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Effects of Mindfulness Training on Stress, Mood and Coping in College Students

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Effects of Mindfulness Training on Stress, Mood and Coping in College Students

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Abstract

The present study examined the stress-reducing effects of a mindfulness meditation (MM) intervention in college students compared with a progressive muscle relaxation (PMR) exercise and a control group. The participants were 43 Connecticut College students high in interpersonal sensitivity. In the two experimental sessions, participants learned the stress-reduction techniques. Perceived stress, mood, coping and cortisol levels were assessed pre-and post-intervention. Participants completed a follow-up four weeks after the second session. Repeated measures MANOVAS were used to assess changes in stress, mood and coping. There were no changes in perceived stress. Though avoidant coping, cortisol levels, and negative mood decreased in all groups, the MM group had higher positive mood post-intervention. Limitations and recommendations for future research are discussed.

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Effects of Mindfulness Training on Stress, Mood and Coping in College Students

Though popular media often portrays the college experience as a carefree time during which students do little more than enjoy themselves, the experience of stress may be endemic to college life. In addition to the obvious academic and vocational concerns, college students frequently report distress related to issues in interpersonal relationships (Jackson & Finney, 2002). This can become problematic when students resort to unhealthy methods to cope with stressors, such as alcohol abuse and other self-destructive behaviors. Around 31 % of college students report drinking behavior that meets the criteria for an alcohol abuse diagnosis and estimates are that 150,000 college students develop alcohol-related health problems (Hingson, Heeren, Zakocs, Kopstein & Wechsler, 2002; Knight et al., 2002). Between 1.2 and 1.5 % of college students reported attempting suicide within the past year as a result of drinking or drug use (National Institute on Alcohol Abuse and Alcoholism, 2007). Due to the prevalence of these unhealthy coping behaviors in response to interpersonal stressors, many college students could benefit from learning more effective methods of coping. Mindfulness meditation, a method of bringing awareness to the present moment, has been found to be effective in reducing stress in both clinical and non-clinical populations (Grossman, Ludger, Schmidt, & Walach, 2003). Mindfulness meditation could provide a healthy method of coping with interpersonal stress for college students and offer a valuable addition to traditional relaxation and imagery techniques.

A Theoretical Paradigm for Stress and Coping

Theoretical perspectives on stress have examined both its objective and subjective

dimensions. Though there is no complete consensus on the meaning of stress, it is often considered to be a relationship between life events and the way that people experience them. Lazarus (1986) theorized that the degree to which an event was considered to be stressful depended on its appraisal. Primary appraisal is an assessment of the amount of risk perceived in the stressor and secondary appraisal is the determination of a person's ability to manage it. According to Lazarus, "Primary and secondary appraisals converge to determine whether the person-environment transaction is regarded as significant for well-being, and if so, whether it is primarily threatening (containing the possibility of harm or loss) or challenging (holding the possibility of mastery or benefit)" (Lazarus, 1986 p. 993). Though many people may experience stressors in the same way, individual personality factors play a role in determining the impact of a negative event. Life events scales have only shown correlations between .2 and .3 between negative life events and illness, a modest relationship that indicates other factors may be involved (Lazarus, 1990).

Stressors produce varying levels of distress depending on their characteristics, including duration, frequency, dimension (major or minor), and whether they are undesirable or desirable events. For example, minor stressful events, often termed daily hassles, may be more predictive of pathologies than major life stressors, because daily hassles are chronic and recurrent (Monroe & Simons, 1991). However, research on daily hassles has often failed to capture the temporal, dimensional and qualitative characteristics of daily stressors. Hassle questionnaires present a list of general events and require people to evaluate the level of stress that the event produced. The questionnaires include events such as "making decisions" and "physical appearance,"

which may be interpreted very differently for each individual and provide little generalizability about stressors (Brown, 1990). Brown provides a more useful paradigm for examining stressors, which is ". . . the identification of specific types of critical events in terms of likely meaning for a typical person in that biographical context" (Brown, 1990, p. 20).

Diathesis stress theories offer a method for examining whether life stressors have a negative impact on the individual. These theories have mainly examined the relationship between stress and depression. Monroe and Simons (1991) described diathesis-stress theories as such: "The basic premise is that stress activates a diathesis, transforming the potential of predisposition into the presence of psychopathology" (p. 406). For example, people who are predisposed by genetic or environmental factors to depression may be particularly affected by stressful events. The diathesis interacts with major acute stressors and repeated life difficulties and leads to the development of depression.

People's perceptual tendencies can lead them to appraise events in a negative way, and this negative appraisal contributes to risk of psychological distress. Research has shown that people with specific cognitive vulnerabilities are more likely to become depressed when they face stressors related to their areas of vulnerability (Nelson, Hammen, Daley, Burge, & Davila, 2001). In particular, Beck theorized that sociotropy, which involves sensitivity to interpersonal relationships, and autonomy, which is characterized by achievement strivings, were related to depression in the areas of relationships and achievement, respectively (cited in Nelson et al., 2001). Cognitive styles may affect the frequency of exposure to certain stressors and the degree to which

they produce distress. Cognitive vulnerabilities may lead people to generate their own stressors, perpetuating an unhealthy cycle (Nelson et al., 2001). This can be problematic in interpersonal relationships, as illustrated below:

> "For example, someone with a high affiliative vulnerability may be especially sensitized to interpersonal interactions in key relationships. Vigilant to possible signs of impending rejection, he or she makes constant demands for assurance and security. Relatively benign interpersonal exchanges may take on major personal meaning; over time the behavior becomes increasingly cloying, and eventually precipitates the very circumstance it was intended to avoid (i.e. rejection)." (Monroe & Simons, 1991, p. 411)

The interplay among personality, cognitions, and behavior in stressful experiences is complex. People may experience increased stress due to the way that they process events. The stress generation process could be related to the frequency that a person thinks about a stressor in addition to the perception of the stressor's severity. Research has shown that a tendency toward rumination is related to mental distress and depressive symptoms. Rumination can be described as ". . .the cognitive rehearsal of past events (unbidden or deliberate) and compulsive focusing on the negative aspects of an experience" (Wade, Vogel, Liao & Goldman, 2008, p. 420). Though rumination is generally a dispositional tendency, it is a process that can occur in individuals without this disposition who experience an acute, but highly stressful, event, such as an interpersonal offense (Wade et al., 2008). People who ruminate on their stressors may reflect on their experiences purposefully, but often rumination involves intrusive thoughts that arrive without intention. Intrusive cognitions could play a role in the experience of

stress, for they are related to psychological distress in the case of post-traumatic stress disorder and depression (Reynolds & Brewin, 1998). Reynolds and Brewin (1998) found that intrusive cognitions were also common in non-clinical populations, particularly in the form of elaborative cognitions, future-oriented thoughts, and images from memory. This provides an indication that ordinary individuals do experience a certain degree of psychological distress in relation to stressors and the ways in which they think about stressful events.

How do people cope with stressors and their resulting negative emotions and thoughts? Coping is defined as "The person's constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the person's resources" (Lazarus, 1986, p. 993). Theoretical perspectives on coping have generally focused on two coping functions: emotion-focused coping, which helps to regulate stressful emotions, and problem-focused coping, which involves taking concrete steps to manage the stressor (Lazarus, 1986, 1990, 2006). People tend to have a habitual way of coping, but they adapt their methods depending on the context. The process of coping is dependent on both personality and social factors (Lazarus, 2006).

Interpersonal relationships are both sources of stressors and a resource for managing them. According to Lazarus (2006), ". . .We are constantly appraising-that is imputing relational meaning to our ongoing and changing relationships with others and the physical environment, and it is this meaning that shapes and defines our emotions" (p. 10). In a study of daily stressors in married couples, interpersonal stressors were the most predictive of distress and accounted for more than 80 % of variance in daily mood

(Bolger, DeLongis, Kessler, & Schilling, 1989). Nevertheless, emotional reactions to negative events can be mediated by support in relationships. Social support is an important dimension of coping. People with lower perceived emotional support are more likely to experience mood disturbance on a stressful day (Lazarus, 1998). Delongis and Holtzman (2005) argue that ". . .when support is lacking from significant others, or when one is dissatisfied with support provided, individuals may be more likely to engage in maladaptive or counterproductive modes of coping that have negative repercussions for their own well-being" (p. 1646).

Stress and Coping Methods in College Students

The influence of interpersonal relationships on stress and coping may be particularly important in college students. Students in college are generally faced with the challenge of discovering who they are and how they relate to others. Erikson theorized that identity formation and the development of intimate relationships were the important developmental tasks of adolescence and young adulthood (cited in Jackson & Finney, 2002). Interpersonal relationships influence an individuals' sense of coherence, which is defined as ". . . a stable feeling of confidence that one's environment, internal and external, will be both predictable and reasonable" (Darling, McWey, Howard, and Olmstead, 2007, p. 215). Stress in relationships is negatively associated with a sense of coherence in college students (Darling et al., 2007). College students who experience stress related to affiliative opportunities, such as friendships and intimate relationships, are more likely to have symptoms of depression, anxiety, anger and hostility than students who do not have stress in these areas (Jackson & Finney, 2002). College students describe isolation from friends and family as a significant source of stress

(Darling et al., 2007). Interpersonal stressors may be particularly distressing because they threaten social support.

There are a number of personality factors related to college students' stress in interpersonal relationships. Students who value relationships or who have specific cognitive vulnerabilities to relationship issues may experience more interpersonal stress. One such personality factor is unmitigated communion, which Nagurney (2007) describes as " . . .the tendency to focus on relationships rather than one's own needs or desires" (p. 267). Students high in unmitigated communion were more sensitive to the effects of interpersonal stress than students low in unmitigated communion on measures of vitality, mental health, anxiety, depression, and positive and negative affect (Nagurney, 2007). Sociotropy, another personality characteristic that involves a focus on relationships and reactivity to interpersonal stressors, is associated with perceived social stress, anxiety, depression, and avoidant coping methods in undergraduates (Connor-Smith & Compas, 2002). However, the connection between sociotropy and interpersonal stressors is not completely understood. Nelson and his colleagues (2004) showed that adolescent women high in sociotropy tended to experience more achievement stress and women high in autonomy, in particular a need for control, were more vulnerable to increases in chronic interpersonal stress. In adolescent women, initial depressive symptoms and poor interpersonal problem solving predicted high levels of interpersonal stress, which predicted future depression (Davila, Hammen, Burge, Daley, & Paley, 1995). Research suggests that personality traits related to interpersonal stress lead college students to use ineffective coping methods when faced with interpersonal stressors, and that in doing so, the individuals generate more stress for themselves

(Connor-Smith & Compas, 2002; Davila et al., 1995; Nagurney, 2007). For example, students high in sociotropy mainly use disengagement coping, which amplifies the relationship between sociotropy and distress (Connor-Smith & Compas, 2002).

College students high in stress may have difficulty managing their stressors. Students with high levels of stress are more likely to have worse health habits than students with lower stress levels (Hudd, Dumlao, Erdmann-Sager, Murry, Phan, Soukas & Yokozuka, 2000). Students who lack effective methods of coping may take efforts to distance themselves from their problems by using drugs and alcohol. College students high in stress have stronger positive expectancies about the effects of alcohol and are more likely to use alcohol to cope than people lower in stress (Willams & Clark, 1998). These unhealthy habits that begin in college can persist throughout adulthood. Following college, men and women are increasingly likely to report stress-reduction as their primary motivation for drinking (Perkins, 1999). For postcollegiate men and women, stress-related drinking was associated with greater frequency and quantity of consumption (Perkins, 1999). In order to curb these behaviors, students high in stress may need to learn adaptive coping strategies and methods of stress reduction.

Mindfulness as a Stress Reduction Strategy

One stress reduction intervention that is becoming increasingly popular is the practice of mindfulness meditation. Mindfulness meditation finds its origins in Buddhist philosophy. Buddhists emphasize the importance of living in the present moment and practicing mindful awareness as a way of freeing the self from suffering and developing compassion for all beings. The practice of mindfulness can be described as ". . . remembering to be present in all our waking moments" and involves acceptance of all

experience without judgment (Kabat-Zinn, 1990, p. 29).

The practice of mindfulness is characterized by four important skills, which include mindful observations of internal and external experience, mindful description of observations, acting with awareness, and nonjudgmental acceptance (Baer, 2004; Dekeyser, Raes, Leijssen, Leysen, & Dewulf, 2008). The first skill, mindful observation requires an individual to bring attention to bodily processes (such as breathing), thoughts, and emotions, as well as to external stimuli. A person who is consciously observing phenomena can practice the second skill of describing or labeling their experience (Baer, 2003; 2004). Thich Nhat Hanh, a Zen Buddhist, advises practitioners of mindfulness meditation to label their feelings as such: "When a feeling of sadness arises, immediately recognize it: 'A feeling of sadness has just arisen in me'" (1975/1976, p. 38). The third mindfulness skill involves bringing awareness to behaviors by focusing completely on an activity (Baer, 2004). A person can act with awareness in any activity, from sitting meditation, to walking down the street, to studying for an exam, by simply putting all focus on that one action. The fourth mindfulness practice, nonjudgmental acceptance involves taking in all experience without evaluating it negatively. In doing so, a person can ". . .allow reality to be as it is without attempts to avoid, escape, or change it" (Baer, 2004, p. 194). For example, using this skill a person who experiences aversive cognitions or emotions can take a realistic problem-focused coping approach instead of denial or avoidant methods.

Mindfulness can be effective as a coping strategy for stress because it requires people to recognize stressors instead of avoiding them (Baer, 2003). Also, observing mindfully allows people to "develop control of attention, a useful skill for individuals

who have difficulty completing important tasks because they are distracted by worries, memories, or negative moods" (Baer, 2003, p. 130). Dispositional mindfulness is inversely related to neuroticism, trait anger, and depressive symptoms, and it may be useful for individuals to develop this skill in order to overcome emotional distress (Feltman, Robinson & Ode, 2009). Practicing mindfulness can help people to stop ruminating on their stressors and focus on the things that they need to do. For people whose distorted perceptions lead them to perceive stress across situations, mindfulness could provide means to change their perceptions. If people mindfully observe things as they are actually occurring, they may learn to appraise their stressors more accurately. Mindfulness could allow people to see their stressors as less threatening and more manageable. Mindful awareness can also help people to more successfully translate their intentions into behavior by increasing their self-control and ability to focus (Chatzisarantis & Hagger, 2007).

In interpersonal relationships, mindfulness can promote healthy interactions. Mindfulness is associated with a number of adaptive interpersonal behaviors. People who are high in mindfulness are more accepting and empathetic towards others and less distressed by interpersonal issues. Dekeyser and his colleagues (2008) conducted a factor analysis of the Kentucky Inventory of Mindfulness in a Dutch sample and examined its correlations with measures of interpersonal reactivity, social assertiveness, alexithymia (difficulty understanding and expressing feelings), and body satisfaction. They found that the four mindfulness skills are negatively related to distress contagions (personal distress when witnessing distress in others), negatively related to social anxiety and positively related to body satisfaction (Dekeyser et al., 2008). Beitel, Ferrer, and Cecero

(2004) administered self-report measures of psychological mindedness, mindfulness, interpersonal reactivity and self-consciousness to undergraduates in order to determine correlations among the measures. They found that psychological mindedness, a concept that involves awareness of psychological processes, was positively related to mindfulness and empathy and negatively related to interpersonal distress.

The quality of mindfulness can help people to communicate more effectively with others, as "verbal and nonverbal message elements can be manipulated intentionally to elicit more thoughtful, creative, and flexible states of mind" (Burgoon, Berger, & Waldron, 2000, p. 112). Mindfulness is also associated with interpersonal effectiveness (Wupperman, Neurmann, & Axelrod, 2008). Shaver, Lavy, Saron, and Miklincer (2007) argue that mindfulness is related to secure attachment, in that people who are securely attached to their caregivers develop the capacity "to remain mindful of what is happening within and around them, analyze problems (including other people's needs) more accurately and quickly, mobilize effective coping strategies, and more easily endure inevitable periods of upheaval, loss, or trauma" (p. 267). People who are high in mindfulness are more skilled at coping with interpersonal stressors and can utilize social support effectively. These findings suggest that people suffering from chronic interpersonal stress could benefit from an intervention to increase mindfulness, which could reduce stress and help them to cope with issues in relationships.

There are a number of mindfulness-based interventions to reduce stress, but the most commonly used technique is one developed by Jon Kabat-Zinn (1990). His Mindfulness-Based Stress Reduction (MBSR) program is a rigorous 8-week program that teaches meditation practices along with yoga and requires people to practice mindfulness

in daily activities (Kabat-Zinn, 1990). This program has been adapted for use with a variety of stress-related ailments, including chronic illnesses and psychological disorders. Mindfulness-based stress reduction has produced fairly strong and consistent effect sizes confirming mental and physical health benefits across a number of studies (Grossman, Niemann, Schmidt, & Walach, 2004; Baer, 2003). In a meta-analysis that examined the effectiveness of interventions incorporating mindfulness meditation, (though not necessarily MBSR), statistically significant improvements were found in physical and psychological symptoms for people suffering from chronic pain, mood disorders, and chronic illnesses (Baer, 2003). Baer (2003) also found significant effects of mindfulness meditation in reducing stress in non-clinical populations. Studies in which eight-week MBSR courses were completed by medical and college students and community volunteers yielded medium to large effect sizes ranging from 0.5 to 1.51 (Baer, 2003).

The use of mindfulness training in certain clinical populations has shown that it is effective in reducing some symptoms of stress related to interpersonal issues. Social anxiety disorder involves feelings of stress and anxiety related to interpersonal interactions, fear of negative evaluation, and avoidance of social situations (Koszycki, Benger, Shlik & Bradwejn, 2007). A study of patients with generalized social anxiety disorder showed that an eight-week MBSR training was as effective as a 12-week cognitive-behavioral therapy treatment, the standard treatment for social anxiety disorder in producing significant improvements on measures of social anxiety, mood, disability, and quality of life (Koszycki et al., 2007). In this study, an instructor who was not a mental health professional and had no previous experience working with social anxiety disorder patients administered the MBSR training, which provides evidence that MBSR

is an effective intervention that can be easily adapted in a number of settings (Kosycki et al., 2007).

Mindfulness-based cognitive therapy, an eight-week program based on MBSR, was found to be more effective in reducing depressive symptoms and improving psychological and social quality of life than an intervention to maintain adherence to antidepressant medication (Teasdale et al., 2008). Mindfulness training can also be incorporated into treatment for borderline personality disorder, a mental disorder influenced by a lack of mindful attention and acceptance towards thoughts and emotions, which ". . . may play an important role in maladaptive coping strategies that contribute to the difficulties with emotion regulation, impulsivity, and interpersonal functioning that have been found to be definitional of the disorder" (Wupperman, Neurmann, & Axelrod, 2008, p. 467). Huss and Baer (2007) describe a case study of a woman with borderline personality disorder who was treated with mindfulness-based cognitive therapy in addition to traditional dialectal behavior therapy (DBT). As a result of this combined treatment, the woman became more aware of her thoughts and emotions, experienced a decrease in depression and anxiety, and improved her communication in interpersonal relationships. Research indicates that for certain psychological disorders that include symptoms of stress, anxiety, and maladaptive coping in interpersonal relationships, mindfulness training can be an effective way of reducing symptoms and improving functioning (Huss & Baer, 2007; Koszycki et al., 2007; Teasdale et al., 2008; Wupperman et al., 2008).

Mindfulness Training and Cortisol Measurement

In addition to self-report measures of stress, neurohormonal stress responses can provide objective information about stress levels. When a person is exposed to a stressor, the hypothalamic-pituitary-adrenocortical (HPA) axis is activated. The hypothalamus, which controls the autonomic nervous system, signals the adrenal gland to secrete the hormone cortisol in the body. Cortisol then can prepare the body to deal with stress by activating defense reactions (Michaud, Matheson, Kelly & Anisman, 2008). Cortisol levels are often used as a measurement of stress levels and levels are typically elevated in response to laboratory stressors, particularly those that involve "uncontrollable social evaluative threat" (Michaud, Matheson, Kelly, & Anisman, 2008). Izawa et al. (2008) measured cortisol levels in response to an acute psychosocial stressor and found that levels increased and peaked 10 minutes after the administration of the stressor. Marin et al. (2007) found that young women who were experiencing chronic interpersonal stressors had higher cortisol levels when exposed to severe episodic stressors than women with lower levels of chronic interpersonal stress. They gave the adolescent women an in-depth life stress interview that focused on stressful issues in relationships and asked the women to rate the level of stress, then collected cortisol samples over the course of two days. They found that there was an interaction between chronic and episodic stressors that predicted cortisol output throughout the day (Marin et al., 2007).

Due to the relationship between cortisol secretion and stress, there is some evidence that mindfulness-based interventions may be helpful for reducing cortisol levels. In a study of breast cancer patients enrolled in a MBSR program, the patients who participated in MBSR had lower cortisol levels than the control group who did not receive MBSR training. Additionally, after completing the MBSR program the patients'

cortisol levels were decreased (Witek-Janusek, Albequerque, Chroniak, Chroniak, Durazo-Arvizu, & Mathews, 2008). However, in other populations, such as health care professionals and faculty at a university, eight-week mindfulness-based stress reduction programs produced no change in cortisol levels over time (Galantino, Baime, Maguire, Szapary, & Farrar, 2005; Klatt, Buckworth, & Malarkey, 2009). This may be due to the fact that salivary cortisol levels can be affected by a number of confounding variables that were not controlled in these studies, such as diet and physical activity (Galantino et al., 2005). Also, these studies assessed cortisol levels over time, whereas it may be simpler to assess changes in cortisol levels in response to an acute laboratory stressor (Galantino et al., 2005; Klatt et al., 2009). In a group of college students who completed a six week-compassion meditation, there were correlations between the amount that the students practiced and their innate immune responses to a laboratory stressor, but no correlation between amount of practice and cortisol responses (Pace et al., 2009). In contrast, a later study showed that innate immune responses to the laboratory stressor did not predict the amount that students practiced the compassion meditation (Pace et al, 2010). The effect of mindfulness training on cortisol levels in non-clinical populations warrants further study.

Mindfulness Training for College Students

Mindfulness-based interventions may also be useful for reducing interpersonal stress and improving coping strategies in non-clinical populations, such as college students. College students high in trait mindfulness are less likely to appraise situations as stressful and less likely to use avoidant coping strategies than students lower in mindfulness (Weinstein, Brown, & Ryan, 2009). Shapiro, Schwartz, and Bonner (1998)

found that premedical and medical students who participated in an eight-week mindfulness based intervention had reduced levels of self-reported psychological distress and anxiety as well as increased empathy. These effects have the potential to improve interpersonal functioning, as students become less distressed and more empathetic in their relations with others. Undergraduates who completed mindfulness-based training programs had greater decreases in perceived stress and rumination and increases in forgiveness than those in a control group at an 8-week follow-up (Oman, Shapiro, Thoresen, Plante, & Flinders, 2008). A Zen breath meditation, which involves a mindful focus on breathing, was found to have a greater effect on reducing interpersonal problems in college students than a relaxation exercise or a control (Tloczynski & Tantriella, 1998). This suggests that interpersonal stress in college students could be managed more effectively by the focused attention of meditation than by simple relaxation (Tloczynski & Tantriella, 1998).

Mindfulness interventions can help college students to reduce generalized symptoms of stress and anxiety by requiring them to pay attention and accept their thoughts and emotions. These interventions may help them to appraise stressors in their relationships as more manageable and less threatening. Mindfulness techniques also promote acceptance of others as shown by increases in empathy and forgiveness in undergraduates (Oman et al., 2008; Shapiro et al., 1998). College students can learn to use mindfulness to cope with relationship issues by taking the perspectives of others, accepting them without judgment, and listening compassionately (Shapiro et al., 1998). Oman and his colleagues (2008) discussed how mindfulness meditation can help students to “tap motivational supports” which “may assist with major meaning-related

developmental challenges, such as career choices, attaining emotional independence from family, and forming enduring personal relationships" (p. 575). The qualities that mindfulness training develops seem to facilitate interactions and help college students to cope with daily stressors, suggesting that a mindfulness intervention is an appropriate technique for college students.

Research has shown that even brief mindfulness interventions can be effective for undergraduates (Ditto, Eclache & Goldman, 2006; Tang et al., 2007). Ditto, Eclache, and Goldman showed that only two sessions of mindfulness meditations were able to reduce stress as shown by physiological measures. They found that for a group of college students, listening to a twenty-minute mindfulness meditation audiotape caused respiratory sinus arrhythmia to increase significantly, and thus enhanced parasympathetic nervous system activity more than progressive muscle relaxation or sitting quietly (Ditto et al., 2006). Another short-term intervention incorporating mindfulness produced significant improvement on measures of anxiety, depression, anger, fatigue, and vigor in Chinese undergraduates after five days of 20-minute sessions (Tang et al., 2007). This method, which is very similar to MBSR, is called integrative body-mind training (IBMT) and "stresses no effort to control thoughts, but instead a state of restful alertness that allows a high degree of awareness of body, breathing, and external instructions from a compact disc" (Tang et al., 2007, p. 17152). Mindfulness-based interventions can also be helpful to change maladaptive health behaviors among undergraduates. A single 90-minute mindfulness-based intervention for college student cigarette smokers was found to reduce smoking rates over a seven-day follow-up period, compared with other similar interventions that did not include mindfulness training (Bowen & Marlatt, 2009).

Tloczynski & Tantriella (1998) implemented a Zen breath meditation intervention for college undergraduates that involved only a one-hour instructional session along with 20 minutes of independent practice per day over the course of three weeks. Students who practiced this short-term meditation had significant improvements in college adjustment (Tloczynski & Tantriella, 1998). Even peer-led stress interventions can effectively reduce levels of anxiety and lower heart rate in an undergraduate population (Fontana, Hyra, Godfrey, & Cermak, 1999). A study done at a small liberal arts school found that both short-term and long-term mindfulness meditation interventions taught in a classroom setting reduced anxiety and negative affect and increased hope in undergraduates, and that this effect was mediated by reductions in cognitive distortions that came from practicing the meditations (Sears & Kraus, 2009).

The Present Study

The present study sought to examine whether a short-term mindfulness meditation intervention can reduce self-reported levels of stress and mood while increasing coping in college students. It compared the effects of the mindfulness intervention with a progressive muscle relaxation exercise and a control group. The present study also sought to determine whether cortisol levels increased in response to a writing prompt about an interpersonal stressor and whether they showed a greater decline after a mindfulness meditation session compared with the progressive muscle relaxation intervention. This study differed from previous research in that it examined both dimensions of acute and chronic stressors and looked at the effects of a short-term mindfulness intervention in a group of college students high in interpersonal sensitivity.

Due to the influence of interpersonal sensitivity on interpersonal stress, an initial

screening study was used to obtain participants high in interpersonal sensitivity. This study differed from previous research in that it examined the effect of mindfulness-based meditation on college students' experience of interpersonal stress using both qualitative and quantitative measures, including hormonal measures of stress. It also looked explicitly at the role that a personality factor of interpersonal sensitivity might play in mediating responses to a mindfulness intervention. It was hypothesized that students in the mindfulness meditation condition would experience greater improvements in measures of stress, mood and coping than students who practice progressive muscle relaxation or the control group who did not receive an active intervention. It was also hypothesized that students with the highest levels of interpersonal sensitivity would show the greatest benefits from the mindfulness intervention.

Method

Screening Study

In order to determine whether a mindfulness intervention could be effective in reducing interpersonal stress, an initial screening study was used to obtain participants high in interpersonal sensitivity. The participants were 103 Connecticut College students, both men and women, who volunteered to participate in the study. Participants were obtained for the screening study by posting a sign-up sheet in a main hallway in Bill Hall, the psychology building of Connecticut College. All participants were obtained on a volunteer basis and gave their informed consent to participate in the study. Participants in psychology courses received 15 minutes of research credit for their participation in this phase of the study.

Participants received an informed consent form, explaining that they would be asked to complete a questionnaire, and that they might be contacted to participate in a follow-up study on methods of stress reduction (see Appendix A). In the screening study, the researcher emailed the participants a link to the online questionnaire. This questionnaire was The Interpersonal Sensitivity Measure (IPSM), developed by Boyce and Parker (1989), which measures sensitivity to interpersonal stressors (see Appendix B). Boyce and Parker define interpersonal sensitivity as "undue and excessive awareness of, and sensitivity to, the behavior and feelings of others" and describe individuals high in this trait as "preoccupied with their interpersonal relationships, vigilant to the behaviour and moods of others, and overly sensitive to the vicissitudes of any interpersonal interaction" (p. 342). The IPSM contains 36 statements of feelings about the self and others, which are rated on a four-point Likert scale from 1 (*very unlike me*) to 4 (*very like*

me). The IPSM contains five subscales: interpersonal awareness, need for approval, separation anxiety, timidity, and fragile inner-self, which yield an overall score for interpersonal sensitivity. Sample questions include: "I worry about what others think of me" for the interpersonal awareness subscale and "After a fight with a friend, I feel uncomfortable until I have made peace" for the need for approval subscale. The Cronbach's alpha for the IPSM was found to be .85 in a clinical group and .86 in a non-clinical group of medical students. The reliability coefficients for the subscales ranged from .55 to .79 in both groups. In the non-clinical student group, the test-retest reliability was .70. The validity of the scale was shown by a significant correlation of .72 of IPSM scores with a clinical judgment of interpersonal sensitivity.

The participants were given the IPSM and instructed to answer all the questions honestly. The participants were also asked to complete the demographic questions at the end of the questionnaire. Upon completion of the questionnaires, the participants received a debriefing form, which provided them with details about the purpose of the study and contact information for the researcher (see Appendix C). The data were analyzed to determine the median score of the participants on the IPSM. The 60 students whose scores were at or above the median were contacted via email to participate in a follow-up study. Medians were determined separately for males and females in order to assure as many males as possible would be included in the next phase of the study.

Experimental Study: Research Design

The follow-up experimental study used a mixed research design to investigate the effects of mindfulness meditation on self-reported levels of stress and coping and on cortisol levels. The study examined both between-subjects and within-subjects factors.

Participants in the two experimental conditions were given either a mindfulness meditation intervention or a progressive muscle relaxation intervention. Participants in the control condition were not given an intervention, but were simply instructed to monitor changes in their stress levels over the course of the study. In all conditions, participants were asked to write about an interpersonal stressor that they were currently experiencing and how they coped with it. They also completed pre-intervention and post-intervention measures of perceived stress and mood. Additionally, in the second session participants provided salivary samples to assess cortisol levels at three intervals during the session: prior to exposure to the stressor of the writing prompt, after completing the writing prompt and the questionnaires, and after practicing the stress reduction interventions.

Participants

The participants were 43 Connecticut College students from the initial screening study, whose scores were above the median in interpersonal sensitivity and who agreed to participate in this experimental study. They received two and a half hours of course credit for their participation. Sixty students were contacted to participate in this follow-up study and 50 were able to participate in the first sessions, though 7 participants dropped out over the course of the study. The participation rate was 72 %. There were 8 men and 35 women. The sample was fairly homogeneous in terms of race: 92 % White, 6 % Asian, and 2% Native American. Of all the participants, 18 % were freshman, 34 % were sophomores, 18 % were juniors, and 30 % were seniors. The participants were randomly assigned to conditions. There were 15 students in the mindfulness meditation condition, 15 in the progressive muscle relaxation condition, and 13 in the control condition.

Twenty percent of participants reported never having practiced meditation, 76 % said they had some experience with meditation, and 4 % said that they practiced meditation often.

Materials

The participants received an informed consent form that explained the study was about stress reduction and interpersonal relationships, and that they were expected to participate in several sessions in order to learn a technique to reduce stress (see Appendix D). In both of the two sessions, participants in the mindfulness meditation condition listened to a ten-minute audio recording from a guided meditation CD by Jon Kabat-Zinn. The recording encourages the listeners to bring mindful awareness to their breathing and to the present moment while sitting in place. Participants in the progressive muscle relaxation condition listened to ten-minute audio recordings from the Total Relaxation CD by John Harvey, which describes how to relax the entire body by tensing and releasing the muscles. At the end of each intervention session, the participants in the mindfulness meditation condition received excerpts from the book *Full Catastrophe Living* by Jon Kabat-Zinn (1990) and participants in the progressive muscle relaxation received excerpts from *Total Relaxation: Healing Practices for Body, Mind & Spirit* by John Harvey (1998). They were expected to read these excerpts during the four weeks between the first and second sessions and in the time after the second session.

Demographic Information

The participants were given a sheet that asks for demographic information, including class year, age, gender, race/ethnicity and socioeconomic status (see Appendix E). It asked whether students had any prior experience with practicing meditation or

relaxation techniques.

Perceived Stress

The participants' overall level of stress was measured using the Perceived Stress Scale (PSS) developed by Cohen, Kamark and Mermelstein (1983: see Appendix F). The PSS is a 14-item scale that contains questions about thoughts and feelings related to stress, and asks participants to identify how often in the past month they experienced these thoughts or feelings on a 5-point Likert scale from 0 (*never*) to 4 (*very often*). The PSS is intended to measure subjective appraisals of stress, in particular "the degree to which respondents found their lives unpredictable, uncontrollable, and overloading" (Cohen et al., 1983 p. 387). Sample items include: "In the past month how often have you felt nervous and 'stressed'?" and ". . . how often have you found that you could not cope with all the things you had to do?" as well as reverse-scored items such as ". . . how often have you felt confident about your ability to handle your personal problems?" The scale reliability coefficients for the PSS at the three times it was administered in this sample were .77, .86, and .86, respectively. In a college student sample, the test-retest reliability was .85. The concurrent validity of the scale is shown by its significant correlations with measures of life events, which ranged from .24 to .49. The PSS was shown to have predictive validity for depressive and physical symptomatology, utilization of health services, and social anxiety.

Mood

The participants' mood was measured by an affect scale (Emmons & McCullough, 2003: see Appendix G). The scale contains 30 affect terms and participants are asked to rate the degree to which they felt each one in the past week on a scale from 1

(*not at all*) to 5 (*extremely*). The items include common affective states, such as "interested," "distressed," and "excited." A factor analysis of this scale showed that two factors, positive and negative affect, accounted for 59% of the variance. The scale's reliability coefficients ranged from .75 to .88. The wording of the mood scale was modified slightly to assess the participants' moods at specific times. The purpose of giving participants the mood scale was to determine their current mood, both before and after receiving stress reduction interventions. Therefore, the instructions on the mood scale were changed to read: "Please indicate the extent to which you are currently experiencing each feeling."

Cortisol Levels

In order to obtain an objective measurement of stress, cortisol levels were assessed. Cortisol measurements were obtained by having participants put a cotton ball in their mouths and removing it once saturated. They then expressed saliva out of the cotton into a collection vial. Samples were taken at the beginning of the session, prior to exposure to the stressor, and post-intervention. After the samples were collected, they were stored in a freezer until an enzyme immunoassay (kit manufactured by Salimetrics, State College, PA) was performed to quantify the amount of cortisol in the sample.

Coping

In addition to the quantitative measures, participants provided written responses to an open-ended question. The question read as follows: "Think of a current stressful situation in one of your close relationships, such as with a friend, a family member, or a romantic partner, and describe your reaction to it and any coping strategies you used to deal with it." To assess coping strategies, the responses were coded based on 11 of the

categories of the Brief Cope Scale (Carver, 1997). The categories of religious coping, substance abuse, and self-blame were omitted because they did not appear in any of the responses and food coping was added because it appeared in several responses. Raters coded for the absence or presence of each coping strategy at each of the three time periods. Certain coping strategies were combined to form three general categories of coping responses: healthy coping, avoidant coping, and social support. The coping strategies of active coping, planning, positive reframing, acceptance, and humor were combined into the category of healthy coping. The strategies of self-distraction, denial, venting, behavioral disengagement, and food coping were combined into the category of avoidant coping. The strategies of emotional support and instrumental support were combined into the category of social support. The participants' scores for the three categories of healthy coping, avoidant coping, and social support were obtained by adding up the number of coping strategies within that category that the participants used at each time period. This calculation produced scores for the three coping styles. The raters were blind to the research hypothesis. The Cohen's kappa for interrater reliability ranged from .66 to 1.0.

Procedure

Participants in the screening study whose scores on the IPSM indicated a high level of interpersonal sensitivity were contacted to participate in a follow-up study. These students gave their informed consent to participate in this study and agree to attend all experimental sessions. They received two and a half hours of course credit for their participation.

Students participated in two laboratory sessions that took place four weeks apart.

The participants were initially divided into groups of students based on the three experimental conditions. In the first session there were 18 students in the mindfulness meditation condition, 18 in the progressive muscle relaxation condition, and 14 in the control condition. The sessions took place in room 401 in Bill Hall. At the start of the first session for each condition the experimenter explained to the participants the following:

> "This study consists of two experimental sessions four weeks apart. You are required to attend both sessions in order to receive full credit for your participation, however if you feel uncomfortable at any point you may contact the researcher with questions or withdraw from the study. After the sessions the researcher will contact you via email with instructions to practice your technique and ask you to follow them. Four weeks after the second experimental session you will be contacted via email to complete a follow-up assessment on surveymonkey.com. The purpose of this study is to assess your current levels of stress and provide you with techniques for coping with stress. The techniques are intended to help with stress but they are not a substitute for psychological treatment. If you feel you might need counseling or other psychological services please contact Student Counseling Services at extension 4587. To begin the study, you will be asked to complete a series of questionnaires and a writing prompt. Please answer all questions as thoroughly as possible."

At this point, the experimenter distributed the PSS and mood scale. When participants finished these questionnaires, the experimenter distributed the open-ended question. The experimenter instructed the participants to read the question and write a

short response to it. Participants were told to write for three to five minutes and after five minutes the experimenter collected the responses. Upon completion of the questionnaires, the experimenter explained to the participants in the control condition that the session has ended. The experimenter explained:

> "Thank you for your participation in this first session. In four weeks, you will return for a second experimental session. In the time between, please make sure to monitor your levels of stress. Pay attention to increases or decreases in feelings of stress and the development of new stressors. Self-monitoring is a technique that has been found to be effective for stress reduction. You will be contacted via email with reminders to practice this technique and to remind you of the next session. If you have any questions, please feel free to contact the researcher."

The experimenter then provided contact information for the researcher. Over the next four weeks, participants in the control condition received weekly emails from the researcher reminding them to monitor their stress levels.

After completing the questionnaires, participants in the mindfulness meditation (MM) condition and the progressive muscle relaxation (PMR) conditions were asked to listen to the 10-minute audio recordings and practice the techniques described. For the MM condition the experimenters explained the following:

> "You are now going to listen to a ten-minute recording from a CD of guided mindfulness meditation by Jon Kabat-Zinn, a psychologist who has developed a mindfulness-based program to reduce stress. Mindfulness meditation involves bringing awareness to the present moment, observing, and accepting experience. This technique has been found to be successful in reducing stress. I will dim the

lights and have you sit comfortably to practice the technique. When the recording is finished, you will complete a short questionnaire."

Participants in the PMR condition were given the following instructions:

"You are now going to listen to a ten-minute recording from a CD of relaxation techniques by John Harvey. This recording will explain how to tense and relax specific muscle groups in order to achieve a complete state of relaxation in the body. This technique has been found to be successful in reducing stress. I will dim the lights and have you sit comfortably to practice the technique. When the recording is finished, you will complete a short questionnaire."

The experimenters dimmed the lights and instructed the participants to sit comfortably. The experimenter then played the CDs. After ten minutes, the experimenter stopped the tapes and turned on the lights. The participants sat up once again and completed the mood scale. After they finished, the experimenter concluded the session. The experimenter explained the following:

"Thank you for your participation in this first session. In four weeks, you will return for a second experimental session. In the time between, please try to practice this stress reduction technique as often as possible. You will receive literature excerpts about your technique to take with you and you will also receive emails from the researcher reminding you to practice. If you have any questions please feel free to contact the researcher."

The experimenter then distributed excerpts from the book *Full Catastrophe Living* by Jon Kabat-Zinn to participants in the MM condition and excerpts from *Total Relaxation: Healing Practices for Body, Mind & Spirit* by John Harvey to participants in

the PMR condition. The experimenter also provided contact information for the researcher. During the four weeks between sessions, participants received weekly emails reminding them to practice their stress reduction techniques.

In the second session for all three conditions the experimenter explained to the participants that they would once again complete a series of questionnaires. The experimenter also explained that in this session the experimenter would measure the participants' cortisol levels at three different times during the session. They explained the following to the participants:

> "The session will begin by getting a baseline measurement of your cortisol levels. Cortisol is a hormone secreted by the pituitary gland in response to stress. It will be measured by taking a saliva sample. You will put a cotton ball in your mouth and remove it once it is saturated, then it will be placed in a vial to be analyzed. The saliva sample will be taken before you complete the questionnaires, after you complete the questionnaires, and then again ten minutes later."

Following these instructions, the participants in all three conditions had a saliva sample taken. Then they completed the PSS and the mood scale. The experimenter then distributed the open-ended question and instructed the participants to write for three to five minutes. When this was completed, the experimenter had the participants take another saliva sample.

Participants in the control condition were instructed that they needed to wait ten minutes before another salivary sample could be taken. For that time period, the control participants were given some light reading materials to occupy them. After ten minutes they took a final salivary sample, and the experimenter concluded the session.

Participants in the MM and PMR conditions were told that in order to build upon their stress-reduction practice, they would listen to ten-minute audio recordings similar to those from the first session. The experimenter repeated the same procedure as in the first session for playing the CDs. After listening to the recordings, the participants had a final saliva sample taken and completed the mood scale. The participants also had the opportunity to discuss with the experimenter about any problems or questions in applying the approaches. Following the discussion period, the participants were informed that the intervention sessions were over, and that they were encouraged to practice their stress reduction techniques individually. They also received new excerpts to read from the books *Full Catastrophe Living* for the MM group and from *Total Relaxation: Healing Practices for Body, Mind & Spirit* for the PMR group.

Four weeks after the second session, participants were contacted via email for a follow-up assessment. They were given a link to surveymonkey.com where they completed online versions of the questionnaires, which included the PSS, the mood scale, and the open-ended question. They were also asked several questions about their practice of the stress reduction techniques (see Appendix H). Upon completion of the assessment, the participants received online versions of the debriefing form and contact information for the researcher (see Appendix I).

The participants' saliva samples were stored in a freezer after collection and the assay was performed several months later. On the day of the assay, the samples were thawed completely. Following thawing, samples were vortexed and centrifuged at 3000 rpm for 15 minutes. For the assay, 2 microtitre plates coated with monoclonal antibodies to cortisol were used. Using a pipette, 25 µL of standards and 25 µL of the salivary

samples containing an unknown amount of cortisol were added to the wells. Next, 200 µL of enzyme-cortisol conjugate, which is a known amount of cortisol conjugated to horseradish peroxidase (HRP) was added to each of the wells. The cortisol from the samples competed with the cortisol in the conjugate solution for the antibody binding sites. The plates were then mixed on a plate rotator for 5 minutes at 500 rpm and incubated at room temperature for 55 minutes. After incubation, the plates were washed with 300 µL of wash buffer. The unbound components were rinsed away so only molecules that were directly or indirectly bound to the plate were left. Next, 200 µL of TMB, which reacts with HRP to form a blue precipitate, was added to all the wells. The plates were mixed on a plate rotator for five minutes and incubated in the dark for an additional 25 minutes. Finally, 50 µL of stop solution was added, which stopped the reaction and turned the plate a yellow color. The plates were mixed on the plate rotator at 500 rpm for 3 minutes and then read in a plate reader at 450 nm. The relative differences in the amount of HRP in the well were detected by obtaining light absorbance values for each well on a plate reader. The more HRP in a given well, the greater the amount of precipitate formed and the greater the absorbance. Brighter color indicated less cortisol and lighter color indicated more cortisol.

Results

Pre-Intervention Measures

At the beginning of the first session, prior to exposure to the stressor and the interventions, participants in all three conditions were given the Perceived Stress Scale, which measured their level of perceived stress over the past four weeks. It was hypothesized that the groups would not differ in their degree of perceived stress prior to the interventions. In order to determine whether participants in the MM, PMR, and control conditions differed in their degree of perceived stress before undergoing any interventions, a one-way ANOVA was performed on the dependent variable of the Perceived Stress Scale prior to intervention. There were no significant differences among the three groups on the Perceived Stress Scale, $F(2, 47) = .38$, $p = .69$, $\eta^2 = .02$, which indicated that the three groups did not differ significantly in their degree of perceived stress prior to receiving any stress-reduction interventions. The means and standard deviations of perceived stress for each group are shown in Table 1.

Table 1

Means and Standard Deviations of Perceived Stress Prior to Intervention

	Group								
	MM		PMR		Control				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,47)	*p*	η^2
Perceived Stress	35.14	.84	35.22	.84	34.21	.95	.38	.69	.02

Note. Perceived Stress was measured by the Perceived Stress Scale (Cohen et al., 1983). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

In the first session, participants in all three conditions completed the mood scale, prior to being exposed to the stressor and practicing the stress-reduction intervention. To examine whether there were any differences in mood at this time, a MANOVA was performed on the dependent variables of positive and negative mood. The analysis indicated that prior to the interventions there were no significant differences in mood among the three groups, Wilks' Lambda =.91, $F(4, 92) = 1.07$, $p = .38$, $\eta^2 = .04$. Means and standard deviations for all three groups for positive and negative mood are shown in Table 2.

Table 2

Means and Standard Deviations of Positive and Negative Mood Prior to Intervention

	Group					
	MM		PMR		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Positive Mood Prior to Intervention	53.47	2.46	55.56	2.46	50.89	2.79
Negative Mood Prior to Intervention	30.56	1.93	26.72	1.93	32.39	2.19

Note. Positive and Negative mood were scores on two subscales of an affect scale (Emmons and McCullough, 2003). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Perceived Stress from Pre-Intervention to Follow-up

The participants in all three experimental conditions were given the Perceived Stress Scale at the beginning of the first session prior to being taught the interventions, then again at the start of the second session at which time they had learned the stress reduction techniques. They completed the Perceived Stress Scale a third time during the online follow-up assessment four weeks after the second session. It was hypothesized

that the MM group would have a greater decrease in perceived stress over the course of the experiment than the PMR or control groups. To assess whether participants' degree of perceived stress changed over the course of the three times tested, and whether there were differences among the three conditions, a one-way repeated measures ANOVA was performed on the dependent variable of perceived stress. The within participants factor was time, which had three levels for the three times perceived stress was measured. The between participants factor was the intervention condition, either MM, PMR, or control. The repeated measures ANOVA revealed no significant main effect of time on the participants' degree of perceived stress, $F(2, 76) = .05$, $p = .95$, $\eta^2 = .01$. This indicates that participants' perceived stress scores did not change significantly over the course of the experimental sessions. The main effect of group was not significant, $F(2,38) = .67$, $\eta^2 = .03$. The analysis also indicated that there was no significant interaction effect between time and group, $F(4,76) = 1.97$, $p = .11$, $\eta^2 = .09$. In other words, there were no significant differences among the three intervention conditions in degree of perceived stress over the three time periods. Table 3 shows means and standard deviations of perceived stress for the three groups at the three times tested.

Table 3

Means and Standard Deviations of Perceived Stress Pre-Intervention, Post-Intervention and at Follow-up

	Group					
	MM		PMR		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Perceived Stress Pre-Intervention	27.39	1.87	25.43	1.87	28.85	1.94
Post-Intervention	26.43	2.05	27.29	2.05	27.08	2.12
Follow-up	29.21	2.06	26.79	2.06	24.69	2.14

Note. Perceived Stress was measured by the Perceived Stress Scale (Cohen et al., 1983). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Mood Session 1

In the first experimental session, participants in the PMR and MM conditions completed the mood scale prior to exposure to the stressor and again after learning the stress-reduction interventions. It was hypothesized that participants in the MM condition would experience greater improvements in mood after learning the interventions than those in the PMR group. In order to assess whether mood differed from before practicing the intervention to after in the PMR and MM groups, a one-way repeated measures MANOVA was performed on the dependent variables of positive mood and negative mood. The within participants factor was time, which had two levels: pre-intervention and post-intervention. The between participants factor was the intervention condition, either PMR or MM. The MANOVA revealed a significant multivariate effect of time, Wilks' Lambda = .28, $F(2,33) = 42.74$, $p = .01$, $\eta^2 = .72$, which indicated that overall, the participants' scores differed significantly from pre-intervention to post-

intervention. There was no significant multivariate effect of group, Wilks' Lambda = .93, $F(2, 33) = 1.26$, $p = .30$, $\eta^2 = .07$. The interaction effect between time and group approached significance, Wilks' Lambda = .87, $F(2, 33) = 2.41$, $p = .10$, $\eta^2 = .13$. Univariate tests revealed that the main effect of time was significant for the dependent variable of negative mood, $F(1,34) = 85.83$, $p = .01$, $\eta^2 = .72$. For both PMR and MM groups, negative mood decreased significantly from pre-intervention ($M = 28.64$) to post-intervention ($M = 20.74$). Univariate tests also revealed that interaction of time and group was marginally significant on the dependent variable of positive mood, $F(1,34) = 4.09$, $p = .05$, $\eta^2 = .11$. A simple effects test showed that for the PMR group there was a significant difference in positive mood from pre-intervention to post-intervention, $F(1,34) = 4.65$, $p < .05$. For the PMR group positive mood decreased significantly from pre-intervention ($M = 55.57$) to post-intervention ($M = 50.83$). There was no significant difference for the MM group. The means and standard deviations for positive and negative mood for the PMR and MM groups at times 1 and 2 are shown in Table 4.

Table 4

Means and Standard Deviations of Positive and Negative Mood Pre-Intervention and Post-Intervention in Session 1

	Group			
	MM		PMR	
	M	*SD*	*M*	*SD*
Negative Mood Pre-Intervention	30.56	1.90	26.72	1.90
Post-Intervention	21.75	1.48	19.72	1.48
Positive Mood Pre-Intervention	53.47	2.50	55.57	2.50
Post-Intervention	55.17	2.85	50.83	2.85

Note. Positive and Negative mood were scores on two subscales of an affect scale (Emmons and McCullough, 2003). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Mood Session 2

In the second experimental session, the PMR, MM, and control groups all completed the mood scale prior to exposure to the stressor and after practicing the stress reduction techniques. It was hypothesized that after practicing the interventions, the MM group would have greater improvements in mood than the PMR or control group. To assess whether the three groups differed in mood from pre-intervention to post-intervention, a repeated measures MANOVA was performed on the two dependent variables of positive and negative mood. The within participants factor was time, which had two levels, and the between participants factor was group. The results of the MANOVA showed a significant multivariate effect of time, Wilks' Lambda = .51, $F(2,40) = 19.32$, $p = .01$, $\eta^2 = 49$. The multivariate effect of group approached

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significance, Wilks' Lambda = .82, $F(4, 80) = 2.14$, $p = .08$, $\eta^2 = .10$. The interaction effect of group and time was not significant, Wilks' Lambda = .94, $F(4,80) = .60$, $p = .66$, $\eta^2 = .02$. Univariate tests revealed that differences in mood from pre-intervention to post-intervention were significant only for the dependent variable of negative mood, $F(1,41) = 34.59$, $p = .01$, $\eta^2 = .46$. Over all three groups, negative mood decreased significantly from pre-intervention ($M = 26.43$) to post-intervention ($M = 21.72$). Univariate analyses also revealed that the effect of group approached significance for the dependant variable of positive mood, $F(2,41) = 2.95$, $p = .06$, $\eta^2 = .13$. In the MM condition, there was little change in positive mood from pre-intervention ($M = 56.44$) to post-intervention ($M = 56.00$) and similarly, in the PMR condition, the degree of positive mood stayed fairly constant from pre-intervention ($M = 45.87$) to post-intervention ($M = 45.47$). However, in the control condition, positive mood decreased from pre-intervention (55.15) to post-intervention (51.89). The overall means and standard deviations of negative and positive mood pre-intervention and post intervention in the second session are shown in Table 5.

Table 5

Means and Standard Deviations of Negative Mood and Positive Mood Pre-Intervention and Post-Intervention in Session 2

	Group					
	MM		PMR		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Negative Mood Pre-Intervention	25.91	1.99	25.73	2.05	27.65	2.20
Post-Intervention	22.06	1.92	19.53	1.99	23.58	2.13
Positive Mood Pre-Intervention	56.44	3.09	45.87	3.19	55.15	3.43
Post-Intervention	56.00	3.60	45.47	3.71	51.89	3.99

Note. Positive and Negative mood were scores on two subscales of an affect scale (Emmons and McCullough, 2003). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

In the second session, participants had already learned the stress reduction techniques and practiced them during the time between sessions. It was hypothesized that this practice would contribute to higher positive mood in the MM condition compared with the PMR and control groups. In order to determine whether the three groups differed significantly in their degree of positive mood during the second session, the positive mood scores at pre-intervention and post-intervention were combined into one variable, which was positive mood during session 2. This combined variable was used to examine the effects of the intervention in the first session and the practice in between, as well as the immediate effects of the intervention in session 2. A one-way ANOVA was performed on the dependent variable of positive mood during session 2. The effect of group on positive mood approached significance, $F(2,43) = 2.95$, $p = .06$.

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Tukey post-hoc analyses revealed that the PMR group differed from the MM group in their degree of positive mood, $p = .06$. The MM group had higher positive mood over the course of session 2 ($M = 112.44$) than the PMR group ($M = 91.33$). Means and standard deviations of positive mood during session 2 for all three groups and univariate results are shown in Table 6.

Table 6

Means and Standard Deviations for Positive Mood in Post-Intervention and Univariate Results

	Group							
	MM		PMR		Control			
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,43)	*p*
Positive Mood	112.44	31.56	91.33	28.81	107.04	16.33	2.95	.063

Note. Positive mood scores at two different times during the second session were combined for an overall positive mood score for this session. Positive mood was measured by one of the subscales of an affect scale (Emmons and McCullough, 2003). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Mood at Follow-up Assessment

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During the follow-up assessment, participants in all three conditions completed the mood scale prior to exposure to the stressor. To determine whether the three groups differed in their mood at the time of the follow-up, a MANOVA was performed on the dependent variables of positive and negative mood. There was no significant multivariate effect of group, Wilks' Lambda = .88, $F(4,78) = 1.24$, $p = .30$, $\eta^2 = .06$. The results indicated that the PMR, MM, and Control conditions did not differ in their degree

of positive and negative mood at the time of the follow-up. Means and standard deviations of positive and negative mood at the follow-up for each group are shown in Table 7.

Table 7

Means and Standard Deviations of Positive and Negative Mood at Follow-up

	Group					
	MM		PMR		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Positive Mood	53.07	1.73	49.00	1.73	48.00	1.86
Negative Mood	33.73	1.76	31.47	1.76	33.00	1.89

Note. Positive and Negative mood were scores on two subscales of an affect scale (Emmons and McCullough, 2003). MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Cortisol Assay

Cortisol was used as an objective measure of stress and was expected to be related to the self-report measures. A correlational analysis was done to examine whether participants' average cortisol levels were related to their scores on the Perceived Stress Scale, and measures of positive and negative mood. It was hypothesized that cortisol would be positively correlated with perceived stress and negative mood and negatively correlated with positive mood. However, average cortisol level was not significantly correlated with perceived stress, $p = .99$, negative mood, $p = .25$, or positive mood, $p = .22$. This indicated that cortisol level was unrelated to the self-report measures.

Cortisol was measured at three time periods during session 2. A repeated measures MANOVA was used to investigate whether participants' cortisol levels changed over the three times measured during the second session and whether there were differences among the three groups. The within participants factor was time, which had

three levels: pre-stressor, post-stressor, and post-intervention. The between participants factor was group, which was either MM, PMR, or Control. The MANOVA revealed that the multivariate effect of time approached significance, Wilks' Lambda = .80, $F(2, 18) = 2.21$, $p = .14$, $\eta^2 = .20$. The main effect of group was not significant, $F(2,19) = .73$, $p = .50$, $\eta^2 = .07$. This indicated that the MM, PMR, and Control groups did not differ significantly in their cortisol levels. Additionally, the interaction effect of group and time was not significant, Wilks' Lambda = .93, $F(4,36) = .35$, $p = .84$ which indicated that there were no significant differences in cortisol levels among the three groups over the three times tested. Univariate analyses revealed that the main effect of time was significant, $F(2,38) = 3.62$, $p = .04$, $\eta^2 = .160$. Overall, cortisol levels decreased from pre-stressor to post-intervention. Means and standard deviations of cortisol levels pre-stressor, post-stressor, and post-intervention for all three groups are shown in Table 8.

Table 8

Means and Standard Deviations of Cortisol Levels Pre-Stressor, Post-Stressor, Post-Intervention

	Group					
	MM		PMR		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Cortisol Pre-Stressor	.23	.08	.34	.08	.21	.08
Post-Stressor	.17	.06	.27	.07	.15	.07
Post-Intervention	.18	.07	.23	.07	.15	.07

Note. Cortisol was measured in µg/dL MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Coping Styles from Pre-Intervention to Follow-up

Participants completed a writing prompt that asked them to describe a current interpersonal stressor and any coping strategies they used to deal with it. Some examples of problems people reported included issues with roommates, arguments with family members, and difficulties in long-distance relationships. The coping strategies participants most frequently reported using were: active coping (48%), positive reframing (36.6%), acceptance (24.4%), and behavioral disengagement (22%). In subsequent analyses, the coping strategies used were combined into the three categories of healthy coping, avoidant coping, and social support.

Coping styles were assessed at the beginning of the first session prior to receiving any interventions, in the second session at which time they had received the interventions, and at the time of the follow-up assessment. To evaluate whether participants' coping styles changed over the three time periods and whether there were differences among the three experimental conditions, a repeated measures MANOVA was performed on three dependent variables: healthy coping, avoidant coping, and social support. The within participants factor was time, which had three levels for the three times coping styles were assessed. The between participants factor was the intervention condition, either MM, PMR, or control. The analysis revealed a significant multivariate effect for time, Wilks' Lambda = .55, $F(6,33) = 4.45$, $p = .01$, $\eta^2 = .45$. This indicated that participants' use of coping styles changed significantly over time. There was no significant multivariate effect of group, Wilks' Lambda = .81, $F(6,72) = 1.34$, $p = .25$, $\eta^2 = .10$. The interaction of group and time was not significant, Wilks' Lambda = .747, $F(12,66) = .86$, $p = .59$, $\eta^2 = .14$. This indicated that the groups did not differ in their

coping styles over the three time periods assessed. Univariate analyses revealed that the effect of time was significant for the dependent variable of avoidant coping, $F(2, 76) = 14.11$, $p = .01$, $\eta^2 = .27$. Overall, avoidant coping scores decreased from pre-intervention ($M = .74$) to post-intervention ($M = .32$) and decreased again at the follow-up ($M = .17$). This indicates that overall, participants' use of avoidant coping strategies decreased over the three time periods tested. Means and standard deviations for avoidant coping for the MM, PMR, and control groups are presented in Table 9.

Table 9

Means and Standard Deviations for Avoidant Coping Pre-Intervention, Post-Intervention and at Follow-up

	Group					
	MM		PMR		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Avoidant Coping Pre-Intervention	.60	.18	.71	.19	.92	.21
Post-Intervention	.07	.14	.57	.14	.33	.16
Follow-up	.13	.10	.21	.10	.17	.11

Note. Avoidant Coping scores were obtained by coding open-ended responses for categories of the Brief Cope Scale (Carver, 1997) and adding together scores on self-distraction, denial, venting, behavioral disengagement, and food coping subscales. MM = Mindfulness Meditation group, PMR = Progressive Muscle Relaxation group.

Effects of Interpersonal Sensitivity Prior to Interventions

The second main hypothesis of the experiment was that students with the highest degree of interpersonal sensitivity would benefit the most from the interventions. To examine the effects of the two independent variables of intervention and interpersonal sensitivity on participants' perceived stress during the first session, which was prior to

learning the interventions, an ANOVA was performed on the dependent variable of perceived stress with interpersonal sensitivity as a covariate. The between participants factor was intervention condition, which had two levels: intervention and control. The MM and PMR groups were combined into one group to simplify the analyses and because previous analyses did not show any differences between the two groups in perceived stress. The ANOVA revealed no significant main effect of intervention, $F(1,47) = .80$, $p = .38$, $\eta^2 = .02$. In addition, there was no significant effect of interpersonal sensitivity level $F(1,47) = .61$ $p = .44$, $\eta^2 = .01$. This indicated that when the effect of interpersonal sensitivity was removed, the intervention and control groups did not differ significantly in their level of perceived stress prior to learning the interventions. This was consistent with previous analyses that showed no differences among the groups in perceived stress prior to receiving the interventions. Means and standard deviations for participants' perceived stress prior to the interventions based on their interpersonal sensitivity level and intervention condition are shown in Table 10.

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Table 10

Means and Standard Deviations of Perceived Stress, Positive Mood and Negative Mood at Prior to Intervention by Interpersonal Sensitivity and Intervention

	Group							
	Intervention				Control			
	High IS		Low IS		High IS		Low IS	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Perceived Stress								
Pre-Intervention	35.14	.80	35.22	.80	36.43	1.28	32.00	1.28
Positive Mood								
Pre-Intervention	51.03	2.37	58.00	2.37	48.14	3.79	53.64	3.79
Negative Mood								
Pre-Intervention	30.50	1.94	26.78	1.94	33.71	3.12	31.07	3.12

Note. Perceived Stress was measured by the Perceived Stress Scale (Cohen et al., 1983). Positive and negative mood were measured by the subscales of an affect scale (Emmons and McCullough, 2003). IS = Interpersonal Sensitivity as measured by the Interpersonal Sensitivity Measure (Boyce & Parker, 1989). The Intervention group consisted of participants in both the Mindfulness Meditation and Progressive Muscle Relaxation groups.

To examine the effects of interpersonal sensitivity on mood participants were divided into two groups based on scores on the Interpersonal Sensitivity Measure (Boyce & Parker, 1989). Though all participants in the study were drawn from a screening study because they were high in interpersonal sensitivity, the medians for interpersonal sensitivity in this selected sample were determined in order to see which participants had the highest levels. Students whose scores were below the median were in the low interpersonal sensitivity group and students whose scores were above were in the high interpersonal sensitivity group. For these analyses, the students in the PMR and MM groups were combined into one group, the intervention group. This group was compared

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to the control group, which did not receive an active intervention. A MANOVA was performed on the two dependent variables of positive and negative mood. The between participants factors were intervention condition, which had two levels, intervention and control and interpersonal sensitivity level. The multivariate effect of interpersonal sensitivity level approached significance, Wilks' Lambda = .92, $F(2,45) = 2.07$, $p = .14$, $\eta^2 = .08$. This indicated that prior to learning the interventions there were differences in mood between participants high and low in interpersonal sensitivity. The multivariate effect of intervention was not significant, Wilks' Lambda = .95, $F(2,45) = 1.26$, $p = .29$, $\eta^2 = .08$ and the interaction of intervention and interpersonal sensitivity level was not significant, Wilks' Lambda = .10, $F(2,45) = .04$, $p = .97$, $\eta^2 = .01$. This indicated that for positive and negative mood there were no differences between the intervention and control groups. Univariate tests revealed that the effect of interpersonal sensitivity level approached significance on the dependent variable of positive mood, $F(1, 46) = 3.89$, $p = .05$, $\eta^2 = .08$. Overall, participants high in interpersonal sensitivity had lower positive mood ($M = 49.59$) than participants low in interpersonal sensitivity ($M = 55.82$). Means and standard deviations for positive and negative mood prior to interventions by interpersonal sensitivity level and intervention are shown in Table 10.

Effects of Interpersonal Sensitivity Post-Intervention

To examine the effects of the two independent variables of intervention and interpersonal sensitivity on participants' perceived stress during the second session, an ANOVA was performed on the dependent variable of perceived stress at the time of the second session, at which time the participants had been given the stress reduction interventions. The between participants factors were the participants' interpersonal

sensitivity which had two levels, either high or low, and intervention condition, which had two levels, intervention and control. The ANOVA revealed no significant main effect of interpersonal sensitivity on perceived stress, $F(1,41) = .96$, $p = .33$, $\eta^2 = .02$. This indicates that participants in the high and low groups of interpersonal sensitivity did not differ significantly in their degree of perceived stress during the second session. The main effect of intervention on perceived stress was not significant, $F(1,41) = 1.07$, $p = .31$, $\eta^2 = .03$. Additionally, the interaction of interpersonal sensitivity and intervention was not significant $F(1,41) = .28$, $p = .60$, $\eta^2 = .01$. Means and standard deviations for participants' perceived stress post-intervention based on their interpersonal sensitivity level and intervention condition are shown in Table 11.

Table 11

Means and Standard Deviations of Perceived Stress, Positive Mood and Negative Mood Post-Intervention by Interpersonal Sensitivity and Intervention

	Group							
	Intervention				Control			
	High IS		Low IS		High IS		Low IS	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Perceived Stress Post-Intervention	35.60	1.06	35.00	1.03	34.93	1.55	32.93	1.55
Positive Mood Post-Intervention	89.20	6.30	114.44	6.09	103.50	9.96	110.07	9.22
Negative Mood Post-Intervention	46.07	3.80	47.22	3.68	46.25	6.00	55.50	5.56

Note. Perceived Stress was measured by the Perceived Stress Scale (Cohen et al., 1983). Positive and negative mood scores at two different times during the second session were combined for overall positive and negative mood scores for this session. Positive and negative mood were measured by the subscales of an affect scale (Emmons and McCullough, 2003). IS = Interpersonal Sensitivity as measured by the Interpersonal Sensitivity Measure (Boyce & Parker, 1989). The Intervention group consisted of participants in both the Mindfulness Meditation and Progressive Muscle Relaxation groups.

Participants' overall positive and negative mood scores in the second experimental session were examined in relation to their interpersonal sensitivity and intervention condition. In the second session, participants had already learned the stress reduction interventions. Participants completed the mood scale at two time periods during this session: prior to practicing the interventions and after practicing the interventions. For this analysis, participants' positive and negative mood scores at the two time periods tested were added together to create two new dependent variables: overall positive mood during session 2 and overall negative mood during session 2. In

order to examine the effects of interpersonal sensitivity and intervention on mood after learning the interventions, a MANOVA was performed on the two dependent variables of overall positive mood and overall negative mood during session 2. The between participants factors were interpersonal sensitivity which had two levels, either high or low, and intervention condition, which had two levels, intervention and control. The MANOVA revealed a significant multivariate effect of interpersonal sensitivity, Wilks' Lambda = .85, $F(2,39) = 3.55$, $p = .04$, $\eta^2 = .15$. There was no significant multivariate effect of intervention, Wilks' Lambda = .96, $F(2,39) = .82$, $p = .45$, $\eta^2 = .04$ and the interaction of interpersonal sensitivity and intervention was not significant, Wilks' Lambda = .96, $F(2,39) = .76$, $p = .48$, $\eta^2 = .04$. Univariate tests revealed that multivariate effect of interpersonal sensitivity approached significance on the dependent variable of positive mood during session 2, $F(1,40) = 3.88$, $p = .06$, $\eta^2 = .09$. Across intervention conditions, participants low in interpersonal sensitivity had significantly higher positive mood ($M = 112.25$) than those high in interpersonal sensitivity ($M = 96.35$) after learning the interventions. Means and standard deviations for positive and negative mood during session 2 by interpersonal sensitivity level and intervention are shown in Table 11.

Effects of Interpersonal Sensitivity at Follow-up

To examine the influence of interpersonal sensitivity and intervention on perceived stress four weeks after the second session, an ANOVA was performed on the dependent variable of perceived stress at follow-up. The between participants factors were interpersonal sensitivity which had two levels, high and low, and intervention condition, which had two levels, intervention and control. There was no significant main effect of interpersonal sensitivity level, $F(1,37) = 1.14$, $p = .29$, $\eta^2 = .03$ and no

significant main effect of intervention $F(1,37) = 1.44$, $p = .24$, $\eta^2 = .04$. In addition, the interaction effect of interpersonal sensitivity and intervention was not significant $F(1,37) = .07$, $p = .79$, $\eta^2 = .01$. Means and standard deviations and standard deviations of perceived stress at follow by interpersonal sensitivity level and intervention condition are shown in Table 12.

Table 12

Means and Standard Deviations of Perceived Stress, Positive Mood and Negative Mood at Follow-up by Interpersonal Sensitivity and Intervention

	Group							
	Intervention				Control			
	High IS		Low IS		High IS		Low IS	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Perceived Stress at Follow-up	33.50	1.29	32.21	1.29	32.00	1.82	29.83	1.96
Positive Mood at Follow-up	51.93	1.84	50.25	1.72	46.14	2.60	50.17	2.81
Negative Mood at Follow-up	29.64	1.71	35.19	1.60	30.86	2.42	35.50	2.61

Note. Perceived Stress was measured by the Perceived Stress Scale (Cohen et al., 1983). Positive and negative mood were measured by the subscales of an affect scale (Emmons and McCullough, 2003). IS = Interpersonal Sensitivity as measured by the Interpersonal Sensitivity Measure (Boyce & Parker, 1989). The Intervention group consisted of participants in both the Mindfulness Meditation and Progressive Muscle Relaxation groups.

In order to assess the influence of interpersonal sensitivity and effect of intervention on mood at the follow-up, a MANOVA was performed on the two dependent variables of positive and negative mood. The between participants factors were interpersonal sensitivity which had two levels, high and low, and intervention condition,

which had two levels, intervention and control. The multivariate effect of interpersonal sensitivity approached significance, Wilks' Lambda = .87, $F(2,38) = 2.80$, $p = .07$, $\eta^2 = .13$. The multivariate effect of intervention was not significant, Wilks' Lambda = .95, $F(2,38) = 1.07$, $p = .35$, $\eta^2 = .05$ and the interaction of interpersonal sensitivity and intervention was not significant, Wilks' Lambda = .95, $F(2,38) = .92$, $p = .41$, $\eta^2 = .05$. Univariate analyses showed that the effect of interpersonal sensitivity was significant on the dependent variable of negative mood at follow-up, $F(1,39) = 5.71$, $p = .02$, $\eta^2 = .13$. In both the intervention and control conditions, participants with lower interpersonal sensitivity had higher negative mood ($M = 35.34$) than participants with higher interpersonal sensitivity ($M = 30.25$). This was inconsistent with predictions that those highest in interpersonal sensitivity would have lower negative mood after receiving the interventions than participants low in interpersonal sensitivity. Means and standard deviations for positive and negative mood by interpersonal sensitivity and intervention are shown in Table 12.

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Effects of Frequency of Practice

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At the time of the follow-up, participants were asked to report how often they had practiced their stress reduction techniques in the time between sessions, from 1 (*not at all*) to 5 (*daily*). Among the participants in the mindfulness meditation and progressive muscle relaxation conditions, 26.7 % reported that they practiced monthly, 60 % reported practicing weekly, and 13.3 % reported that they practiced several times per week. To examine whether participants' self-reported frequency of practice of interventions during the time between sessions had any effect on participants' degree of perceived stress in the second session after learning the interventions, an ANOVA was performed on the

dependent variable of perceived stress post-intervention with frequency of practice as a covariate. The between participants factor was group, which had two levels: PMR and MM. The ANOVA revealed no significant main effect of group, $F(1,27) = .16$, $p = .69$, $\eta^2 = .01$. In addition, there was no main effect of frequency of practice, $F(1,27) = .56$, $p = .46$, $\eta^2 = .02$. This indicated that regardless of how frequently participants practiced the interventions, their degree of perceived stress did not differ and there were no differences between the groups.

To examine the effect of amount of practice between sessions on perceived stress at the follow-up four weeks after the second session, an ANOVA was performed on the dependent variable of perceived stress at follow-up and frequency of practice was examined as a covariate. The between participants factor was group, which had two levels: PMR and MM. The ANOVA revealed no significant main effect of group, $F(1,25) = .05$, $p = .83$, $\eta^2 = .01$ and no main effect of amount of practice, $F(1,25) = .07$, $p = .79$, $\eta^2 = .01$. Again, this indicated that there were no differences between the MM and PMR groups in perceived stress and the frequency that participants practiced their interventions had no effect on their degree of perceived stress.

To examine whether self-reported frequency of practice of stress reduction techniques between sessions had an effect on participants' mood, a MANOVA was performed on two the dependent variables of positive and negative mood in the second session with frequency of practice as the covariate. The between participants factor was group, which had two levels: PMR and MM. The MANOVA revealed a significant multivariate effect of group, Wilks' Lambda = .75, $F(2,26) = 4.34$, $p = .02$, $\eta^2 = .25$. Also, the multivariate effect of frequency of practice approached significance, Wilks'

Lambda = .82, $F(2,26) = 2.96$, $p = .07$, $\eta^2 = .19$. Univariate tests revealed that the multivariate effect of group was significant on the dependent variable of positive mood in session 2, $F(1, 27) = 5.61$, $p = .03$, $\eta^2 = .17$. The MM group had a higher degree of positive mood during session 2 ($M = 113.87$) than the PMR group ($M = 91.33$). Univariate tests also showed that the effect of frequency of practice was significant on the dependent variable of positive mood, $F(1,27) = 5.00$, $p = .03$, $\eta^2 = .16$, and approached significance on the dependent variable of negative mood $F(1,27) = 3.59$, $p = .07$, $\eta^2 = .12$. Accounting for the influence of frequency of practice, participants in the MM condition had not only higher positive mood but also significantly higher negative mood during session 2 ($M = 49.03$) than the PMR group ($M = 45.27$).

To examine the role of frequency of practice between sessions on mood at the time of the follow-up, a MANOVA was performed on the two dependent variables of positive and negative mood with frequency of practice as a covariate. The between participants factor was group, which had two levels: PMR and MM. The MANOVA showed that the multivariate effect of group was not significant, Wilks' Lambda = .89, $F(2,26) = 1.64$, $p = .21$, $\eta^2 = .11$. There was no significant multivariate effect of frequency of practice, Wilks' Lambda = .95, $F(2,26) = .64$, $p = .54$, $\eta^2 = .05$. This indicated that frequency of practice did not have an effect on positive or negative mood at the time of the follow-up.

Discussion

The purpose of this study was to examine whether a short-term mindfulness meditation intervention could produce improvements in stress, mood, coping, and cortisol levels in college students high in interpersonal sensitivity. The study examined the effects of the mindfulness intervention in comparison with a progressive muscle relaxation intervention and a control group that did not receive an intervention. The study examined how the personality factor of interpersonal sensitivity affected participants' responses to the interventions.

Participants, who were screened for higher levels of interpersonal sensitivity were divided into the three experimental conditions. Participants attended two experimental sessions four weeks apart in which they learned and practiced the interventions and completed an online follow-up survey four weeks after the second session. Participants' perceived stress, mood, and coping strategies were measured prior to learning the interventions, after learning and practicing the interventions, and at the follow-up. In each session, participants completed a writing prompt about a current stressful situation, which was expected to be a stressor. In the second session, cortisol measurements were assessed at three time periods: baseline, after exposure to the stressor, and after practicing the stress reduction interventions. At the follow-up, in addition to the other measures participants also reported how often they practiced the stress reduction techniques individually during the time periods between sessions.

It was hypothesized that participants in the mindfulness meditation condition would have greater improvements in stress, mood, and coping than participants in the progressive muscle relaxation condition or the control condition. For the most part, this

hypothesis was not supported. Over the course of the experiment, there were no differences among the three groups in measures of perceived stress, cortisol levels, and coping. Across all three groups, there were no significant changes in perceived stress over the course of the experiment. All groups experienced a significant decrease in cortisol levels during the second session from baseline to post-intervention. Participants in all three conditions decreased their self-reported use of avoidant coping strategies, as was shown in their responses to the open-ended question.

Nonetheless, on measures of mood there were some differences among the groups, which provided partial support for the first hypothesis. While overall participants experienced decreases in negative mood from pre-stressor to post-intervention during the first and second experimental sessions, the mindfulness meditation group had a higher degree of positive mood than the progressive muscle relaxation or control groups during the first and second sessions. However, at the time of the follow-up session, there were no between group differences in positive or negative mood.

The second hypothesis was that participants with the highest degree of interpersonal sensitivity would show the greatest benefits from the mindfulness meditation intervention. The effects of interpersonal sensitivity level on participants' perceived stress and mood were inconsistent. After learning the stress-reduction interventions, there were no differences between the groups that received stress-reduction interventions and the control group in terms of how interpersonal sensitivity level affected responsiveness to the interventions. In the first session and second sessions, interpersonal sensitivity did not have an effect on perceived stress. However, across conditions there were some differences in mood between participants high in

interpersonal sensitivity and those low in interpersonal sensitivity. In the first and second sessions, participants higher in interpersonal sensitivity displayed less positive mood than participants lower in interpersonal sensitivity. At the time of the follow-up, participants with the lowest interpersonal sensitivity had the highest negative mood. It is possible that interpersonal sensitivity did not play a role in participants' stress, but simply contributed to less positive mood throughout the study regardless of interventions. The role of interpersonal sensitivity in perceived stress and mood was not consistent and warrants further investigation.

In the present study, there were no long-term changes in perceived stress and no differences among the groups. However, one probable explanation for this finding is a limitation of the research design. The mindfulness training in the present study consisted solely of listening to a ten-minute mindfulness meditation audio recording during two experimental sessions four weeks apart. Though participants were reminded weekly to practice the mindfulness techniques on their own and were given readings to guide their practice, more than a quarter of participants practiced the techniques only once a month. There was some effect of frequency of practice on responsiveness to interventions, but this finding should be examined with caution as demand characteristics may have led to over-reporting of actual practice. When frequency of practice was examined as a covariate there were no differences between the progressive muscle relaxation and mindfulness meditation groups in perceived stress, but there were significant differences in mood. The mindfulness meditation group had higher positive mood post-intervention, but also had higher negative mood than the progressive muscle relaxation group. This finding may reflect that the mindfulness meditation group developed a greater capacity

for awareness of both kinds of mood states by practicing the mindfulness techniques, for the goal of mindfulness is to accept all experience without evaluating it as positive or negative.

Generally, mindfulness-based stress reduction interventions are based on Jon Kabat-Zinn's (1990) 8-week MBSR program. Mindfulness-based interventions that have been shown to be effective at reducing stress typically follow an intensive schedule: participants are required to attend daily 2.5-hour sessions for a fixed 8 to 10-week period and practice individually each day outside of sessions (Baer, 2003; Grossman et al., 2004; Kabat-Zinn, 2003; Teasdale et al., 2008). The eight-week MBSR schedule has been shown to be effective in reducing perceived stress and self-reported for college students (Oman et al., 2008; Shapiro et al., 1998). Due to time and resource limitations, the present study only involved two short training sessions separated by four weeks. The sessions may not have been long enough or regular enough for the participants to fully learn and practice the techniques. More intensive and regular mindfulness training sessions may be necessary to produce long-term changes in perceived stress.

Another consideration is that while the control group did not listen to an audio recording like the PMR and MM groups, they were instructed to practice self-monitoring of thoughts and feelings related to stress. The experimenter told the control group that self-monitoring was a technique that has been shown to be effective at reducing stress. This statement could have had a placebo effect as participants in the control condition believed they were getting some type of intervention. Participants in this condition may have even derived some benefits from being told to monitor their thoughts and feelings. Self-monitoring is an important component of cognitive behavioral therapy and may play

a role in interpersonal interactions. According to Snyder (1974, p. 528), "the self-monitoring individual is particularly sensitive to the expression and self-presentation of others in social situations and uses these cues as guidelines for monitoring and managing his own self-presentation and expressive behavior." If participants in the control condition practiced self-monitoring this may have helped to improve their interpersonal relationships and manage their perceived stress. Future research could examine the effectiveness of a self-monitoring intervention and its relationship to mindfulness.

In addition, The Perceived Stress Scale measured participants' degree of perceived stress in the previous four weeks and was only used at the start of each session. Another measure of psychological distress may have been useful to examine changes in self-reported stress within the individual sessions after the participants practiced the interventions. Since one of the goals of the study was to reduce stress for students experiencing interpersonal stress, it may have been more effective to give them the Interpersonal Reactivity Index, which measures empathy and includes dimensions of perspective taking, empathetic concern and personal distress (Davis, 1983).

All participants in the experiment showed some short-term reductions in physiological measures of stress over the course of a single session. During the second session, all participants experienced a decrease in cortisol levels from baseline to post-intervention. However, there were no differences among the three groups. While the mindfulness meditation group and the progressive muscle relaxation group experienced a decline in cortisol after listening to the audio recordings and practicing the stress reduction techniques, the control group also experienced a decline in cortisol levels simply by sitting quietly for ten minutes. Previous research has produced mixed findings

on the short-term physiological effects of mindfulness meditation. A series of experiments using mindfulness meditation training for college students, showed overall decreases in heart rate during intervention sessions, but failed to show any differences among the three interventions, which included mindfulness meditation, progressive muscle relaxation, and quiet sitting (Ditto et al., 2006). However, it was also shown that mindfulness meditation produced greater increases in respiratory sinus arrhythmia than progressive muscle relaxation or sitting (Ditto et al., 2006).

In the current study all three groups sat quietly for ten minutes during the session, whether or not they listened to an audiotape. It is possible that the simple act of sitting quietly was enough to decrease cortisol levels. Though both mindfulness meditation and progressive muscle relaxation techniques can be practiced in a seated position, it is often recommended that participants practice the techniques lying down. In future research, it may be useful to examine the effects of body position on cortisol levels while practicing stress reduction techniques.

Another important issue in the current study was that cortisol did not increase as expected after participants completed the writing prompt about a current interpersonal stressor. In all groups, cortisol levels decreased after completing the writing prompt. This may indicate that writing about an interpersonal stressor was not a stressor. In fact, participants may have experienced some reduction in stress from writing about their stressor, as was shown in the decrease of cortisol levels. This is supported by previous research that showed writing about a traumatic experience produced improvements in immune and autonomic functioning in addition to subjective distress (Pennebaker, Kiecolt-Glaser & Glaser, 1988). A better way of measuring responses to stress could be

to use a standard lab-based stressor such as the Trier Social Stress Test, which requires participants to prepare a speech and do mental arithmetic in front of others (Kirschbaum, Pirke, Hellhammer, 1993). This type of stressor includes a social evaluative threat, which "occurs when an important aspect of the self-identity is or could be negatively judged by others," such as when participants must perform in front of an audience or their performance is recorded (Dickerson & Kemeny, 2004, p. 358). Laboratory stressors that include a social evaluative threat have been shown to produce greater increases in cortisol than those that do not include this component (Dickerson & Kemeny, 2004). Also, for the purpose of simplifying the experiment, cortisol was only assessed during the second session. If cortisol had been examined in the first session, it might have provided a better baseline. The window for examining changes in cortisol may have been too small in this experiment. More measurements of cortisol pre-intervention, post-intervention, and at follow-up could provide more information about long-term changes in stress for future research.

The present study showed that mindfulness meditation produced greater short-term benefits on the dimension of positive mood than the other interventions. While all groups experienced a decrease in negative mood from pre- to post-intervention, there were significant differences in positive mood. In the first session, the progressive muscle relaxation group experienced a decrease in positive mood after learning the intervention and in the second session, the mindfulness meditation group had significantly higher positive mood than the progressive muscle relaxation group. Though differences in the quality of the audio recordings may have contributed to differences in mood, there are some promising directions suggested by this finding. The participants' changes in mood

may indicate that progressive muscle relaxation had a dampening effect on both positive and negative emotions, whereas the mindfulness meditation group seemed to have higher positive mood in addition to decreased negative mood. This finding may reflect the differing goals of the two coping strategies. Progressive muscle relaxation seeks to relax the body, mindfulness meditation is focused on bringing a sense of awareness, alertness and acceptance to the present moment. These cognitive elements of mindfulness meditation may have contributed to greater positive mood among those in the mindfulness condition. This is consistent with previous research that found that a short-term mindfulness meditation intervention not only decreased negative affect, but also increased hope, a positive emotion (Sears & Kraus, 2009). Though the mindfulness meditation group displayed a greater positive mood than the other groups within the first and second sessions, there were no group differences at the follow-up. There was no evidence that the mindfulness meditation group derived long-term benefits from the intervention. This finding may provide more support for the idea that mindfulness training requires regular intensive practice in order to be beneficial (Kabat-Zinn, 1990).

The effects of interpersonal sensitivity were not clear. Interpersonal sensitivity had no effect on responsiveness to interventions but did affect positive and negative mood. Those high in interpersonal sensitivity tended to have lower positive mood those lower in interpersonal sensitivity in sessions 1 and 2. At the follow-up, participants higher in interpersonal sensitivity had lower negative mood than participants with low interpersonal sensitivity. This effect could be explained by the concept that people high in interpersonal sensitivity have less positive feelings about their relationships with others. This experiment could be modified so that interpersonal sensitivity would be examined as

a dependent variable rather than a mediating quasi-independent variable. As interpersonal sensitivity did not have an effect on responsiveness to interventions it could have been more effective to select people high in perceived stress or neuroticism. This may be useful to determine the role of negative emotion in responsiveness to mindfulness interventions.

The main limitations of the study were the short length of the intervention sessions and the long periods of time between sessions, during which regular practice was encouraged, but not monitored. Also, there may have been issues related to measurement, for some measures assessed long-term changes in stress or coping, while others measured short-term changes. It may have been beyond the scope of this study to examine changes in stress and mood outside of the intervention sessions. There were many uncontrolled variables that could have affected stress and mood during the time between sessions. For example, the follow-up occurred at the end of the semester, close to finals period when there is naturally a greater amount of work and stress. The stress of finals period may have erased any effects of the mindfulness intervention on positive mood. A final limitation was the small sample size and the homogeneity of the sample, which was primarily comprised of women.

This study contributes to research on the role of mindfulness-based interventions and their adaptation to different populations. Short-term mindfulness interventions can produce improvements in positive and negative mood. In particular, mindfulness training may have greater benefits on the dimension of positive mood than other stress reduction interventions, such as progressive muscle relaxation. Future research should examine the effects of short-term mindfulness interventions on other positive emotions.

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Appendix A

Consent Form

I hereby consent to participate in Lily Preer's Honors Thesis research under the supervision of Professor Singer about stress and college students.

I understand that this research will involve reading completing a questionnaire.

Although I understand that the direct benefits of this research to society are not known, I have been told that I may learn more about the experience of stress in college students.

I understand that this research will take about 15 minutes.

I have been told that there are no known risks or discomforts related to participating in this research.

I have been told that Lily Preer can be contacted at ext. 4895 and Professor Singer can be contacted at ext. 2343.

I understand that I may decline to answer any questions as I see fit, and that I may withdraw from the study without penalty at any time.

I understand that all information will be identified with a code number and *not* my name.

I have been advised that I may contact the researcher, who will answer any questions that I may have about the purposes and procedure of this study.

I understand that this study is not meant to gather information about specific individuals and that my responses will be combined with other participants' data for the purpose of statistical analyses.

I consent to publication of the study results as long as the identity of all participants is protected.

I understand that I will be asked to provide my email address and that I may be contacted for a follow-up study on stress reduction. I understand that my survey results will be retained for the purpose of the follow-up study and that after the conclusion of the follow-up study my email and personal information will be destroyed.

I understand that this research has been approved by the Connecticut College Human Subjects Institutional Review Board (IRB).

Concern about any aspect of this study may be addressed to Professor Audrey Zakriski, Chairperson of the Connecticut College IRB (439-5134).

- -

I am at least 18 years of age, and I have read these explanations and assurances and voluntarily consent to participate in this research about stress and college students.
Name (printed)____
Signature____Date ____________

Appendix B

The Interpersonal Sensitivity Measure (IPSM)

A number of statements are listed below which relate to how you might feel about yourself and other people in your life. Please indicate how each one applies to you. Respond to each statement in terms of how you are GENERALLY and not necessarily just at present. There are no right or wrong answers.

For each statement, indicate whether it is:

1. Very unlike you
2. Moderately unlike you
3. Moderately like you
4. Very like you

1) I feel insecure when I say goodbye to people _____
2) I worry about the effect I have on other people _____
3) I avoid saying what I think for fear of being rejected _____
4) I feel uneasy meeting new people _____
5) If others know the real me, they would not like me _____
6) I feel secure when I'm in a close relationship _____
7) I don't get angry with people for fear that I may hurt them _____
8) After a fight with a friend, I feel uncomfortable until I have made peace _____
9) I am always aware of how other people feel _____
10) I worry about being criticized for things I have said or done _____
11) I always notice if someone doesn't respond to me _____
12) I worry about losing someone close to me _____
13) I feel that people generally like me _____
14) I will do something I don't want to do rather than offend or upset someone ____
15) I can only believe that something I have done is good when someone tells me it is _____
16) I will go out of my way to please someone I am close to _____
17) I feel anxious when I say goodbye to people _____
18) I feel happy when someone compliments me _____
19) I fear that my feelings will overwhelm people _____

20) I can make other people happy _____
21) I find it hard to get angry with people _____
22) I worry about criticizing other people _____
23) If someone is critical of something I do, I feel bad _____
24) If other people knew what I am really like, they would think less of me _____
25) I always expect criticism _____
26) I can never be really sure if someone is pleased with me _____
27) I don't like people to really know me _____
28) If someone upsets me, I am not able to put it easily out of my mind _____
29) I feel others do not understand me _____
30) I worry about what others think of me _____
31) I don't feel happy unless people I know admire me _____
32) I am never rude to anyone _____
33) I feel hurt when someone is angry with me _____
34) My value as a person depends enormously on what others think of me _____
35) I care about what people feel about me _____

Appendix C

Debriefing/Explanation of Research Form

First of all, thank you for participating in this screening study dealing with stress and college students. In this research, I am looking at how college students report stress in their interpersonal relationships. All participants in this study are Connecticut College students. One of the issues in the literature is how college students experience and cope with interpersonal stressors. Typically, research has focused on college students' academic stress. To my knowledge, no research has focused solely on college students' interpersonal stressors and stress reduction techniques that could be introduced to cope with them.

Because this is an ongoing project I would greatly appreciate it if you not discuss the underlying goals of this research with fellow students. Thank you.

This is a screening study, used to gather participants for a more in-depth follow-up study on stress reduction techniques. You may be contacted via email to participate in this follow-up study. If you are contacted, I would greatly appreciate your participation. The follow-up study will be approximately 2.5 hours and will consist of two experimental sessions four weeks apart and an online questionnaire follow-up six weeks after the second session.

If you are interested in this topic and want to read the literature in this area, please contact Lily Preer at 4895.

Listed below are two sources you may want to consult to learn more about this topic:

Darling, C., McWey, L., Howard, S., and Olmstead, S. (2007). College student stress: the influence of interpersonal relationships on sense of coherence. *Stress and Health, 23,* 215-229.

DeLongis, A. & Holtzman, S. (2005). Coping in context: The role of stress, social support, and personality in coping. *Journal of Personality, 73,* 1633-1656.

Appendix D

Consent Form

I hereby consent to participate in Lily Preer's Honors Thesis research under the supervision of Professor Singer about stress reduction and interpersonal relationships.

I understand that this research will involve attending two experimental sessions during which I will learn a stress reduction technique. I understand that the two sessions will take place four weeks apart and that in the time between the first and second sessions I will receive emails from the researcher with instructions to practice the stress reduction technique. I understand that during the second session I will be asked to give saliva samples in order to measure my levels of cortisol, which is a hormonal measure of stress. I understand that the researcher will email me a link to a follow-up questionnaire online six weeks after the second session.

Although I understand that the direct benefits of this research to society are not known, I have been told that I may learn more about techniques for reducing stress.

I understand that the stress reduction techniques taught in the experimental sessions are not a substitute for psychological treatment. I understand that if I feel I may need counseling or other psychological services I can contact Student Counseling Services at ext. 4587.

I understand that this research will take a total of about 2.5 hours.

I have been told that there are no known risks or discomforts related to participating in this research.

I have been told that Lily Preer can be contacted at ext. 4895 and Professor Singer can be contacted at ext. 2343.

I understand that I will only receive full credit if I participate in all parts of the study, but that I may decline to answer any questions as I see fit, and that I may withdraw from the study without penalty at any time.

I understand that all information will be identified with a code number and *not* my name. I understand that I will be asked to provide my email address so that the researcher can contact me during the period between sessions and so that the researcher can email me a link to the follow-up assessment. I understand that after the conclusion of the study, my email address and personal information will be destroyed.

I have been advised that I may contact the researcher, who will answer any questions that I may have about the purposes and procedure of this study.

I understand that this study is not meant to gather information about specific individuals and that my responses will be combined with other participants' data for the purpose of statistical analyses.

I consent to publication of the study results as long as the identity of all participants is protected.

I understand that this research has been approved by the Connecticut College Human Subjects Institutional Review Board (IRB).

Concern about any aspect of this study may be addressed to Professor Audrey Zakriski, Chairperson of the Connecticut College IRB (439-5134).

- -

I am at least 18 years of age, and I have read these explanations and assurances and voluntarily consent to participate in this research about stress and college students.
Name (printed)____
Signature____Date ____________

Appendix E

Personal Information

Class Year: _____

Age: _____

Gender: (circle one) F M Transgender Other

Race/Ethnicity: (circle one)

Caucasian/White

African American/Black

Hispanic/Latino(a)

Asian/Asian Pacific

Native American

Other _____

Household Income: (circle one)

Less than $25,000

$25,000-$50,00

$50,000-$75,000

$75,000-$100,000

More than $100,000

Meditation Experience:

1) How often have you practiced meditation techniques? (check the option that best fits)

Never _____

Once or twice _____

Sometimes _____

Fairly Often _____

Very Often _____

2) How often have you practiced relaxation techniques, such as progressive muscle relaxation? (check the option that best fits)

Never _____

Once or twice _____

Sometimes _____

Fairly Often _____

Very Often _____

Appendix F

The Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts. In each case, you will be asked to indicate *how often in the past month* you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

0. never
1. almost never
2. sometimes
3. fairly often
4. very often

1. How often in the past month have you been upset because of something that happened unexpectedly? _____
2. How often in the past month have you felt that you were unable to control the important things in your life? _____
3. How often in the past month have you felt nervous and "stressed"? _____
4. How often in the past month have you dealt successfully with irritating life hassles? _____
5. How often in the past month have you felt that you were effectively coping with important changes that were occurring in your life? _____
6. How often in the past month have you felt confident about your ability to handle your personal problems? _____
7. How often in the past month have you felt that things were going your way? ____
8. How often in the past month have you found that you could not cope with all the things that you had to do? _____
9. How often in the past month have you been able to control irritations in your life? _____
10. How often in the past month have you felt that you were on top of things? _____
11. How often in the past month have you been angered because of things that

happened that were outside of your control? _____

12. How often in the past month have you found yourself thinking about things that you have to accomplish? _____
13. How often in the past month have you been able to control the way you spend your time? _____
14. How often in the past month have you felt difficulties were piling up so high that you could not overcome them? _____

Appendix G

Affect Scale

The following are a list of feelings. Please indicate the extent to which you are experiencing each feeling right now:

1. not at all
2. very little
3. somewhat
4. fairly often
5. extremely

Interested _____
Distressed _____
Excited _____
Alert _____
Irritable _____
Sad _____
Stressed _____
Ashamed _____
Happy _____
Grateful _____
Tired _____
Upset _____
Strong _____
Nervous _____
Guilty _____
Joyful _____
Determined _____
Thankful _____
Calm _____
Attentive _____
Forgiving _____
Hostile _____
Energetic _____
Hopeful _____

Active _____
Afraid _____
Proud _____
Appreciative _____
Angry _____
Enthusiastic _____

Appendix H

Follow-up Questions

1) How often were you able to practice your stress reduction technique? (Check the option that best fits)

   Not at all _____
   Once or twice _____
   Several Times _____
   Weekly _____
   Daily _____

2) How beneficial has this technique been for you? (Check the option that best fits)

   Not at all _____
   Very little _____
   Somewhat _____
   A great deal _____

3) Have there been any new stressors or issues in the period since the last session? If so, discuss.

4) Did you have challenges in applying the stress reduction technique? If so, discuss.

Appendix I

Debriefing/Explanation of Research Form

First of all, thank you for participating in this study dealing with stress reduction techniques. In this research, I am looking at whether college students can benefit in their interpersonal relationships from a stress reduction technique designed to increase mindfulness. All participants in this study are Connecticut College students. One of the issues in the literature is how mindfulness meditation can be used to cope with different types of stressors in various populations. Typically, research has focused mindfulness-based stress reduction interventions for individuals with chronic illness or psychological disorders. To my knowledge, no research has focused on how a short-term mindfulness-based intervention could be used to deal with interpersonal stress in college students.

The stress reduction techniques taught in the experimental sessions have been found to be beneficial in a variety of populations. However, they are not a substitute for psychological treatment. If you feel you might need counseling or other psychological services please contact Student Counseling Services at ext. 4587.

Because this is an ongoing project I would greatly appreciate it if you not discuss the underlying goals of this research with fellow students. Thank you.

If you are interested in this topic and want to read the literature in this area, please contact Lily Preer at 4895.

Listed below are two sources you may want to consult to learn more about this topic:

Grossman, P., Ludger, N., Schmidt, S., Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research, 57*, 35-43.

Shapiro, S., Schwartz, G., & Bonner, G. (1998). Effects of Mindfulness-Based Stress Reduction on Medical and Premedical Students. *Journal of Behavioral Medicine, 21*, 581-599.