

Four days of mindfulness meditation training for graduate students: A pilot study examining effects on mindfulness, self-regulation, and executive function

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Self-regulation facilitates coping with academic stress and demands. This pilot study examined the effects of four consecutive mindfulness meditation classes on self-regulation and executive function in graduate students. Self-report measures of mindfulness, self-regulation, and executive functions were completed before and after the mindfulness classes. Paired t-tests compared pre-post training scores and effect sizes were calculated using Cohen's d. A sample of 8 psychology graduate students (7 female) volunteered to participate in the mindfulness training. The group classes were modeled after meditation practices in Mindfulness-Based Cognitive Therapy. Each class involved a specific theme: (1) Stepping Out of Automatic Pilot, (2) Awareness of the Breath, Body, Sounds, and Thoughts, (3) Mindful Movement, and (4) Working with Difficulty. Students significantly improved in mindfulness and self-regulation skills. Large effects were obtained for increases in total mindfulness, and the mindfulness facets of acting with awareness and non-reactivity to inner experiences. Additionally, large effects were calculated for total self-regulation and the self-regulatory facet of self-reinforcement. The current pilot study provides preliminary support for cultivating mindfulness skills and enhancing self-regulatory capacity in graduate students through four consecutive days of mindfulness training.

Keywords: *mindfulness; meditation; self-regulation; executive function; higher education*

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INTRODUCTION

Mindfulness meditation involves directing attention so that one is purposefully aware of current stimuli, on a moment-to-moment basis, and in an accepting and non-judgmental way (Kabat-Zinn, 1994). Research indicates that mindfulness training enhances higher-order cognitive processes (see Chiesa, Calati, & Serretti, 2011, for review). Even brief mindfulness training (i.e., 20 minutes per day for four days) is associated with significant improvements in executive function tasks (Zeidan, Johnson, Diamond, David, & Goolkasian, 2010). Executive functions promote the capacity for effective self-regulation and engagement in purposeful, goal-directed behavior. Self-regulation (also termed self-management or self-control) is commonly conceptualized as the ability to persist in low probability behaviors, without external motivational supports (Kanfer, 1970). Self-regulation is comprised of three facets: self-monitoring, self-evaluation, and self-reinforcement. Self-monitoring involves attention to relevant stimuli, while self-evaluation involves determining if monitored stimuli indicate progress toward an internalized goal, and self-reinforcement involves self-administered reward or lack thereof (Mezo & Short, 2012). This iterative feedback loop gradually motivates and enhances self-change and self-control. Although intrinsic motivation and related processes (e.g., self-regulation and executive function) are relevant to students pursuing graduate studies, the self-regulatory benefits of mindfulness training have not been explored in this population.

Graduate school attrition is alarmingly high, with rates ranging from 47% to 67% for the humanities and social sciences disciplines (Bowen & Rudenstein, 1992; Nerad & Miller, 1996; Sowell, 2008). Moreover, research indicates that self-motivation is strongly associated with graduate degree completion (Mason, 2012). Coping with the demands of graduate studies requires the ability to monitor and control ongoing behavioral, cognitive, and motivational processes in academic contexts. Self-regulatory processes are related to educational attainment and work-related knowledge and skills (see Sitzmann & Ely, 2011, for review). Lower levels of executive functions, particularly metacognition (e.g., planning, organizing, initiating tasks, problem-solving during tasks), are associated with poor coping, academic problems, and procrastination in undergraduate students (Rabin, Fogel, & Nutter-Upham, 2011; Wingo, Kalkut, Tuminello, Asconape, & Han, 2013).

The potential link between mindfulness and self-regulation of performance has received growing empirical attention. Mindfulness may enhance self-regulation by improving attention and capacity to act in accordance with one's goals (Shapiro & Schwartz, 2000). Recent research indicates that dispositional mindfulness is associated with self-regulation of performance in various domains, such as sport (Blecharz et al., 2014) and academic contexts. For example, dispositional mindfulness is associated with higher levels of self-control and goal orientation among

undergraduate students (Howell & Buro, 2011). However, focused attention and preparedness is not systematically trained in most academic settings (Shapiro, Brown, & Astin, 2011). To our knowledge, the relationships between cultivated mindfulness and the three-facet model of self-regulation have yet to be explored. The current pilot study examines the effects of four consecutive classes of mindfulness meditation training on mindfulness, self-regulation, and executive functions in graduate students.

MATERIALS AND METHODS

Participants

Participants were recruited through an email that was sent to all graduate students in the Department of Psychology at a Canadian university. Although 50 students were enrolled in psychology graduate programs and received the email, only 35 students were living in the area for the semester. There were 10 students who expressed interest in participating in the study; however, two students could not attend due to scheduling conflicts. Thus, a sample of 8 graduate students (7 female) completing a masters or doctoral degree in psychology volunteered to participate in the mindfulness training. This sex ratio is consistent with the student population of psychology graduate programs at this university, as well as other universities in North America. Participants averaged 26.57 years of age ($SD = 3.01$) and the majority of participants were White (87.5%). Over half of the sample (62.5%) was in a committed relationship and 37.5% were single. To enhance the external validity of the study, students were not excluded based on previous meditation or yoga practice. Three students had no previous experience with meditation, and five students had some experience (e.g., yoga classes or previous meditation groups for one to three months).

Measures

The internal consistencies of the study measures were estimated using Cronbach's alpha, and are all above the acceptable threshold of .70 (Nunnally, 1978). This statistic is an estimate of scale reliability, and determines how closely related items are as a group.

Five Factor Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The FFMQ is a 39-item measure of mindfulness and consists of five subscales. The subscales include observing (e.g., "When I'm walking, I deliberately notice the sensations of my body moving"), describing (e.g., "I'm good at finding words to describe my feelings"), acting with awareness (e.g., "I find it difficult to stay focused on what's happening in the present"; reverse scored), non-judging of inner experience (e.g., "I believe that some of my thoughts are abnormal or

bad and I shouldn't think that way"; reverse scored), and non-reactivity to inner experience (e.g., "I perceive my feelings and emotions without having to react to them"). Participants rate their responses on a five-point Likert-type scale, ranging from one (never true) to five (always true). Cronbach's alphas were acceptable for the present study (.87 for both pre-training and post-training scores).

Self-Control Self-Management Scale (SCMS; Mezo, 2009). The SCMS is a 16-item self-report measure of self-regulation, and is comprised of three subscales measuring each facet of the self-control and self-change cycle: self-monitoring (e.g., "When I am working towards something, it gets all of my attention"), self-evaluation (e.g., "I make sure to track my progress regularly when I am working on a goal"), and self-reinforcement (e.g., "I congratulate myself when I make some progress"). Participants are asked to report how well the items describe them on a six-point Likert-type scale, ranging from zero (very un-descriptive of me) to five (very descriptive of me). Cronbach's alphas were acceptable for pre-training and post-training scores (.87 and .92, respectively).

Behavior Rating Inventory of Executive Function—Adult (BRIEF-A; Roth, Isquith, & Gioia, 2005). The BRIEF-A is a 75-item questionnaire measuring self-reported deficits in executive functioning. This measure includes a global score, two broad indexes (i.e., metacognition and behavioral regulation), and nine subscales: inhibit (e.g., "I have problems waiting my turn"), self-monitor (e.g., "People say I don't think before acting"), plan/organize (e.g., "I have trouble organizing work"), shift (e.g., "I have trouble changing from one activity or task to another"), initiate (e.g., "I have trouble getting started on tasks"), task monitor (e.g., "I make careless mistakes"), emotional control (e.g., "I overreact to small problems"), working memory (e.g., "I have trouble staying on the same topic while talking"), and organization of materials (e.g., "I have trouble finding things in my room, closet, or desk"). Participants rate their responses on a three-point Likert-type scale, ranging from one (never a problem) to three (often a problem). Cronbach's alphas were acceptable for pre-training and post-training scores (.94 and .93, respectively).

Procedure

The appropriate Institutional Review Board approved this pilot study. Psychology graduate students were invited to volunteer for four consecutive days of mindfulness meditation training. Participants completed demographic questions and measures of mindfulness, self-regulation, and executive function before and after the mindfulness training.

The classes consisted of mindfulness meditation practices modeled after Mindfulness-Based Cognitive Therapy (Segal et al., 2012). The classes were intended to provide direct training and education in mindfulness, rather than be a form of psychotherapy. Each mindfulness training class involved a specific theme.

The theme of the first class was “Stepping Out of Automatic Pilot” and practices included: (1) mindful eating, and (2) the body scan. The theme of the second class was “Awareness of the Breath, Body, Sounds, and Thoughts” and involved various sitting meditations including: (1) mindfulness of the breath, (2) mindfulness of the breath, body, sounds, and thoughts, and (3) the regular three-minute breathing space. “Mindful Movement” was the theme of the third class and practices included: (1) mindful stretching followed by a sitting meditation of mindfulness of the breath, (2) mindful walking followed by a sitting meditation of mindfulness of sounds and thoughts, and (3) the responsive three-minute breathing space. The final class involved “Working with Difficulty” and practices included: (1) mindful walking followed by a sitting meditation of mindfulness of the breath and body, and (2) working with difficulty sitting meditation. This class also included a discussion of strategies for continuing the mindfulness practices after the program ended.

The four classes were designed to include a progression of skills through the practices, where foundational skills (e.g., focusing attention inward on body sensations) were introduced in the initial class and more advanced skills (e.g., non-judgmentally exploring the connection between difficult emotions, thoughts, and body sensations) were practiced in the latter classes. Moreover, the training program included a variety of practice modalities (e.g., sitting, walking, stretching) that students could explore. The facilitators (M.M.S. and L.J.O.) have personal mindfulness practices and are professionally trained in conducting mindfulness-based interventions. Mindful inquiry was led by the facilitators after each practice to provide participants opportunity to discuss and reflect on the training experiences. During the classes, the facilitators aimed to foster a curious, accepting, and non-judgmental attitude towards all experiences expressed by the participants. The classes were delivered in a group format, and occurred once a day during the evening, over four consecutive days. The length of each class was 1.5 hours.

Statistical Analyses

Paired *t*-tests¹ were conducted to compare the pre-training and post-training mean scores and calculate whether the participants’ levels of mindfulness, self-regulation, and executive function significantly changed after the four classes of mindfulness training (i.e., whether the average scores changed more than might be expected due to chance fluctuations or variations on the attributes measured). Next, effect sizes² were calculated using Cohen’s *d* to estimate the size of the

1 $p < .05$ indicates that the null hypothesis is rejected (i.e., the pre-training and post-training mean scores do not differ greater than what would be expected by chance) and the alternative hypothesis is accepted (i.e., the pre-training and post-training mean scores do differ greater than what would be expected by chance).

2 Cohen’s *d* estimates the size of the difference between the pre-training and post-training mean scores according to Cohen’s (1992) guidelines: 0.2 to 0.4 suggests a small effect, 0.5 to 0.7 suggests a medium effect, and 0.8 and greater suggests a large effect.

difference between the pre-training and post-training mean scores. These analyses were conducted to help determine whether four classes of mindfulness training may be associated with a small, medium, or large change in mindfulness, self-regulation, and executive function for psychology graduate students (in other words, to determine if the actual amount of change was meaningful for practical purposes).

RESULTS

Results of paired *t*-tests comparing pre-training and post-training scores are shown in Table 1. There were statistically significant increases in mindfulness and self-regulation skills after the four days of training. The pre-post difference for executive function did not achieve statistical significance but was in the hypothesized direction.

Variable	Time 1 <i>M</i> (<i>SD</i>)	Time 2 <i>M</i> (<i>SD</i>)	<i>t</i>	Cohen's <i>d</i>
Mindfulness	128.63 (14.16)	141.25 (11.95)	-4.01**	-1.49 ^a
Observe	24.13 (3.14)	26.63 (2.72)	-1.61	-0.57 ^b
Describe	29.88 (6.03)	30.13 (6.96)	-0.27	-0.10
Act with Awareness	23.50 (3.55)	26.38 (3.02)	-2.34*	-0.84 ^a
Non-Judging	29.38 (4.14)	33.63 (5.13)	-2.08	-0.74 ^b
Non-Reactivity	21.75 (3.45)	24.50 (2.56)	-4.24**	-1.73 ^a
Self-Regulation	58.63 (10.62)	62.25 (10.14)	-4.53**	-1.74 ^a
Self-Monitoring	20.75 (3.37)	21.63 (4.24)	-1.26	-0.50 ^b
Self-Evaluation	21.50 (3.78)	22.25 (2.82)	-1.53	-0.72 ^b
Self-Reinforcement	16.38 (4.81)	18.38 (4.24)	-3.06*	-1.11 ^a
Executive Function ^d	101.38 (17.86)	97.38 (15.79)	0.73	0.26 ^c
Metacognition ^d	59.88 (10.82)	55.63 (8.77)	1.14	0.44 ^c
Behavioral Regulation ^d	41.50 (8.12)	41.75 (7.87)	-0.11	-0.04

Note. ^alarge effect size; ^bmedium effect size; ^csmall effect size; ^dhigher scores = greater deficits.

**p* < .05

***p* < .01

Table 1: Effects Sizes and *t*-Tests Comparing Mean Scores of Mindfulness, Self-Regulation, Executive Function, and Distress Before and After Four Days of Mindfulness Training

To determine the standardized difference between the pre-training and post-training means, effects sizes were calculated using Cohen's *d* (see Table 1). Effect sizes are described according to Cohen's (1992) guidelines: 0.2 to 0.4 suggests a small effect, 0.5 to 0.7 suggests a medium effect, and 0.8 and greater suggests a large effect. Large effects were obtained for increases in total mindfulness, the mindfulness facets of acting with awareness, and non-reactivity to inner experiences, total self-regulation, and the self-regulation facet of self-reinforcement. Medium effects were obtained for increases in the mindfulness facets of observe, and non-judging of inner experiences, and the self-regulation facets of self-monitoring, and self-evaluation. Small effects were obtained for enhancing total executive function and metacognition. No meaningful effect size was obtained for the mindfulness facet of describe and the executive function facet of behavioral regulation, suggesting that the mindfulness training was not associated with changes in these skills.

DISCUSSION

The current pilot study examined the effects of brief mindfulness meditation training on mindfulness, self-regulation, and executive functions in psychology graduate students. The four days of mindfulness classes provided training in mindfulness skills and exposure to a variety of practice modalities (e.g., longer periods of formal sitting meditation, mini-meditation exercises used to respond to stress, mindful movement exercises). All of these meditation practices are commonly employed in Mindfulness-Based Cognitive Therapy (Segal et al., 2012). Findings from this study provide preliminary support for enhancing mindfulness and self-regulation through brief mindfulness training.

The mindfulness facets of acting with awareness, non-reactivity to inner experiences, and although not statistically significant, observing current stimuli, and non-judging of inner experiences increased after the training. No meaningful effect was found for the mindfulness facet of describing current stimuli, which may suggest that this skill is less developed after brief mindfulness training and may become more developed during later stages of training. Research has only recently begun to explore changes in the facets of mindfulness after meditation training programs (Park, Reilly-Spong, & Gross, 2013). The current results are consistent with previous findings indicating that a seven-week mindfulness course conducted with undergraduate psychology and medical students had the greatest effects on increases in non-reactivity toward inner experience (de Vibe et al., 2013). These results highlight the benefit of using a multifaceted measure of mindfulness in meditation training research. Moreover, not automatically reacting to internal stimuli, such as thoughts, physical sensations, and emotions, appears to be a primary outcome of early stages of mindfulness training.

Self-reinforcement, and although not statistically significant, self-monitoring and self-evaluation increased after training. Therefore, self-regulation may not only be enhanced through increased attention of current stimuli and one's actions, but also through being non-reactive and non-judgmental when one's behavior does not meet an internal standard. The process of self-regulation involves self-motivation through positive reinforcement of desired behaviors (e.g., goal progress) and the lack of reinforcement after undesired behaviors (e.g., procrastination). Self-criticism after undesired behaviors may possibly hinder the self-regulation cycle, as research indicates that this form of self-punishment is related to diminished goal progress (Powers, Koestner, Zuroff, Milyavskaya, & Gorin, 2011). However, taking a non-reactive and non-judgmental mindset after undesired behaviors, as promoted in mindfulness training, may further enhance the self-regulation cycle.

The small effect of decreased metacognitive dysfunction suggests that brief mindfulness training may also contribute to increases in metacognition. Metacognition is a component of executive function that represents cognitive abilities in managing attention and problem solving (Roth et al., 2005). Mindfulness may enhance metacognitive abilities, which allow an individual to sustain motivation in a task and systematically solve problems through organization and planning, while sustaining these efforts in working memory. Considering deficits in metacognition are associated with academic problems (Wingo et al., 2013), enhancing metacognitive capacity through mindfulness training may help adjustment in university, and particularly in graduate school.

The findings from the current pilot study are promising in terms of targeting self-regulatory capacity in graduate students through brief mindfulness training, particularly given that the mindfulness program produced large effects in a small sample of students. Future research will need to examine this brief mindfulness meditation program in a larger sample of students in order to adequately evaluate the moderate and small effects of the training. Additionally, possible mediators of change and the long-term effects of the mindfulness program should be examined with a control group. The current study employed self-report outcome measures, and although self-report data provides an individual's perspective of their functioning, this approach may be limited by poor recall and lack of insight into thoughts, emotions, and behaviors (Paulhus & Vazire, 2007). Utilizing instruments that do not rely on self-report, such as informant-report questionnaires and performance-based measures may be useful in subsequent studies. Assessing a broader range of outcomes (e.g., academic achievement, quality of life) could also help evaluate effects of the mindfulness training that were potentially missed in the present study.

Although the sex ratio of this sample is consistent with psychology graduate student populations, the predominately female sample limits the ability to gen-

eralize the findings to males in graduate school. Few studies have addressed sex differences in mindfulness training. Some studies suggest no sex differences for the general population (e.g., Nyklicek & Kuijpers, 2008), while another study indicated greater reductions in stress for female compared to male undergraduate students (de Vibe et al., 2013). A larger study may help clarify whether sex is related to the effects of mindfulness training in graduate students, and for what outcomes. Notably, pre-training average total scores from graduate students in this pilot study were comparable to average total scores from undergraduate student populations for the FFMQ ($M = 128.63$ versus 125.77 , respectively, $N = 213$; Short & Mazmanian, 2013), SCMS ($M = 58.63$ versus 53.03 , respectively, $N = 410$; Mezo & Short, 2012), and BRIEF-A ($M = 101.38$ versus 112.6 , respectively, $N = 212$; Rabin et al., 2011). Future research may specifically target students who are at higher risk of graduate school attrition, such as those low in intrinsic motivation and those with a tendency to procrastinate. Although this discussion goes beyond our data, these findings suggest that mindfulness training might be a protective factor against graduate school attrition, and graduate programs may choose to incorporate mindfulness training for students to enhance self-regulation skills.

CONCLUSIONS

This pilot study provides preliminary evidence for the efficacy of four days of mindfulness training in significantly cultivating mindfulness skills and enhancing self-regulatory capacity. Training in mindfulness meditation practices may increase intrinsic motivation toward goal-directed behavior by enhancing abilities to monitor relevant stimuli, attend to task requirements, and positively reinforce gains towards a goal.

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