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The Effects of a Brief Mindfulness Intervention on Impulsivity in College Students

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Abstract

This study investigated the impact of a brief, introductory mindfulness intervention on attention, executive control, and impulsivity. I randomly assigned forty-seven undergraduate students to a treatment group (TG) receiving mindfulness training and a waiting list control group (WLG). Participants completed a battery of self-report questionnaires and standardized neuropsychological tests before and after the intervention. Participants high in trait mindfulness suffered less interference on a Stroop task, were less impulsive on the Balloon Analogue Risk Task, but also evidenced less cognitive flexibility on a dual fluency test at baseline. The TG demonstrated greater improvement than the WLG from baseline to re-test on one cognitive measure (Mental Control). Paradoxically, they also demonstrated a greater increase in impulsivity on the Balloon Analogue Risk Task than the WLG. Despite its limited effects on attention, executive function, and impulse control, my 2-hour mindfulness intervention successfully motivated college students to engage in the component exercises of meditation, body scanning, and yoga. Perhaps future studies incorporating more extensive training and a longer practice interval will yield larger effects on cognition.

The Effects of a Brief Mindfulness Intervention on Impulsivity in College Students

As defined by modern psychology, mindfulness is the cultivation of attention and awareness brought to bear on present moment experiences. Mindfulness theory is rooted in ancient Buddhism, but its concepts are being gradually transplanted into western science. Mindfulness is an "open awareness and attention which may be reflected in a more regular or sustained consciousness of ongoing events and experiences" (Brown & Ryan, 2003, p. 822). This ongoing awareness and attention is cultivated and maintained through a variety of meditative exercises. Mindfulness has received compelling support for its status as an effective form of behavioral medicine. It has been used successfully to treat anxiety, depression, chronic pain, binge eating, and substance abuse (Kabat-Zinn, 1990; Kabat- Zinn et al., 1992; Kristeller & Hallett, 1999; Teasdale, Segal, Williams, Ridgeway, Soulsby, & Lau, 2000). More than 250 medical institutions in the United States currently offer mindfulness-based stress reduction (MBSR) programs (Kabat-Zinn, 2003; Kabat-Zinn et al., 1992).

The objective of the current study is to investigate the impact of a brief, introductory mindfulness intervention on attention, executive control, and impulsivity in college undergraduates. Impulsivity can be defined as a tendency to respond quickly to a given stimulus without deliberation and evaluation of consequences (Buss & Plomin, 1975). Impulsivity is a failure of emotional regulation that has been linked to both maladaptive risk-taking behaviors and weak executive cognitive function (Aytaclar, Tarter, Kirisci, & Lu, 1999; White, Moffitt,, Caspi, Bartusch, Needles, & Stouthamer-Loeber, 1994). Hoffman, Friese, and Roefs (2009) found that regulation of impulses involves separate

contributions from executive attention, inhibitory control, and affective regulation. The strength of any of these central systems mediates the impact of automatic affective reactions that initiate impulsive behavior. Logan, Schachar, and Tannock (1997) suggest deficient inhibitory regulation is the predominant factor underlying impulsivity. Previous research indicates that children with attention deficit hyperactivity disorder (ADHD) - a disorder commonly characterized by impulsivity - have more trouble inhibiting action than both normal controls and controls with other psychiatric diagnoses (Schachar, Tannock, & Logan, 1993). Barkley (1997) further emphasizes the importance of inhibitory control as it purportedly creates a delay that allows executive functions to proceed unimpeded by irrelevant information. Both insufficient inhibition and poor executive functioning are associated with decreased attention and working memory (Brocki & Bohlin, 2006).

Contemporary neurological research suggests that visceral, emotional responses (impulses) originate from the amygdala, but can be modified or filtered by the prefrontal cortex (PFC) before a full-fledged behavioral response is executed (Davidson et al., 2003). Cresswell, Eisenberger, & Lieberman, 2007 provide evidence that mindfulness training can improve the PFC's ability to regulate limbic responses. Mindfulness treatment has been shown to decrease overgeneralization and to improve cognitive flexibility (Heeren, Van Broeck & Phillippot, 2009). Furthermore, Jha, Krompinger, and Baime (2007) provide evidence that mindfulness modifies multiple subsystems of attention in order to improve behavioral responses. Many researchers believe that mindfulness practice achieves these results by operating on the pivotal mechanism of inhibitory control. Mindfulness incorporates intense, sustained surveillance of one's

breath. Bishop (2004) suggests that redirecting attention from intruding thoughts to breathing helps inhibit secondary processing of extraneous thoughts, feelings, and sensations. Moreover, the deliberate shifting of attention, which is integral to many mindfulness techniques, may strengthen cognitive flexibility (Bishop, 2004; Alexander, Langer, Neman, Chandler & Davies, 1989).

Complimentary evidence that mindfulness enhances executive functions has emerged from a growing body of biological observations. Newberg, Wintering, Waldman, Amen, Khalsa, & Alavi, (2010) showed that mindfulness practitioners experience increased cerebral blood flow in the PFC. Researchers have also concluded that mindfulness practice can cause direct anatomical changes in the brain based on evidence from structural MRI scans. Individuals with extensive meditation experience have thicker cortices and increased gray matter concentration in the PFC than individuals who do not meditate regularly (Lazar, Kerr, Wasserman, Gray, Greve, Treadway, et al., 2005; Holzel, Ott, Gard, Hempel, Weygandt, Morgen, et et al., 2008; Luder, Toga, Lepore, & Gaser, 2009). All of these discoveries suggest that mindfulness facilitates attentional regulation and may help inhibit impulses. However, little experimental research has examined the impact of mindfulness on standardized neuropsychological and self-report measures of impulsivity.

Methods

Participants

I recruited forty-seven undergraduate students from Butler University to participate in an experiment testing the impact of mindfulness meditation on attention and

executive processing. The study was advertised via fliers distributed throughout campus and on the university on-line news feed, but most participants were directly recruited from introductory psychology courses. I randomly assigned participants to one of two conditions: a treatment group receiving the mindfulness intervention (TG; n=24) and a control group placed on a waiting list (WLG; n=23). The TG and WLG were statistically equivalent in age (t (45) <1), gender (χ^2 (n = 47)=1.08, p =.30) and baseline Mindfulness (t (44)<1). See Table 1.

Procedure

I selected a number of neuropsychological tests to assess what are considered to be distinct components of executive functioning and two self-report measures to assess mindfulness and risk-taking. The neuropsychological tests encompass a range of executive cognitive abilities including working memory, cognitive set-shifting, and response inhibition. The main investigators and undergraduate lab assistants administered pre-test measures to participants in individual testing sessions prior to the intervention. Participants completed the same battery of tests three weeks subsequent to the intervention. All participants completed measures of trait mindfulness, self-reported risk-taking, impulse control, response inhibition, executive problem solving, cognitive flexibility, mental control, and interference resolution. To encourage participation and prevent attrition, all participants were offered $30 or extra credit in a psychology course upon completion of the second testing session.

Control participants resumed their normal everyday activities after pre-test. The week following pre-testing, the treatment group attended a two-hour mindfulness

intervention at the Christian Theological Seminary southwest of Butler University's campus. The intervention opened with a slideshow presentation of the neuropsychological processes mindfulness affects (featuring empirical results drawn from recent studies) and a description of the core attitudes associated with mindfulness. I then introduced three mindfulness techniques derived from John Kabat-Zinn's Mindfulness-Based Stress Reduction Program: (1) Formal Sitting Meditation, (2) Body Scan Exercise, and (3) Hatha Yoga. Participants practiced each technique for twenty to thirty minutes. The intervention closed with a strategy for the use of mindfulness in everyday situations as offered by Terry Fralich, M.A., LCPC. Please see the Appendix for a manualized account of the intervention. Upon closing the intervention, I prompted participants to practice for a minimum of 20 minutes per day throughout the following two weeks. I also provided each participant with an audio CD to complement the exercises when practicing at home. All participants, including controls, received a journal to record time spent practicing any meditative or relaxation exercises. Control participants were offered the option of experiencing the intervention once post-testing had been completed. Interestingly, none of the control participants opted to attend the intervention although their decision was likely mitigated by weather conditions that evening.

Materials

Mindful Attention Awareness Scale (MAAS: Brown & Ryan, 2003). The MAAS is a 15 item self-report questionnaire designed to measure dispositional mindfulness. This measure qualifies everyday experience in terms of attention and awareness.

Risky Behaviors Scale (RBS: Fischer & Smith, 2004). The RBS is a 97 item Likert questionnaire measuring level of engagement in a number of risky activities. Participants in this study answered a subset of 21 items from this scale to measure their engagement in risky behaviors normally associated with college status such as substance abuse and sexual activities.

STOP-IT Task (Verbruggen et al., 2008). The STOP-IT task is a computerized behavioral measure of response inhibition. Participants discriminated between two different shapes, a square and a circle, responding to each by pressing a designated key. A stop signal tone presented during 25% of the trials cued participants to inhibit responding on those trials. The STOP-IT score represented the probability that a participant would respond on a stop signal trial.

The Tower of London (TOL DX: Culbertson & Zillmer, 2001). The Tower of London is a neuropsychological instrument which assesses executive problem solving and measures inhibitory control, mental flexibility, and working memory capacity. Participants completed a series of tasks which required them to move colored beads positioned on three vertical pegs to replicate a presented configuration. All of the moves were controlled by two problem solving rules. Participants solved each problem in as few moves as possible. The resulting ToL Moves Score was the total number of moves participants made to solve all problems, with lower values indicating more efficient performance.

Mental Control. Mental Control is a subtest of the Wechsler Memory Scale -- Third Edition (WMS-III: Wechsler, 1997). The Mental Control task required participants

to retrieve and manipulate well rehearsed lists of information. For example, participants recited the days of the week or months of the year in reverse order as rapidly as they could. This task assesses working memory, cognitive flexibility, and processing speed.

Stroop Task (Stroop, 1935). The Stroop introduces a conflict between automatic and effortful processing that participants must resolve. It required participants to (1) name the font color of a series of "xxx"s and (2) name the font color of color words when the font color and actual word conflict. Calculating the speed difference between naming the font color of the xxxs and naming the font color of the conflicting color words measured how successfully participants resolved the conflict. Thus, the Stroop task measures cognitive inhibition and conflict resolution.

The Balloon Analogue Risk Task (BART: Lejeuz et al., 2002). The BART is a behavioral measure of impulsivity. Participants viewed 30 balloons one at a time on a computer screen. Participants clicked the balloon to pump it up and accrued 5 cents in a temporary bank with each pump. At any moment, participants could choose to transfer the monetary reward gained into a permanent bank and start with a new balloon. After a random number of pumps, the balloon exploded and any money not previously placed into the permanent bank was lost. In the present study, instead of the usual extrinsic monetary reward, participants received silly bands contingent on their task performance (one silly band for every $10 earned in the game). The average number of pumps (excluding balloons that exploded) represented the degree of risk taking or impulsivity.

Dual Fluency Task. The Dual Fluency task measures cognitive flexibility. Participants generated three words beginning with a certain letter followed by three

exemplars from a particular category, such as animal names. They continued switching back and forth, providing three words from each category for one minute. The total number of words generated in 60 seconds represented the Dual Fluency Score.

Hypotheses & Analyses

My first hypothesis was that high levels of trait mindfulness at pre-test would be associated with high levels of attention and executive control and low levels of impulsivity. To test the first hypothesis, I calculated Pearson correlation coefficients between scores on the trait mindfulness questionnaire and scores on the self-report and neuropsychological measures of attention, executive control, and impulsivity. For my second hypothesis, I posited that the mindfulness intervention would motivate the TG to practice meditational and relaxational exercises more frequently than the WLG. To gauge the success of the intervention, I conducted a series of t-tests examining how many minutes each group spent engaged in mindfulness activities. My third hypothesis was that the intervention would successfully augment mindfulness and cognitive performance on outcome measures of attention and executive control, consequently diminishing cognitive and behavioral impulsivity. To test the third hypothesis, I ran a mixed-model ANOVA expecting to find a time x group interaction. Due to the exploratory nature of this study, I opted not to lower the statistical threshold below a p value of .05.

Results

Hypothesis 1

Pearson correlation coefficients between scores on the trait mindfulness questionnaire and scores on the self-report and neuropsychological measures at baseline

are summarized in Table 2. Participants high in trait mindfulness suffered less interference on a Stroop task (r= -.305, p=.046). Although no other correlations reached significance, trends emerged indicating participants high in mindfulness were less impulsive on the Balloon Analogue Risk Task (r= -.287, p=.056), but also evidenced less cognitive flexibility on the Dual Fluency test (r= -.27, p=.18).

Hypothesis 2

Two of the experimental participants and three of the control participants failed to return for post-test assessment. As a result, journals recording the time spent in mindfulness practice during the test-retest interval were available for 22 individuals in the TG and 20 individuals in the WLG. A series of independent samples t-tests revealed the TG spent significantly more time meditating (M=91.0, SD=64.8) than the WLG (M=.95, SD=4.4), t (41) = 6.4, p<.001. They also spent more time performing body scans (TG: M=96.1, SD=56.7; WLG: M=0, SD=0) and practicing yoga (TG: M=97.2, SD=121.0; WLG: M=11.4, SD=36.1). Both of these differences were also statistically significant (body scan: t (41)=7.8, p<.001; yoga: t (41)=3.1, p<.01). On average, the TG spent over an hour and a half on each of the three mindfulness techniques during the three week interval between the initial testing session and the final assessment. See Figure 1.

Hypothesis 3

To examine the effect of the intervention and mindfulness practice on outcome measures, TG participants who had completed less than 3 hours of total Mindfulness practice were excluded (n = 6). The excluded TG participants did not differ in age [F (1,

20)=2.26, p=.148], gender [(χ^2 (n=22) < 1)], or baseline mindfulness [F (1, 20)=.392, p=.538] from those participants retained in the analyses.

Pre-test and post-test results on all outcome measures are summarized in Table 3. Despite their increased engagement in mindfulness, a repeated-measures ANOVA revealed the TG only improved on one of eight self-report and cognitive measures; they showed a greater improvement in Mental Control from baseline to retest than the WLG, time x group interaction: F (1, 34)=6.26, p<.05. See Figure 2. Post-hoc analyses indicated that the TG performance on Mental Control was significantly higher at post-test than pre-test, F (1, 15)=5.47, p<.05, while the WLG performance was stable from pre-test to post-test, F (1, 19)<1, p=.457. Unexpectedly, the TG also demonstrated a greater increase in impulsivity on the Balloon Analogue Risk Task than the WLG, time x group interaction: F (1, 34)=4.32, p=.045. Post hoc analyses revealed that, again, the TG changed significantly from pre-test to post-test, F (1, 14)=20.67, p<.001, whereas the WLG did not, F (1, 19)=1.61, p=.22. See Figure 3. I used the data gathered from practice reports recording time spent performing meditation, body scan, and yoga to create a 'total minutes of practice' variable. I then calculated difference scores on each of the outcome measures by subtracting pre-test performance values from post-test values. Pearson correlation coefficients revealed that participants in the TG who spent more time practicing during the test-retest interval also demonstrated a greater increase in trait mindfulness from pre-test to post-test that neared statistical (r= .41, p=.07). See Table 4.

Discussion

The core objective of this study was to determine whether a brief introduction to mindfulness practice would produce visible cognitive change in the mechanisms specific to impulse control. Mindfulness-Based Stress Reduction was originally designed for clinical populations undergoing psychological distress. Accordingly, most of the present literature examines its use for reducing symptoms and instantiating higher levels of well-being. This study is unprecedented in targeting the effects of mindfulness on a specific personality trait in healthy individuals. The first question to be asked necessarily was: is impulsivity inversely related to mindfulness? Brown and Ryan (2003) found that mindfulness correlated negatively with the neuroticism impulsivity subscale of the NEO-PI. In the current study, analyses showed baseline mindfulness tending to correlate inversely with behavioral impulsivity as measured by the Balloon Analogue Risk Task. Baseline mindfulness also correlated significantly with interference resolution on the Stroop test. However, no significant relationships were observed between mindfulness and self-reported risk taking.

Although mindfulness research scarcely evaluates self-reported practice time, I wished to examine the role of this intervention in stimulating behavior change through self-reports of practice. According to participant reports, the 2-hour intervention motivated treatment group participants to spend over thirty minutes per week on average practicing each of the Mindfulness techniques (meditation, body scan, yoga). This average exceeds the 20-minute practice requirement and highlights the success of the intervention in the domain of behavior. This also corroborates Astin's (1997) findings in

another sample of college students who reported practicing mindfulness 30 minutes per day, 3.5 days per week.

Despite having a positive effect on behavior change, the between group results on cognitive and risk-taking outcomes from pre-test to post-test do not reflect the hypothesized impact of the intervention. While treatment group participants improved significantly on mental control - thereby showing improvement in working memory, cognitive flexibility and processing speed - they also demonstrated an increase in behavioral impulsivity relative to the control group. In Astin's (1997) study with college students, practice time was not significantly correlated with improvement on the relevant outcomes (OCD symptom severity). On the other hand, some studies with older clinical populations have detected a significant relationship between practice time and outcomes (Carmody & Baer, 2008, Kristeller & Hallett, 1999). The current study provides some suggestive evidence that more extensive practice is related to increases in trait mindfulness in a college sample. Future research might examine whether the relationship between practice time and trait mindfulness could potentially mediate the effects of MBSR treatment on outcome measures.

Reviewing my findings, the failure of the intervention to produce cognitive changes in measures of executive attention, inhibitory control, and impulsivity could be due to several factors. The shortcomings of the intervention are in fact quite obvious when contrasted to the traditional MBSR program. In Baer's (2003) comprehensive review of the Mindfulness literature, MBSR programs are consistently conducted as 8-to 10-week courses for groups of up to 30 participants. Weekly instructional meetings typically last 2-2.5 hours and are complimented with discussions concerning stress and

coping, as well as various homework assignments. Programs also include an all-day 7-8 hour intensive mindfulness session held around the sixth week of training. Session time typically totals 26 hours and participants are prompted to practice formal meditation with guided CDs for 45 minutes each day. The intervention I devised for the present study was condensed into a single intensive 2-hour session, and participants practiced the acquired techniques for only three weeks prior to the post-test. I encouraged participants to practice for 20 minutes each day and provided them with a short, 25-minute supportive CD. However, Carmody and Baer (2009) reviewed 29 MBSR studies and found no significant correlations between number of class hours and effect sizes for outcomes of psychological distress. It must be noted that only one study included in this meta-analysis spanned less than the prescribed eight weeks; it was run across four weeks. Thus the present study stands alone in the extremity of its brevity.

While the content of the intervention in my study reflects the fundamental principles of mindfulness practice as laid out by Kabat-Zinn (1990), the lack of treatment effects on the primary outcome variables suggests that this particular intervention may have been too brief to elicit a sufficient conceptual understanding of Mindfulness. The practices of meditation, body scan, and yoga are tools for developing and refining sensitivity, attention, and awareness. Kabat-Zinn (1990) emphasizes that competence in these skills is highly dependent upon sustained practice. Perhaps future studies presenting the program in its entirety will document significant changes in attention, executive control, and impulsivity.

Finally, in Astin (1997) and Shapiro's (1998) research with college student samples, significant effects of MBSR were reported for measures of psychological

symptoms, empathy ratings, and spiritual experiences. When asked how much their mindfulness program afforded them "lasting value and importance," Astin's (1997) participants gave a mean rating of 9.3 out of 10. Although many participants in my study made unsolicited comments indicating their satisfaction with the intervention, my study included no formal measures of subjective well-being. Perhaps a 2-hour introductory mindfulness intervention is insufficient to produce visible cognitive and behavioral effects, but may be enough to cause change in subjective well-being. Including self-report measures of psychological and emotional health in future condensed intervention studies could address this possibility.

In summary, I created a brief introduction to mindfulness that inspired college students to practice meditation, body scan exercises, and yoga for more than 90 minutes per week. Although this intervention did not yield the expected effects on cognitive executive functioning and impulsivity, similar interventions in the future might positively impact cognition and behavior in individuals with pre-existing difficulties in these domains (e.g. those diagnosed with ADHD or who have suffered traumatic brain injury). They may also positively influence subjective well-being in typical college students.

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Appendix

Description of the Mindfulness Intervention

Participants viewed a Powerpoint slideshow and received hard-copy handouts of the slides from the presentation. A guided discussion closing adhering to the following script introduced the meditation exercises. Additionally, participants received audio CDs of the experimenter conducting each exercise to use as a reference during practice.

Neurological Processes (adapted from *Cultivating Lasting Happiness* by Terry Fralich, 2007):

In terms of basic structure the brain can be characterized by three fundamental parts. First, there is the brainstem, the most primitive section of the brain. The brainstem regulates vital survival functions such as circulation, respiration, sleep cycle, etc. Perched above the brainstem is the second component of the brain, the limbic region. The limbic region contains a special structure called the amygdala. The amygdala is critical for processing emotions – especially fear and anger. Together, the brainstem and the limbic system constitute the brain's alarm system. When the alarm system perceives a potential risk, it initiates the aptly named fight-or-flight response. Heart rate and blood pressure spike, muscles tense up, and hormones such as adrenaline or cortisol are secreted into the bloodstream. In the meantime, maintenance functions such as digestion and immune activities are suppressed. The alarm system lacks fine discrimination, which is fortunate in a situation of real danger when there is limited time to react. But this also has the effect of triggering false alarms in harmless situations (i.e. when startled by the presence of a garden hose rather than a snake). The third part of the brain, the cortex, composes most of

the whole brain. It contains many stations for sensory integration which support finer discriminations and more accurate situational assessments. Often times when people are scared or angry they lose their ability to think straight. This is because the brain has undergone an "emotional hijacking" in which the alarm system has taken over the brain and created too much "neural static" for conscious processes to operate (Johnson, 2004). The amygdala sets off a stress response literally before there is time to think because it receives sensory input 95% faster than the cortex (Beck-Coon, 2009). The amygdala also has access to memories beneath conscious awareness. It can trigger emotional reactions of anger and fear without us even knowing why. This can conceivably cause us many problems in our relationships to other people. We may find ourselves quarreling with a close friend without the slightest notion of what provoked our hostility. Furthermore, it is detrimental for the body to remain in such a state of arousal for extended periods of time because prolonged stress impairs its ability to heal and repair. The good news is: there is evidence that mindfulness meditation can enhance conscious abilities and dampen alarm responses, rescuing the body from unnecessary stress.

Core Attitudes

<< The success of one's journey through mindfulness is in many ways contingent upon the cultivation of certain attitudes. These attitudes provide the framework which supports a mindfulness practice effective in reducing stress and promoting mental and physical health. The first important attitude is ***Non-judging***. Our minds are occupied by a constant stream of judging which categorizes our experiences into the good, the bad, and the boring. In fact, we tend to tune out many of our sensations and write them off as irrelevant when there is actually potential to learn from them. By keeping an attitude of

non-judging, you watch your judgments as they arise and recognize that they are not objective labels which reflect truth. In this way, you prevent yourself from being locked into mechanical patterns of responding to a given situation. When practicing a meditation exercise you may notice yourself thinking "this is stupid," or "it's never going to work." Realize that these are mere judgments and allow them to flit past so you can gain from the task at hand.

Patience is the second attitude. Keep an open stance towards the moment you are experiencing. Stay connected to the present rather than allowing your mind to ruminate on the past or worry about events to come. Each moment you experience is your life in that moment. Realize that things have a way of unfolding on their own time.

The next attitude is called the ***Beginner's Mind***. With this mindset, one sees everything as if for the first time. When you remove the veil cast by previous experience and get rid of perceptions that are tainted by thoughts and opinions, you understand that each moment in time is unique and contains unique possibilities.

Trust is another crucial attitude in the practice of mindfulness. Mindfulness is a very personal and intimate process. You alone have the power to steer your personal development through this practice. You are more familiar with yourself as a person than anyone else, so you decide what works for you and what doesn't. Have trust in your own feelings and intuition and in your own goodness and being.

Non-striving is the next attitude. Allow every part of your experience to be with you. Invite yourself to grow and unfold instead of pushing things along.

Acceptance is the next attitude. Acceptance allows you to see things as they are, unbiased by the self-serving judgments of the mind. It is important to keep an accurate and realistic view of the present and avoid creating cognitions that mask the truth. This way, you are not affected by the pain associated with longing or being shameful of who you are. Once you can accept the present fully, you have set the preconditions for true healing.

The last attitude a mindful person cultivates is ***Letting Go***. Our minds tend to hold on to thoughts which often continue to cause us distress. By letting go of thoughts and observing them as they pass, you become detached from them. You realize that your thoughts do not compose your identity, they are just thoughts. You get the best of your present experience when you are free from your mind and its attempts to pull you away from the here and now.

A final word in conjunction with these fundamental attitudes is that your growth and success in mindfulness will also depend on your commitment and intentions. As mindfulness works to cultivate a certain healthy state of mind, maintaining this state of mind is dependent on regular practice. It is recommended that each day you devote some portion of your day, if only 15 minutes, to perform mindful exercises and nourish the attitudes previously discussed. You may also wish to establish a vision to serve as your underlying motivation. This might be a vision of yourself if you were to transcend the limitations of your mind, and actualize your true potential.>>

Sitting Meditation

<<Mindfulness meditation is centered on the breath. The process of breathing reflects the rhythm associated with all life: the ebb and flow of the tides, the continuous cycle of gases in the atomosphere, the change of seasons, the exchange of energy in photosynthesis, the circadian rhythms of our bodies. Breathing is intimately connected with the experience of being alive. We also possess some degree of conscious control over our breathing. Mindfulness takes advantage of these qualities of the breath, and uses breathing as a way to empower attention and awareness. Breath is the anchor for all aspects of meditative awareness. >>

<< Adopt an alert and dignified posture, keeping your back straight but relaxed. You may want to use the Burmese posture drawing one leg close, and draping the other one in front. Some people may choose a hero's pose, simply sitting comfortably on their knees. You might like to try the lotus position, drawing one leg up so that each foot rests on the thigh of the opposite leg, or a half-lotus in which only one foot rests on top of the opposite thigh. Choose whatever posture is most comfortable for you, but try to keep the head, neck, and back aligned and the shoulders relaxed. This is the easiest way for breath to circulate the body. Breathe from your belly by allowing it to relax and you will engage your diaphragm. Do not attempt to control the manner of your breathing, but simply relax and pay attention to how it naturally occurs. You can achieve more breath and better control this way. Be aware of the feelings and sensations in your belly and the movement of the muscles and organs at work. Focus intently on each inbreath and outbreath. When the mind wanders, bring it back to the breath. As thoughts pass through your mind, remain focused and calm and just observe them. Note their content and their charge -- or

the degree to which a certain thought dominates your mind. Whether a thought is trivial or insightful, let go of each one as it comes up. Each time you release a thought and come back to breathing, you are training your mind to be less reactive and more stable. You are strengthening your mind's ability to concentrate and be calm. Our thoughts contain evaluative labels and reflect neither reality nor our true selves. You are affirming the knowledge that you are not who you "think" you are, you are the awareness observing your thoughts. If you begin to feel sensations of discomfort, resist the first impulse to shift position. Welcome them into your awareness and accept them in the moment. We can use pain as a tool to develop our insight and awareness rather than avoiding it with automatic and mindless responses. See if you can relax into the discomfort. As you attend to your breathing, you return to your wholeness. You affirm the intrinsic balance of mind and body. Relax into the peaceful depths of your being, far below the surface and the agitated waves of the mind. >>

Body Scan

<< Lie down on your back and allow your eyes to close gently. With your beginner's mind, imagine you are encountering your body for the first time. Feel the rising and falling of your belly with each inbreath and outbreath. Feel your body as a whole from head to toe. Feel the envelope of your skin. Notice the sensations of touch in the places where your body is in contact with the floor. Now focus your attention to the toes of your left foot. See if you can channel your breath to them so that it feels as if you are breathing into your toes and out from your toes. Imagine the breath moving through the body from where it enters through the nose, then down into the lungs, now coursing through the abdomen and the length of the left leg, and then retreating back up and out

through the nose. Permit yourself to feel any and all sensations in your toes and notice any differences among them. It is fine if you do not feel anything, simply allow yourself to not feel anything. Now concentrate and pull a deeper breath back down to the toes. This time, imagine your toes dissolving with the outbreath. Redirect the breath now to the sole of the foot. Breathe in to the sole of the foot and out from the sole of the foot. Be aware of any sensations you are experiencing. [Exercise is repeated for each section of the body from the left toes up the left leg to the pelvis, from the right toes up the right leg and back to the pelvis, up the torso, lower back, abdomen, upper back, chest, shoulders, down each arm, to the fingers, and up the neck, throat, all regions of the face, to the back of the head, and finally the breath moves out through (an imaginary hole in) the top of the head.] As you move through your body with your breath, feel the tension and fatigue of each muscle flowing out with every outbreath, and feel the inbreath infuse them with energy, vitality, and relaxation. You are harvesting tension and pain and discharging them from your body. You are refining your sensitivity to the body, and attuning yourself to your physical organism. The body scan technique is most effective when practiced at least once a day for about twenty minutes. If it is difficult for you to stay awake during this exercise, try it with your eyes open. >>

Hatha Yoga

<< In mindfulness, yoga is used to mobilize attention and awareness through physical movement. Yoga is free from the typical agitations and reactivity that go hand in hand with other forms of exercise. It involves a careful transition between various poses or "asanas." Through yoga, we strengthen the connection between the body and mind by noticing how changes in our physical orientation correspond to internal changes in our

feelings and mood. The process is used to hone one's balance, stretch the muscles and make them longer, and develop optimal energy flow in the body. In yoga, one explores the body's limitations carefully and mindfully. This means that you realize when a stretch is becoming too painful and you stop before injuring yourself. Eventually, your limitations will recede after effort and practice. Most of our bodies are frequently restricted by disuse atrophy. This means if our bodies are never asked to twist, bend, stretch, or run, then they start to lose their capacity to do these things. Practicing yoga wakes up your body to its full range of motion and potential for movement. Yoga allows us to be with our bodies, nourish them, and listen to them. >>

Sequence of Poses

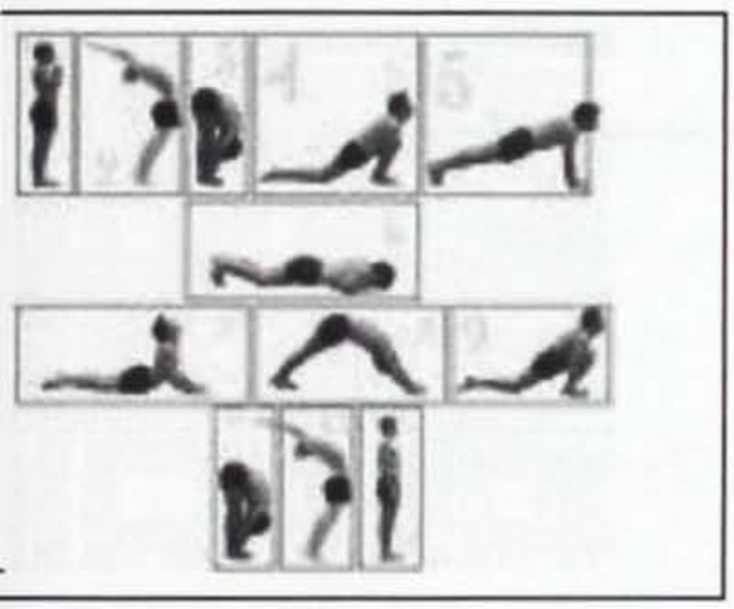
1. Sun Salutation: mountain pose → cobra (or upward facing dog) → downward facing dog → mountain pose.

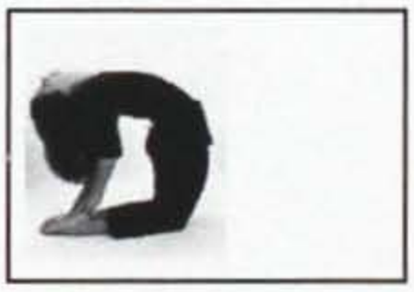
2. Warrior → triangle → tree

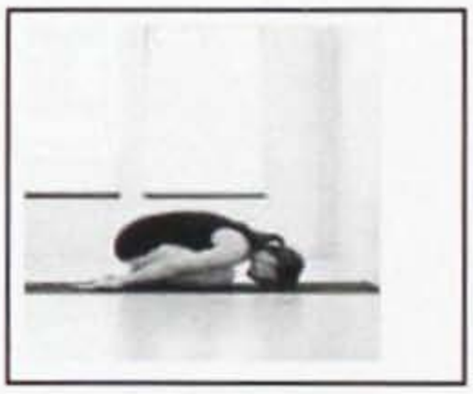
3. Spinal twist → hero → camel → child's pose → boat

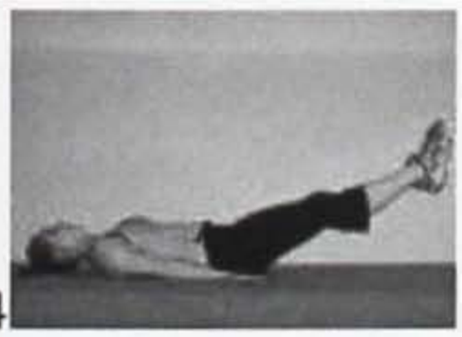
4. Leg lifts → shoulderstand → plough → bridge

5. Corpse









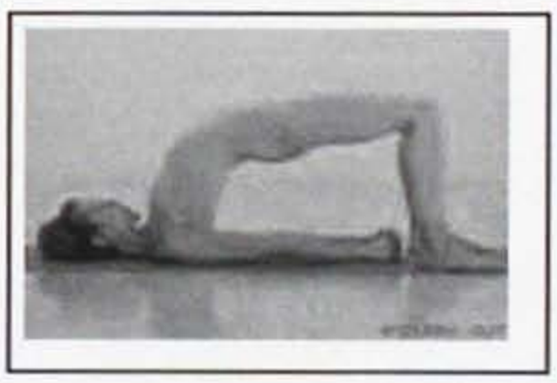


Table 1.

Age, Gender and Baseline Mindfulness Demographics

	Treatment Group (TG) (N=24)	Wait List Group (WLG) (N=23)
Age: Mean (sd)	19.92	20.09
Percent Male	25	13
Baseline Mindfulness	34.48	36.82

Table 2.

Correlations Between Baseline Mindfulness and Cognitive and Behavioral Outcome Measures in the Full Sample

	Mindful Attention Awareness Scale	
	r	p
Risky Behavior Scale	-.04	.78
Mental Control	-.09	.55
Dual Fluency	-.20	.18
Stroop Interference	-.31*	.05
Tower of London	-.11	.46
Balloon Analogue Risk Task	-.29	.06
STOP-IT	-.05	.76

* Correlation significant at the 0.05 level (2-tailed)

Table 3.

Treatment Group vs. Waiting List Group Performance on Pre-test and Post-test

	Treatment Group (N= 16)		Waiting List Group (N=20)	
	Pre-test	Post-test	Pre-test	Post-test
Risky Behavior Scale	26.5 (4.62)	25 (2.35)	28.8 (7.93)	25.2 (3.72)
Mindfulness Scale	34.8 (13.09)	35.93 (16.71)	37.45 (11.95)	33.9 (10.52)
Mental Control	26.31 (6.77)	28.88 (5.89)	30 (5.43)	29.5 (5.7)
Dual Fluency	17.44 (3.76)	20.88 (4.8)	19.75 (4.4)	21.75 (4.03)
Stroop Interference	25.63 (10.03)	28.63 (10.13)	25.11 (9.56)	28.84 (8.37)
Tower of London	26 (19.51)	24.38 (20.17)	21.9 (14.7)	16.5 (11.2)
Balloon Analogue Risk Task	27.76 (16.2)	38.45 (14.15)	34.57 (14.92)	37.98 (15.4)
STOP-IT	40.62 (9.08)	43.29 (8.84)	44.79 (15.71)	46.73 (15.29)

Table 4.

Correlations Between Total Amount of Mindfulness Practice and Difference Scores for Outcome Measures (Post-test – Pre-test)

	Total Minutes of Practice	
Difference Scores (T2-T1)	r	p
Risky Behavior Scale	-.09	.7
Mindful Attention Awareness Scale	.41	.07
Mental Control	.04	.88
Dual Fluency	.00	.99
Stroop Interference	-.18	.45
Tower of London	.41	.86
Balloon Analogue Risk Task	.29	.21
STOP-IT	.19	.41

Figure 1.

Mean Comparison (in minutes) of Mindfulness Practice in Treatment Group (TG) and Wait List Group (WLG)

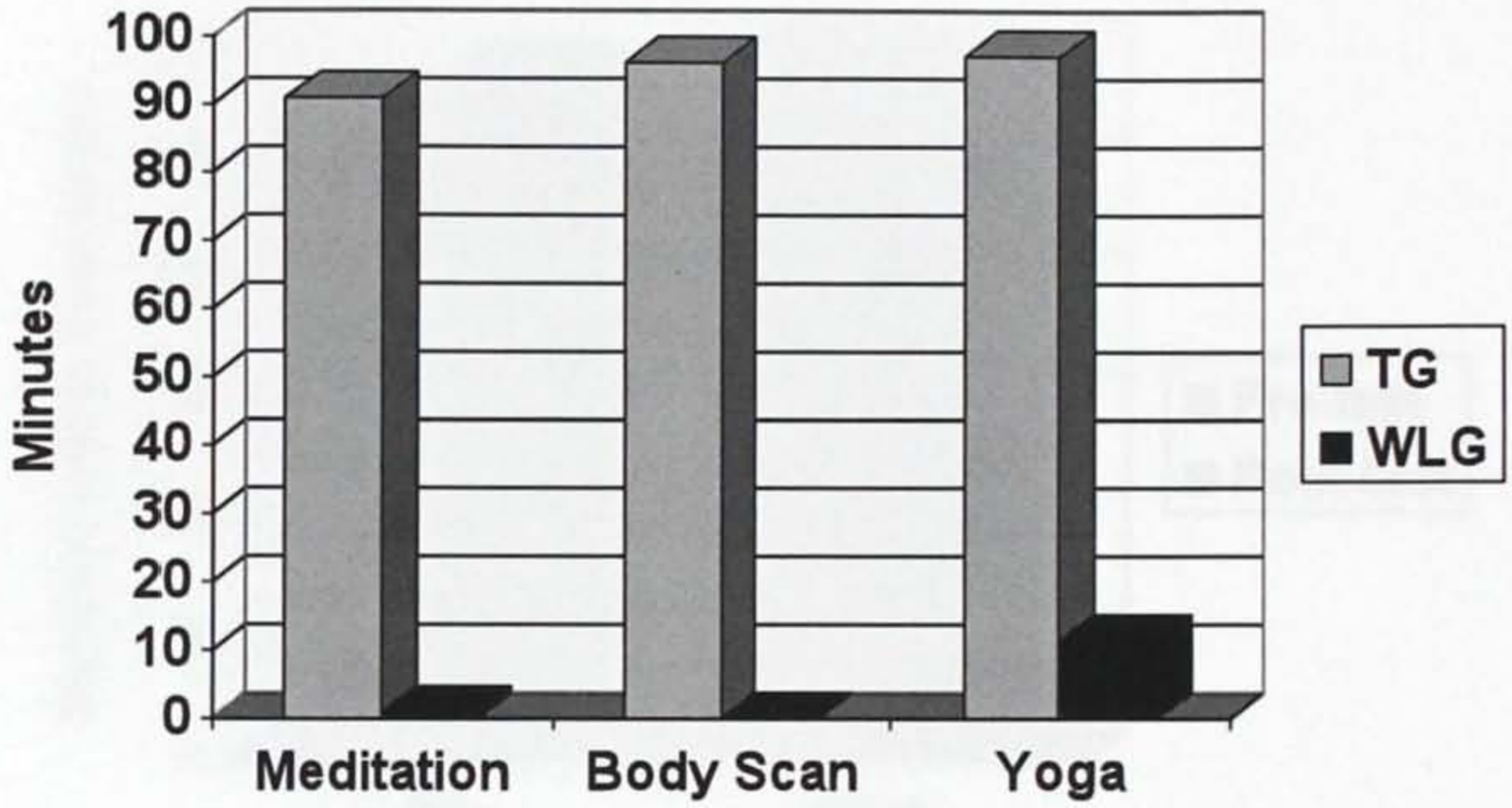


Figure 2.

Treatment Group (TG) vs. Waiting List Group (WLG) Mental Control Performance at Pre-test and Post-test

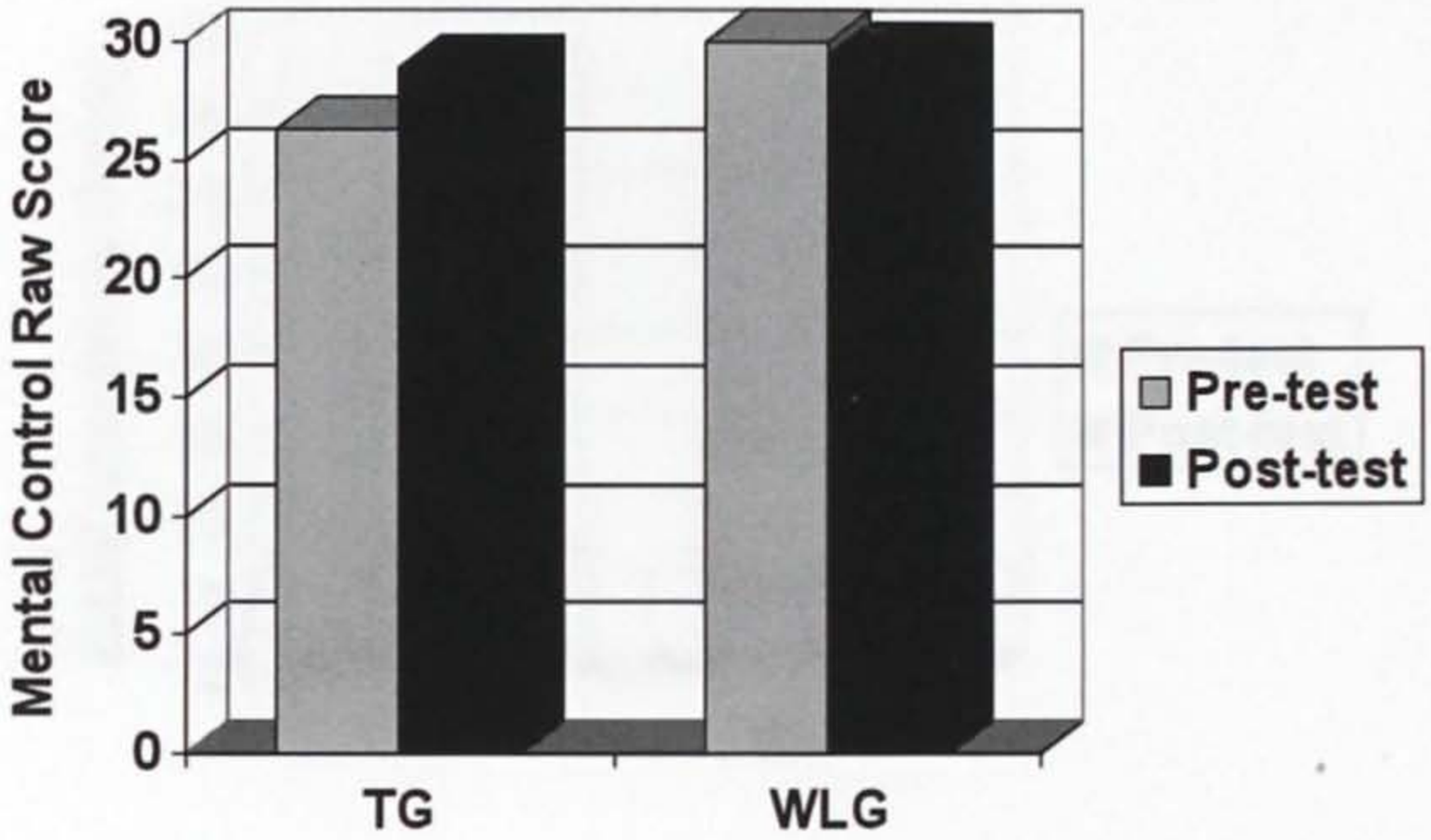


Figure 3.

Treatment Group (TG) vs. Waiting List Group (WLG) BART Impulsivity Ratings at Pre-test and Post-test