$). Two example items are, "When trying to focus my attention on something, I have difficulty blocking out distracting thoughts" and "I can quickly switch from one task to another."

Hostile attribution bias. The Attribution Measure (Crick & Dodge, 1994) has 10 items ($\alpha_{pre} = .79$, $\alpha_{post} = .83$). Each item presents a situation where something bad happens, and the individual responds with the extent to which the person in the scenario was being mean (1 = *not possible*, 5 = *very likely*). An example item is as

follows, “Pretend that your teacher asks for a volunteer to stay after school to help clean up the classroom. You did not volunteer because you want to go home, but your teacher asks for you to stay and help anyway. How likely is it that the teacher asked you to stay because she was being mean to you?”

Willingness. Participants completed this measure every day after listening to the mindfulness recording. It is a three-item scale used to determine the extent to which the participants were engaging in the mindfulness (1 = *never true*, 6 = *always true*). An example item is, “I tried to participate in the mindfulness.” We averaged the responses from all days to create an overall willingness measure ($\alpha = .97$).

Results

In order to test many of our hypotheses, we ran a series of repeated-measures ANOVAs. To test our theoretical framework, we ran a series of Pearson’s correlations. Descriptive statistics can be found in Table 1. Although we had a sample of 115, some of the students did not complete either the pretest or the posttest and therefore are not included in the analyses that include time as a factor, such as a repeated-measures ANOVA.

Mindfulness

At both the pretest and posttest, both groups had moderate levels of mindfulness (Table 1). To test our mindfulness hypothesis, we ran a 2 (time: pretest, posttest) X 2 (condition: mindfulness, control) repeated-measures ANOVA. There was not a significant main effect of time on mindfulness, $F(1, 69) = 0.61, p = .43, \eta^2 < 0.01$. Further, there was not a main effect of condition on mindfulness, $F(1, 69) = 1.27, p =$

.26, $\eta^2 = 0.02$. Finally, there was not a statistically significant interaction between time and condition on mindfulness, $F(1, 69) = 0.13, p = .72, \eta^2 < 0.01$ (Table 1).

Reappraisal and Attentional Control

Our next hypothesis was that there would be an interaction between time and condition on reappraisal. By using a repeated-measures ANOVA, we did not find a statistically significant main effect of time on reappraisal, $F(1, 65) = 0.11, p = .74, \eta^2 < 0.01$. Both conditions at the pretest and posttest had moderate levels of reappraisal (see Table 1). Further, we found no main effect of condition on reappraisal, $F(1, 65) = 0.04, p = .85, \eta^2 < 0.01$. Finally, there was no statistically significant interaction between time and condition on reappraisal, $F(1, 65) = 1.36, p = .25, \eta^2 = 0.02$.

Next, we hypothesized that there would be an interaction between time and condition on attentional control. We measured the levels of mindfulness and found that the mindfulness and control conditions had moderate levels of attentional control at both pre and posttest. By using a repeated-measures ANOVA, we found a statistically significant main effect of time on attentional control, $F(1, 64) = 5.29, p = .03, \eta^2 = 0.01, d = .24$. Cohen's (1992) d was calculated because the result was significant. Both mindfulness and control conditions improved in their attentional control over time ($M_{\text{pre}} = 2.39, SD_{\text{pre}} = 0.40; M_{\text{post}} = 2.48, SD_{\text{post}} = 0.36$; Table 1). We did not, however, find a main effect of condition on attentional control, $F(1, 64) = 0.30, p = .59, \eta^2 < 0.01$. There was not a statistically significant interaction between time and condition on attentional control, $F(1, 64) = 0.01, p = .94, \eta^2 < 0.01$ (Table 1).

Hostile Attribution Bias

Next we hypothesized that there would be an interaction between time and condition with regard to hostile attribution bias. Both conditions at the pretest had moderate levels of hostile attribution bias (Table 1). At the time of the posttest, we found that both conditions continued to have moderate levels of hostile attribution bias. By using a repeated-measures ANOVA, we found no statistically significant main effect of time on hostile attribution bias, $F(1, 60) = 1.77, p = .19, \eta^2 = 0.03$. We did, however, find a statistically significant main effect of condition on hostile attribution bias, $F(1, 60) = 5.39, p = .02, \eta^2 < 0.08, d = .52$ (Cohen, 1992). The mindfulness condition had higher levels of hostile attribution bias compared to the control condition at both pre ($M = 3.29, SD = 0.63$) and posttests ($M = 2.97, SD = 0.60$). Finally, there was not a statistically significant interaction between time and condition with regard to hostile attribution bias, $F(1, 60) = 0.70, p = .41, \eta^2 = 0.01$.

Willingness

Our final hypothesis was that the effect of mindfulness on attentional control, reappraisal, and hostile attribution bias would be moderated by student's willingness to engage in the mindfulness. We created two groups of willingness, high and low, based off of the median level. The low willingness group ranged from 1.00 to 3.49, and the high willingness group ranged from 3.50 to 6.00. We ran a series of 2 (time: pretest, posttest) X 2 (willingness level: high, low) repeated-measures ANOVAs for the levels of: mindfulness, attentional control, reappraisal, and hostile attribution bias.

Unfortunately, not all of the participants in the mindfulness condition consistently filled out the willingness scale, so the analyses are based on a sub-sample.

We found no statistically significant main effect of time on mindfulness, $F(1, 35) = 1.09, p = .31, \eta^2 = 0.03$, and no main effect of willingness level on mindfulness, $F(1, 35) = 0.64, p = .43, \eta^2 = 0.02$. Furthermore, results indicated no statistically significant interaction between willingness and time on mindfulness, $F(1, 35) = 2.01, p = .16, \eta^2 = 0.06$ (Table 3).

We found no statistically significant main effect of time on attentional control, $F(1, 31) = 1.66, p = .21, \eta^2 = 0.05$ and no statistically significant main effect of willingness condition on attentional control, $F(1, 31) = 0.15, p = .70, \eta^2 < .01$. There was no statistically significant interaction between willingness and time on attentional control, $F(1, 31) = 1.41, p = .25, \eta^2 = 0.04$ (Table 3).

We found no statistically significant main effect of time on reappraisal, $F(1, 30) = 1.10, p = .30, \eta^2 = 0.04$, and no statistically significant main effect of willingness on reappraisal, $F(1, 30) = .06, p = .81, \eta^2 < .01$. We also found no statistically significant interaction between willingness and time on reappraisal, $F(1, 30) < .01, p = .93, \eta^2 < 0.01$ (Table 3).

Lastly, we found no statistically significant main effect of time on hostile attribution bias, $F(1, 29) = 0.16, p = .69, \eta^2 < .01$, and no statistically significant main effect of willingness on hostile attribution bias, $F(1, 29) = 0.05, p = .82, \eta^2 < 0.01$. We found no statistically significant interaction between willingness and time on hostile attribution bias, $F(1, 29) = .53, p = .47, \eta^2 = 0.02$ (Table 3).

Correlations

To test our hypotheses about the relation between the continuous variables we ran a series of Pearson's correlations. We ran these tests solely for the pretest data to

test our theoretical model. Results are provided in Figure 2. See Table 2 for correlations between all variables at pre and posttest.

With regard to our theoretical framework, results indicated that there were significant positive correlations between mindfulness and attentional control, $r(92) = .32, p < .01$. There were not, however, significant positive correlations between mindfulness and reappraisal, $r(95) = -.11, p = .28$. The relation between mindfulness and hostile attribution bias was significantly negatively correlated, $r(87) = -.28, p < .01$. Attentional control was significantly negatively correlated with hostile attribution bias, $r(87) = -.23, p = .03$. In addition, there was not a significant negative correlation between reappraisal and hostile attribution bias, $r(86) = .16, p = .15$.

Discussion

In this study, we examined the effect of mindfulness on reappraisal, attentional control, and hostile attribution bias. The presence of mindfulness in psychological research has increased over the past decade and has found that there are positive psychological and physical effects of mindfulness, such as decreasing levels of depression, anxiety, and aggression (Borders, et al., 2010; Brown & Ryan, 2003; Grossman et al., 2003; Heppner et al., 2008; Singh et al., 2007) and increasing attention and awareness (Heppner et al., 2008). Further, past research has found that aggression and hostile attribution bias are strongly related (Bailey & Ostrov, 2008; Dodge et al., 1990; Orborio de Castro et al., 2008) and mindfulness can decrease aggression (Borders et al., 2010; Heppner et al., 2008; Singh et al., 2007). Due to this relation, our study explored the impact of mindfulness on hostile attribution bias. Though there is a small body of research focused on the effect of mindfulness on

attention and awareness, our study aimed to further explore how attention and awareness may be key components of mindfulness. By knowing more about these relations, we can better understand how these positive outcomes of mindfulness arise.

Inconsistent with our hypothesis, we found that students in the mindfulness condition did not have higher levels of self-reported mindfulness after participating in two weeks of mindfulness. In addition, our findings were contrary to past research that suggests mindfulness interventions increase levels of mindfulness (Davidson, 2010; Kabat-Zinn, 1982; Kiken, Garland, Bluth, Palsson, & Gaylord, 2015). The lack of support for this hypothesis may be due to the fact that our intervention only lasted two weeks, which is significantly shorter than most mindfulness interventions. For example, a commonly practiced program of MBSR lasts 8 weeks (Kabat-Zinn, 1982). Further, research considers practices such as MBSR a “short” practice (Davidson et al., 2003) and suggests that mindfulness takes constant effort (Germer, 2005). Furthermore, the mechanisms behind mindfulness, such as attentional control, can develop and change over time (Astle & Scerif, 2008; Schneider & Chein, 2003). These studies suggest that individuals need more time to adjust to mindfulness before the positive outcomes arise. Future research should further explore how length of mindfulness training impacts its effects.

Next, we hypothesized that there would be an interaction between time and condition with regard to reappraisal, such that individuals in the mindfulness condition would report higher levels of reappraisal at the posttest compared to the individuals in the control condition. Our findings were inconsistent with this hypothesis. The lack of support for this hypothesis reveals an important nuance in the psychological

components of mindfulness. Both mindfulness and reappraisal involve decentering and looking at a situation differently (Hayes-Skelton & Graham, 2013); however, they have one important difference with regard to *how* an individual looks at a situation differently. The first aspect of mindfulness and reappraisal are the same, in that they both encourage individuals to decenter from their initial response (Hayes-Skelton & Graham, 2013). The second aspect of these processes, however, is different. Both mindfulness and reappraisal encourage individuals to decenter and take a step back from their initial thoughts. However, though some research on reappraisal does not specify that reappraisal is the reframing of “negative” thoughts to “positive” thoughts (Garland, Gaylord, & Park, 2009), reappraisal often has this additional evaluative step. Future research should consider using a scale that specifically targets the decentering aspect of reappraisal (Fresco et al., 2007).

Our hypothesis that there would be higher levels of attentional control for the mindfulness condition was not supported, but the levels of attentional control in both conditions increased over time, recognizing there was a small effect size. One possible explanation for this finding is that past research suggests levels of attentional control generally increase over time with development (Astle & Scerif, 2008; Schneider & Chein, 2003). However, being in school for two weeks may not be enough to suggest that the students developed enough to have different levels of attentional control. Though there is not a clear explanation why there would be a main effect of time, one reason might be that the students thought about the items on the attentional control measures and answered the questions differently at the posttest.

We also hypothesized that there would be a main effect of condition mindfulness on hostile attribution bias, such that individuals in the mindfulness condition who participated in the mindfulness program would report lower levels of hostile attribution bias compared to individuals in the control condition. Though we did find that levels of hostile attribution bias differed based on condition, our findings were inconsistent with this hypothesis because levels of hostile attribution bias were higher in the mindfulness conditioned compared to the control condition. One possible explanation is that regardless of their random assignment, the level of hostile attribution bias in the control group was lower across time compared to the mindfulness group (Table 1).

We also hypothesized that individuals in the mindfulness group would have lower levels of hostile attribution bias after the intervention compared to those in the control group. Though past research has found that mindfulness can decrease aggression (Borders et al., 2010; Heppner et al., 2008; Singh et al., 2007), and thus levels of hostile attribution bias due to their strong positive correlation (Bailey & Ostrov, 2008), we did not find support for the hypothesis that mindfulness decreases hostile attribution bias. One potential reason as to why there was no support for this hypothesis is because the hostile attribution measure was placed last in the questionnaire. Not only is it likely that the participants were mentally disengaged from the questionnaire by the time they reached this measure, but this measure consisted of lengthy paragraph scenarios that the students needed to read in order to appropriately answer the questions. Qualitative data collected from the teachers suggested that the length and difficulty of the paragraph scenarios were “too much,” or too difficult, for a

majority of their students. Past research has indicated that when students are mentally fatigued they are less likely to pay attention (Boksem, Meijman, & Lorist, 2005).

Contrary to prior research that suggests that attitude impacts the effects of mindfulness (Grabovac et al., 2011; Kabat-Zinn, 2003; Seligman & Schulman, 1968; Shapiro et al., 2006), our findings did not support our hypothesis that there would be a moderated relationship between the effect of willingness and levels of mindfulness, reappraisal, attentional control or hostile attribution bias. Instead, our findings found that levels of willingness did not have any impact, positive or negative. One potential explanation for why willingness had no impact could be because our measure for willingness only included three items, which did not accurately assess the extent to which the students were participating in the mindfulness. Furthermore, on average, only half of participants in the mindfulness condition completed the willingness measure. It is hard to accurately reflect the importance of willingness with such a small sample.

Furthermore, these results could be explained by research regarding motivation within self-determination theory (Deci & Ryan, 1985). Specifically, this theory proposes that there is an important distinction between autonomous motivation, or intrinsic motivation, and controlled motivation, or externally regulated motivation (Deci & Ryan, 2008). Past research suggests that when individuals are autonomously motivated, they have greater psychological outcomes and perform better on tasks (Deci & Ryan, 2008). Though research suggests that mindfulness encourages autonomous motivation (Deci & Ryan, 2008), because our study was in a school setting there may have been an underlying sense of controlled motivation, leading to participants feeling

less willing to engage. Future research should continue to examine how motivation, and willingness, may impact the results of mindfulness.

Lastly, in order to test our theoretical framework (Figure 1), we hypothesized that there would be a positive correlation between levels of mindfulness and reappraisal and attentional control and a negative correlation between levels of mindfulness and hostile attribution bias. Furthermore, we hypothesized that there would be a negative correlation between reappraisal and hostile attribution bias, as well as attentional control and hostile attribution bias. Our hypotheses were partially supported by our findings. Bishop et al.'s model (2004) proposed that both awareness and attention are key components within mindfulness. Our study furthered research on mindfulness by proposing attentional control instead of attention and reappraisal instead of awareness. Our study found partial support for this model. As hypothesized, attentional control was positively correlated with mindfulness and negatively correlated with hostile attribution bias. However, reappraisal was not correlated with mindfulness or with hostile attribution bias.

The positive support for our hypotheses regarding attentional control suggests that it may be a key psychological component within mindfulness. One possible explanation for the positive relationship between attentional control and mindfulness is that mindfulness encourages individuals to pay attention to the present moment. Consistent with previous research, mindfulness encourages individuals to regulate their attention by way of non-elaborative awareness of an individual's thoughts, feelings, and sensations (Bishop et al., 2004). The inhibition of elaborative awareness may also

provide an explanation for the negative correlation between attentional control and hostile attribution bias.

Our findings suggested that attentional control is negatively correlated with hostile attribution bias. Those who have high levels of attentional control are also more likely to have higher levels of self-control, or the ability to regulate various thoughts, feelings, and behaviors (Muraven & Baumeister, 2000). Hostile attribution bias requires individuals to exercise self-control when deciding how to respond to social situations, especially when there are negative emotions (Muraven & Baumeister, 2000). Furthermore, attentional control helps individuals respond less impulsively when engaging in social situations (Mischel & Ayduk, 2002). Future research should focus on how attentional control and aggression within hostile attribution bias are related.

While one response to the support for attentional control may be that attentional control is the *sole* component within mindfulness, we caution against this frame of mind. Mindfulness does not only encourage individuals to control their attention, but it also encourages non-judgmental awareness. Being able to focus one's attention on what one wants, or engaging in attentional control, is a part of mindfulness, but it is only one aspect of the underlying mechanisms of mindfulness. One way to continue this research is by expanding upon our theoretical framework and examining the role of decentering, instead of the broader mechanism of awareness or reappraisal, as a potential component. Although our intervention was not successful in increasing levels of mindfulness, reappraisal and attentional and reducing hostile attribution bias, future research should continue to explore the effects of mindfulness training. In addition,

there can be significant benefits that come from mindfulness practice, and future research should continue to explore the components within mindfulness in order to more fully understand how and why these positive outcomes arise.

Limitations

Our study included several general limitations that may have impacted our results. First, because our study was not based out of a lab, we were not able to control for every confounding variable in the classroom setting. For example, some students listened to music while participating in the mindfulness, while others had poor attendance and missed consecutive days of school. Further research should examine the extent to which the positive benefits from mindfulness interventions can occur depending on how one engages with the mindfulness.

Another possible limitation of our study is the repetitive nature of the mindfulness. When listening to a recording many times, it is easy to become less engaged, which may lead to students not actively engaging in focusing their attention or reframing situations. Future research should explore how different types of mindfulness, some passive, such as a mindfulness recording, and some more active, such as yoga or mindful eating could impact the benefits of mindfulness.

Another potential limitation is that it can be difficult to engage in mindfulness, even though research suggests mindfulness is non-esoteric (Grossman et al., 2004). Social facilitation theory suggests that individuals do poorly on difficult tasks when surrounded by their peers compared to those doing easy tasks (Ryan & Deci, 2000). One benefit to an 8-week long mindfulness program, such as MBSR, is that individuals have time to practice various types of mindfulness, such as mindfulness stretching or

silent retreats, where they become more comfortable with mindfulness techniques (Kabat-Zinn, 1982). Future research should examine the extent to which peer influence and perceived difficulty of mindfulness impacts potential benefits of mindfulness.

One difficulty within this study was the extent to which our sample differed from other populations. The high school the research was conducted at is considered an alternative high school and many students that attend have social or academic difficulties. Many teachers stated that the seven-minute mindfulness was too long and keeping the students engaged was difficult. Further, one major limitation of this study was the extent to which the participants attended school. For example, out of a school that has a student enrollment of 160 students, only one third completed the pretest and posttest. This lack of attendance raises questions about how frequently and consistently one needs to engage in mindfulness for there to be benefits.

Implications

Overall our study provides important implications for future research involving mindfulness interventions and the theoretical framework behind mindfulness. Although our intervention did not lead to the predicted beneficial results, like many mindfulness interventions have done in the past, we still received positive feedback from the teachers and school regarding the mindfulness, such as it encouraged active listening and added a sense of routine. Future research should continue to examine the potential role mindfulness can play in a school setting. Furthermore, the support for attentional control as a component of mindfulness adds to the growing body of literature attempting to operationalize mindfulness. The role of attentional control within

mindfulness also has important implications with regard to other executive processes that might benefit from mindfulness.

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Table 1

Means and Standard Deviations for the Levels of Mindfulness, Reappraisal, Attentional Control, and Hostile Attribution Bias by Condition and Time

Construct	Mindfulness Condition				Control Condition			
	Pretest		Posttest		Pretest		Posttest	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
CAMM	1.91	0.82	1.83	0.62	2.05	0.65	2.03	0.67
Reappraisal	3.98	1.27	4.21	1.20	4.22	1.02	4.04	0.92
AC	2.37	0.38	2.46	0.39	2.41	0.41	2.50	0.32
HAB	3.31	0.59	3.27	0.67	3.05	0.53	2.88	0.67

Note. CAMM refers to the Child and Adolescent Mindfulness Scale, which ranges from 0 to 4. The reappraisal scale ranges from 1 to 7. AC refers to Attentional Control, which ranges from 1 to 4. HAB refers to Hostile Attribution Bias and this measure ranges from 1 to 5.

Table 2

Relations Among the Averages of Key Variables at Pretest and Posttest

	Variable								
	1	2	3	4	5	6	7	8	9
1. CAMM Pretest	1.00	.70**	-.11	.18	.32**	.32**	-.28**	-.19	-.15
df	99	69	95	67	92	67	87	66	52
2. CAMM Posttest		1.00	.11	.21	.31*	.41**	.01	-.14	-.02
df		81	67	78	66	78	63	77	37
3. Reappraisal Pretest			1.00	.51**	.06	.15	.16	.22	.13
df			95	65	91	65	86	64	49
4. Reappraisal Posttest				1.00	.21	.35**	-.08	.10	.01
df				79	64	77	61	76	35
5. AC Pretest					1.00	.65**	-.23*	-.27*	-.08
df					92	64	87	63	46
6. AC Posttest						1.00	-.16	-.24*	-.03
df						79	61	78	36
7. HAB Pretest							1.00	.57**	.17
df							87	63	43
8. HAB Posttest								1.00	.05
df								78	36
9. Willingness									1.00
df									56

Note. CAMM stands for mindfulness, AC stands for attentional control, HAB stands for hostile attribution bias. DF stands for degrees of freedom, and they were reported for each because participation for each measure varied. * $p < .05$. ** $p < .01$.

Table 3

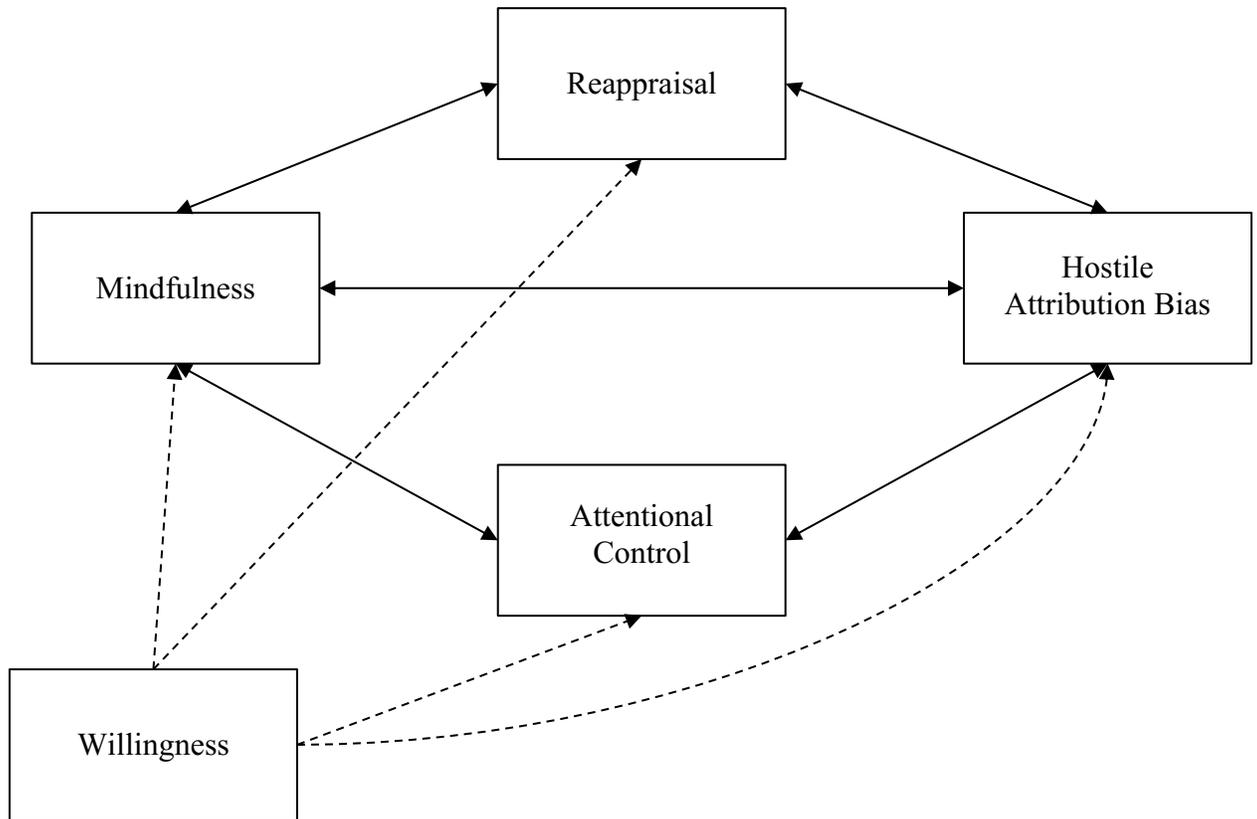
Means and Standard Deviations for the Levels of Mindfulness, Reappraisal, Attentional Control, and Hostile Attribution Bias by Willingness Group and Time

Construct	Low Willingness				High Willingness			
	Pretest		Posttest		Pretest		Posttest	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
CAMM	2.12	0.79	1.90	0.64	1.82	0.73	1.85	0.60
Reappraisal	3.90	1.23	4.13	1.30	3.92	1.30	4.08	1.07
AC	2.46	0.41	2.50	0.43	2.35	0.36	2.46	0.38
HAB	3.28	0.55	3.15	0.74	3.24	0.61	3.26	0.58

Note. CAMM refers to the Child and Adolescent Mindfulness Scale, which ranges from 0 to 4. AC refers to Attentional Control, which ranges from 1 to 4. The reappraisal scale ranges from 1 to 7. HAB refers to Hostile Attribution Bias and this measure ranges from 1 to 5.

Figure 1

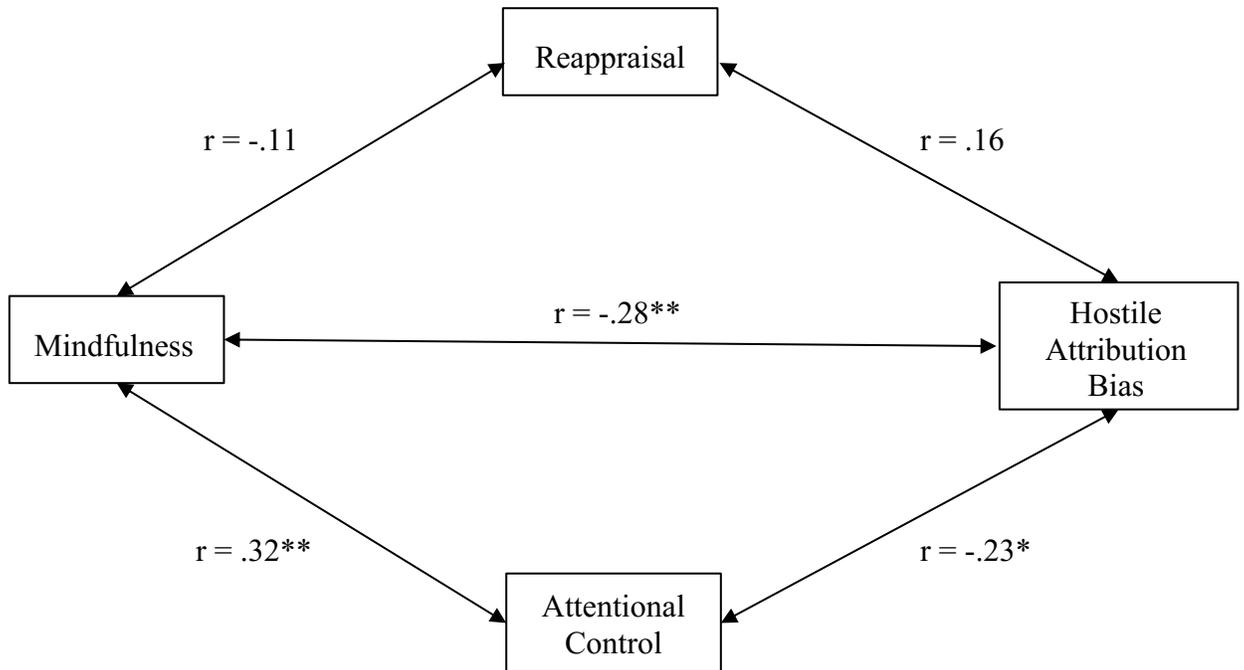
Working Model of the Relationship between Mindfulness, Reappraisal, Attentional Control, and Hostile Attribution Bias



Note. The dotted lines reflect the hypothesis that level of willingness will act as a moderator for mindfulness, reappraisal, attentional control, and hostile attribution bias.

Figure 2

Correlations on Theoretical Model of the Relationship Between Mindfulness, Reappraisal, Attentional Control and Hostile Attribution Bias at Pretest



Note. * $p < .05$. ** $p < .01$.

Appendix 1

Meditation for Working with Difficulties

You can use this practice to work with difficult emotions or body sensations
Find a posture that's comfortable to you
And then check inside your body and try to locate a part of your body that feels good to you right now
Pleasant, safe, at ease,
Or at the very least, neutral
You can check out your hands or feet or legs
But let your attention go to this pleasant part of your body
Hands or feet or wherever you've chosen
And let your attention rest there
Feel it
Sense it
Notice what those sensations are
Let your mind relax a bit
Feeling that part of the body
And now if there's something difficult that's happening for you
A difficult emotion, or a physical sensation that's hard
Let your attention go to that
So it may be an aching in your shoulder or back
Or a headache
Or it could be a sense of sadness
Or anxiety
Or anger
Where do you feel that sensation in your body
Where do you feel that emotion in your body
Notice it
Just notice it for one moment
Tap into it
Feel it
Make sure to breathe
And now return your attention back down to that area that feels at ease
Your hands or feet or legs
And just let yourself stay there for a moment
Feeling it sensing it
Relaxing. maintaining the mindfulness
Yet giving yourself a break from what could be potentially overwhelming to feel
And now once again return your attention to that part of the body that feels unpleasant
The body ache or pain
Or the emotion the sensations of the emotion in your body
The vibrations in your chest
Or the clenching in your belly
Or the tightness in your jaw

Just notice
And breathe
And let it be there
Let whatever is there, be there
And then bring your attention again back down to this pleasant or neutral part of the
body
Hands, feet, so forth
Relaxing
Staying present and alert
Feeling the safety
The connection in that place
Now let yourself stay connected to this place
But see if you can cast what we might call a sidelong glance at the difficult area in your
body
Is it possible to still feel connected to your body in the area that feels good
And yet know there's something going on that feels unpleasant
And just let it be there
Keeping maybe 75% of your attention on the part that feels peaceful and at ease
Still breathing
Casting the side long glance at this difficult area
Noticing what happens to it, is it growing or shrinking
Is it changing, shifting into something else
Becoming aware of whatever it is it's doing
Relaxing, breathing
And now see if you can bring some loving kindness
Just some kindness to yourself for whatever you're feeling right now
Physical pain, emotional pain
Hold yourself with kindness
You're not the only one
So may we all be free from our pain and our suffering
May we all have happiness
[bell rings]

Note. This transcript was taken from Mindful Awareness Research Center (MARC)
UCLA.