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Mindfulness Training and Reductions in Teacher Stress and Burnout: Results From Two Randomized, Waitlist-Control Field Trials

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The effects of randomization to mindfulness training (MT) or to a waitlist-control condition on psychological and physiological indicators of teachers' occupational stress and burnout were examined in 2 field trials. The sample included 113 elementary and secondary school teachers (89% female) from Canada and the United States. Measures were collected at baseline, post-program, and 3-month follow-up; teachers were randomly assigned to condition after baseline assessment. Results showed that 87% of teachers completed the program and found it beneficial. Teachers randomized to MT showed greater mindfulness, focused attention and working memory capacity, and occupational self-compassion, as well as lower levels of occupational stress and burnout at post-program and follow-up, than did those in the control condition. No statistically significant differences due to MT were found for physiological measures of stress. Mediational analyses showed that group differences in mindfulness and self-compassion at post-program mediated reductions in stress and burnout as well as symptoms of anxiety and depression at follow-up. Implications for teaching and learning are discussed.

Keywords: mindfulness, self-compassion, teachers, stress, burnout

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Recently, mindfulness training (MT) has emerged as a novel way to teach individuals to cope more effectively with stress (Grossman, Niemann, Schmidt, & Walach, 2004). Our purpose in this study was to test the feasibility and efficacy of a professional development program for teachers aimed at the reduction of job stress and symptoms of burnout through mindfulness training (MT). The MT program under investigation aims to assist teachers in developing skills and mind-sets that are hypothesized to lead to stress reduction, resilience enhancement, and the improvement of teaching and learning in the schools (Mind and Life Education Research Network [MLERN], 2012; Roeser, Skinner, Beers, & Jennings, 2012). Through mindfulness training, for instance, individuals are taught how to monitor their internal reactions to emotionally evocative situations and thereby know when they are in the grips of an emotion and need to take time to calm down before responding. In addition, individuals who undertake MT are taught how to cultivate an attitude of kindness and compassion toward themselves, especially during moments of difficulty that inevitably arise on the job and in life more generally. In this study, we examine whether or not teachers can learn and apply these kinds of

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skills and mind-sets in their professional lives to reduce stress and feelings of burnout.

The theory of change we pursue in this study is that MT provides teachers with a set of resources (mindfulness and occupational self-compassion) that helps them to cope more effectively with and bounce back more quickly from the inherent and considerable social-emotional and cognitive challenges of classroom teaching (see Figure 1). By coping more effectively and being more resilient, we believe, teachers conserve physical and mental energies that are then available to invest in effectively managing, relating to, motivating, and teaching students. Furthermore, by assisting teachers in developing the kinds of self-regulatory strategies and qualities of awareness that are critical for stress management and effective teaching, teachers become role models for the kinds of skills and mind-sets that students in the 21st century also need to be successful in school and in life (e.g., Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Moffitt et al., 2011; Shoda, Mischel, & Peake, 1990). In these ways, mindfulness training for teachers is hypothesized to exert both direct effects on teachers' capacities to teach more effectively and indirect effects on students' capacities to learn more effectively (Jennings & Greenberg, 2009; MLERN, 2012). A logic model that describes these hypothetical effects of mindfulness training on teachers and students is presented in Figure 1 (see also Roeser, Skinner, et al., 2012). In this study, we examine the first several steps in this logic model with regard to the hypothesized effects of mindfulness training on teachers' ability to cope with job stress and reduce feelings of occupational burnout.

Teaching as Stressful Occupation

Whereas an understanding of the deleterious effects of stress on children's health, well-being, and readiness to learn through the impairment of executive functions such as focused attention and emotion control is among the key insights of modern educational and developmental neuroscience (Blair & Diamond, 2010; Davidson & McEwen, 2012; Diamond & Lee, 2011), a parallel understanding of the deleterious effects of job stress and burnout on teachers' health, well-being, and teaching ability, through the same executive functions, is only beginning (MLERN, 2012; Montgomery & Rupp, 2005). In a recent meta-analysis, for example, Montgomery and Rupp (2005) identified individual differences in emotion-regulation skills as a key factor in understanding teacher stress.

Why is teaching among the most stressful of occupations (Johnson et al., 2005; Travers, 2001)? Some have theorized that teachers' job stress is due primarily to the inherently social-emotional demands of working with up to 30 or more children or adolescents at once (Schutz & Zembylas, 2009; Zapf, 2002). Others have pointed to the uncertain and attention-intensive nature of teaching—an activity in which teachers must flexibly and creatively make hundreds of decisions "on the fly" each day—as a key source of teacher job stress (Roeser, Skinner, et al., 2012). Teachers themselves report that workload, lack of collaborative time with colleagues, lack of support from administrators, and the management of difficult student behavior in the classroom are among the most stressful aspects of their jobs (e.g., Kyriacou, 2001). Some of these factors appear to be more inherent in the job of teaching itself (e.g., managing multiple relationships at once), whereas others seem amenable to change through school policy and practice (e.g., provisions for common planning time).

Why does understanding teacher stress matter for our understanding of student motivation and learning? Over time, chronic high levels of teacher stress can lead to occupational burnout, a syndrome consisting of emotional exhaustion, depersonalization,

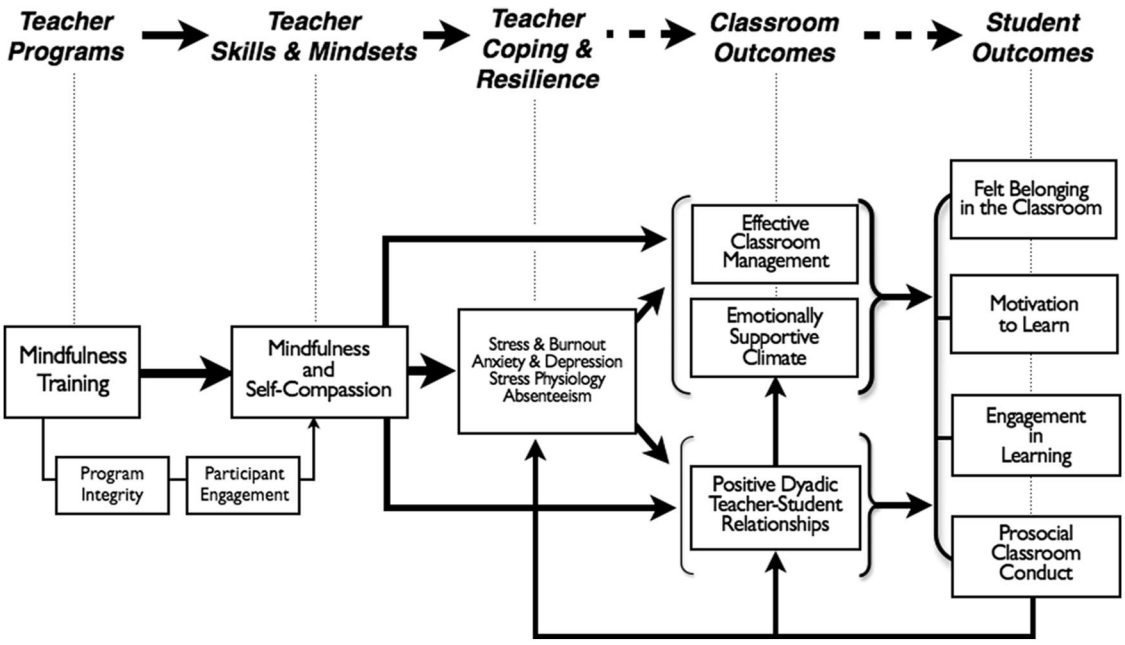

Figure 1. Teacher mindfulness training logic model and theory of change.

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and a lack of feeling of accomplishment in one's work (Maslach, Schaufeli, & Lieter, 2001). Chronic stress and burnout, in turn, are associated with a suite of undesirable personal and professional outcomes for teachers. On the one hand, they take a toll on physical and mental health in terms of anxiety and depression, high blood pressure, or even cardiovascular disease (Dimsdale, 2008; Gunnar & Quevedo, 2007; Maslach et al., 2001; McEwen, 2008). On the other hand, teacher stress and burnout can lead to work absenteeism and a diminished capacity to engage and effectively teach students (Darr & Johns, 2008; Roeser, Skinner, et al., 2012). One might predict negative indirect effects of teacher stress on student achievement through teacher absenteeism, for instance (e.g., Miller, Murnane, & Willett, 2007).

In sum, teacher stress and burnout can undermine teacher health and well-being. In turn, teacher health problems can increase district health care and human resource costs associated with teacher illness, absenteeism, and desistance from the profession. With regard to students, teacher stress and burnout may adversely affect student engagement and learning through teacher absenteeism, exhaustion, and diminished teaching effectiveness (Briner & Dewberry, 2007; Jennings & Greenberg, 2009). Generally, teacher education and teacher professional development programs do not assist teachers in developing skills such as mindful emotion regulation or attitudes such as self-compassion that they then might use to address the inherently stressful aspects of their work environments (Roeser, Skinner, et al., 2012). And yet, as we discuss below, we hypothesize that it is these kinds of higher order skills and mind-sets that are needed for individuals to function effectively in inherently high-stress professions like teaching.

Theory of Teacher Stress and Burnout

From a social-cognitive perspective (Lazarus & Folkman, 1984), stress results when individuals appraise situational demands as taxing or overwhelming the personal and social resources the individual has at his or her disposal to address demands effectively. *Coping* can be understood as those appraisal processes and resources leading to effective regulation under stress, *resilience* as those leading to effective recovery from stress, and *distress* as ineffective coping with or recovery from stress due to a lack of resources to meet demands (Skinner & Zimmer-Gembeck, 2009).

By definition, appraisals of situations as stressful divert emotional and cognitive resources toward efforts to cope and protect oneself from the perceived threat. In the case of teachers, such diverted resources are no longer available for investment in classroom relationships and the processes of motivating and teaching students (e.g., Boekaerts, 1993). One implication of this perspective in the context of the inherently stressful features of the job of teaching is that teachers need assistance in developing their self-regulatory resources (e.g., higher order skills and mind-sets) for coping and being resilient. Our purpose in this study was to examine whether or not a MT that aims to teach teachers mindfulness and self-compassion as resources for coping with workplace stress is acceptable, feasible, and efficacious in this regard.

Mindfulness Training and Stress Reduction

A considerable body of evidence with adult populations indicates that mindfulness, a particular way of deploying attention and awareness in the present moment without emotional reaction or conceptual judgment, is instrumental in helping adults reduce stress, regulate emotion, and thereby improve their health and well-being (Carmody & Baer, 2008; Grossman, Niemann, Schmidt, & Walach, 2004). Several key mechanisms underlying the salutary effects of mindfulness for health and well-being have been theorized, and all of them seem to point toward the necessity of teaching individuals how to recognize and regulate "stress reactions" that are triggered in situations that are in fact not life-threatening (but for which the stress reaction originally evolved; Ekman, 2003; Gunnar & Quevedo, 2007); to move toward mindful awareness and mindful emotion regulation through the use of prefrontal cortex (executive) functions to regulate emotion and relax (Benson, 1975); and to reflect, plan, and problem solve in the presence of non-life-threatening demands and challenges (Davidson & McEwen, 2012). The challenge is twofold: to down-regulate bottom-up, fast-onset stress reactions and to up-regulate slow, top-down, nondominant response tendencies associated with executive function (EF; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). Because EF is particularly vulnerable to the disorganizing effects of stress, strengthening EFs such as focused attention and emotion regulation through intentional training in nonstressful situations, similar to the way an athlete trains for the Olympics, is essential (MLERN, 2012). Recently, there has been growing interest in using MT to help teachers address job stress and burnout through intentional training in mindfulness and self-compassion delivered within the safe context of an 8-week professional development program (Roeser, Skinner, et al., 2012).

Kabat-Zinn (1994) defined mindfulness as "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (p. 4). As such, mindfulness can be understood as involving three interrelated mental skills and dispositions: (a) focusing attention intentionally on the here and now (rather than letting the mind wander into ruminating on the past or worrying about the future); (b) perceiving situations and engaging in actions with the clear light of conscious awareness (rather than doing so emotionally, automatically, and nonconsciously or mindlessly); and (c) experiencing each moment just as it is, without biasing emotional reactions or mental judgments (e.g., expectations, wishes, or fears that may or may not be relevant to what is actually happening). Mindfulness is also sometimes described in terms of an attitude of warmhearted curiosity toward the present (Cullen, 2011). A closely related attitude has been termed "self-compassion" (Neff, 2003) and involves (a) mindful self-awareness, (b) a suspension of self-judgment and criticism in favor of self-kindness and acceptance, and (c) an understanding of the universal nature of challenge, setbacks, and difficulty in human existence. In the professional development (PD) work we describe here, the notion of teachers' development of "occupational self-compassion"—a mindful, nonjudgmental, and accepting view of oneself and one's challenges as a teacher—is infused throughout the 8 weeks of the MT program.

The utility of mindful self-regulation skills and self-compassionate mind-sets for coping with stress is hypothesized to lie in the use of these to (a) develop awareness of the antecedents to one's own stress reaction (e.g., what are my emotional triggers and how can I use this knowledge to be proactive about stress management?); (b) develop awareness of the bodily sensations that accompany being "stressed out" (e.g., knowing what I am feeling); and (c)

develop a set of strategies for coping effectively with stress, once it arises, through various techniques (e.g., stopping and taking a breath before reacting, disengaging from ruminative thinking in favor of present-centered awareness, letting go of unnecessary expectations and illusions of control, seeing the pain behind others' difficult behavior rather than taking it personally, practicing compassion for oneself when things are difficult).

Mindfulness Training Program

The mindfulness training program under investigation is an 8-week, 11-session program that met after school for a total of 36 contact hours. The MT employed a variety of pedagogical approaches and activities all designed to foster mindfulness and self-compassion as resources that teachers can use to cope with stress more effectively and manifest emotional resilience more quickly. This MT program has been described fully in Benn, Akiva, Arel, and Roeser (2012). Here, we provide only a brief description.

The MT program is primarily experiential in nature and uses five main teaching activities to teach mindfulness and self-compassion to teachers: guided mindfulness and yoga practices, group discussions of mindfulness practice, small-group activities to practice skills in real-life scenarios, lecture and guided home practices, and homework assignments (Roeser, Horn-Keller, Stadick, & Urdan, 2012). A common focus in all teaching activities is the cultivation of teachers' abilities to direct and sustain attention intentionally and nonjudgmentally on present-moment somatic and mental experience in the form of bodily sensations, feelings, mental images, and thoughts through specific practices (Young, 2012). Such practices can include body scans, in which participants focus their attention progressively throughout the body to bring awareness to somatic/emotional experience; focused-attention meditation to develop concentration, in which attention is focused on a single object like the breath or external sound; and open-monitoring meditation, in which one learns to practice "bare attention" with regard to moment-to-moment awareness of all facets of experience without becoming emotionally reactive or caught in conceptual thought (Kabat-Zinn, 1994). A fourth, closely related practice, loving-kindness meditation, uses focused attention in the service of cultivating positive emotion toward oneself and others (Salzberg, 2008).

In addition, the program includes didactic instruction (two lectures) on how to use mindfulness to regulate emotions and stress and on how to use mindfulness to regulate emotions and stress more effectively (Bishop et al., 2004; Chambers, Gullone, & Allen, 2009). Weekly group discussions of home practice and homework assignments support teachers in developing and applying mindfulness and self-compassion in their professional lives. Homework assignments invite teachers to apply the skills of mindfulness and compassion to some aspect of their teaching each week and to report back to the group. For instance, teachers are invited to keep a mindful emotion diary for one week, in which they document their emotions, "emotional triggers," and ways of coping in the classroom. They discuss these diaries in a subsequent meeting and explore how mindfulness might help them to cope differently. In sum, all of the teaching activities, practices, discussions, and homework assignments of the MT are meant to provide teachers with ample opportunities to learn mindfulness and compassion for self and others and to learn how to use these resources in the service of coping better with the stressful aspects of their jobs (see Figure 1).

Research Questions

We addressed the following three research questions:

1. Is an 8-week, 36-hour MT for public school teachers acceptable in terms of teachers' perceptions that the MT delivers professional benefit and feasible in terms of teachers' ability to do the home practices and to complete the program?

2. Do teachers randomized to MT show greater reductions in psychological and physiological indicators of occupational stress and burnout at post-program and 3-month follow-up than those in a waitlist-control group?

3. Do teachers randomized to MT show greater mindfulness, focused attention and working memory capacity, and self-compassion at post-program, and do such group differences at post-program mediate the impact of MT on reductions in teacher stress and burnout later at 3-month follow-up?

Method

Study Designs

This research took place in western Canada and the western United States (U.S.) in 2009 and 2010. We conducted a randomized, waitlist-control field trial in each research site (Canada, U.S.), with a target of 30 teachers per condition (mindfulness training condition, waitlist-control condition). Flyers advertising the study were sent to all eligible teachers in each district by school district staff. Participation in the stress-reduction program and research was voluntary and was based on the first 65 teachers who responded to the flyers in each site (Canada and U.S.). Participating teachers received the MT for free and were compensated monetarily for their time spent completing assessments.

Participating teachers completed baseline assessments after enrolling in the research, and they were randomly assigned to the mindfulness training or waitlist-control conditions. Those randomized to the MT condition completed the 8-week mindfulness training in spring of 2009 or 2010 (April to June); those assigned to the waitlist condition completed the training in autumn of 2009 and 2010 (October to December). There were three assessment times in both studies: baseline (T1, February–March), post-program (T2, June), and 3-month follow-up (T3, October).

Samples

The final Canadian sample included 58 public school teachers (52 women, 6 men; 50% elementary level) from a large urban public school district in western Canada.[1] Based on self-reports, the Canadian sample was 67% European Canadian, 18% Asian Canadian, and 15% other race/ethnicities (e.g., French Canadian,

[1] Teachers in this Canadian school district were screened for prior exposure to training for the MindUp program (see http://www.thehawnfoundation.org/mindup), a mindfulness-based program for students that is very popular in this district. We excluded teachers who had received MindUp training from our study as a means of controlling for teachers who were more highly motivated than other teachers to engage with mindfulness practice.

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Aboriginal, Filipino, Black Canadian). Of the Canadian teachers, 42% reported having a bachelor's degree, 22% reported having a post-bachelor's diploma, and 35% reported having a master's degree.

The final U.S. sample included 55 public school teachers (48 women, 7 men; 51% elementary level) from a suburban public school district in the western United States. Based on self-reports, the U.S. sample identified as 93% European American, 5% mixed ethnicities (e.g., Japanese and American), and 2% Asian American. Of the U.S. teachers, 20% reported having a bachelor's degree, 73% reported having a master's degree, and 7% reported having a JD or PhD.

Based upon analyses described below, the two samples were combined for this report. The final combined sample included 113 public school teachers (see Table 1). Women were overrepresented (89%), although the gender composition of our sample is consistent with the profession as a whole (Aud et al., 2010). The age of the teachers in combined sample ranged from 27 to 64 years (M = 46.9 years, SD = 9.2, *Median* = 48, *Mode* = 46). In terms of teaching experience, teachers ranged from having taught from 1 to 35 years in the classroom (M = 14.9 years, SD = 8.5, *Median* = 13, *Mode* = 6).

Data Collection Procedures

In both studies, data collection included (a) a take-home survey that assessed teachers' self-reported occupational stress, burnout, health, and well-being at all time points; (b) an objective assessment of each teacher's blood pressure and pulse rates by trained research assistants or nurse practitioners at baseline and post-program; and (c) a mindfulness training program evaluation survey and daily mindfulness practice journal collected at the end of the MT at post-program. In Canada, several additional measures were assessed at baseline and post-program during a 1-hr assessment done in teachers' classrooms after school. During these assessments, trained research assistants had teachers complete a computer-based measure of focused attention/working memory capacity (WMC) and a semistructured interview about their teaching. Teachers' blood pressure and heart rates were assessed at this time as well in Canada. No classroom visits were done at 3-month follow-up, so these measures were collected only at baseline and post-program. Canadian teachers also completed a "home stress kit" on a working Monday at baseline/post-program/3-month follow-up. The home stress kit (described below) assessed teachers' levels of cortisol, a hormone related to stress. In the United States, data collection included a health assessment with a registered nurse to measure basic health parameters (blood pressure, resting heart rate, blood oxygen efficiency, balance, pain level) and obtain health histories. This assessment occurred at all three time points. We did not collect measures of focused attention/WMC or cortisol in the U.S. sample.

Intervention Procedures

To insure fidelity of program implementation across research sites (Canada, U.S.), the same mindfulness instructor delivered the intervention in both sites. This instructor was also the primary author of the mindfulness training curriculum (Cullen & Wallace, 2010).

Measures

Outcome measures.

Mindfulness. Mindfulness was assessed with the Five Factor Mindfulness Questionnaire, a validated measure for use with adults (FFM; Baer et al., 2008). This 39-item questionnaire measures five facets of mindfulness training found both in beginning meditation training and in clinical interventions. These include awareness of sensation, feeling, and thought; noting and labeling of the components of experience with words; nonjudgment of experience; nonreactivity to experience; and acting with awareness rather than in automatic, nonconscious ways. Items were rated on a 5-point metric of frequency (1 = *almost never,* 5 = *almost always*), and scales were computed as the mean frequency across all items. The nonreactivity to experience subscale was omitted in the Canadian sample due to a copying error, resulting in a 31-item overall scale. In each site, the total mindfulness scales were statistically reliable at each time point in the study (Cronbach's alphas $> .90$).

Focused attention and WMC. In the Canadian study, in order to measure focused attention and WMC behaviorally, teachers were administered a laptop-based, automated version of the Operation Span Task (Ospan; Turner & Engle, 1989) in their classrooms at baseline and post-program. In brief, the Ospan task requires participants remember a sequence of unrelated letters while checking whether basic math problems are correct (see Unsworth, Heitz, Schrock, & Engle, 2005). The span of the sequence of unrelated letters ranges from three to seven letters. The Ospan score—most commonly used to index attention and work-

Table 1
Descriptive Information by Sample (Canada and United States) and Condition (Mindfulness Training and Waitlist Control)

	Canadian sample		U.S. sample	
Demographic characteristic	Mindfulness group	Control group	Mindfulness group	Control group
Number of teachers (N = 113)	26	32	28	27
Sex (% female)	92%	88%	82%	93%
School level (% elementary teachers)	46%	54%	49%	51%
Age in years, median (range)	50 (28–59)	46 (29–63)	52 (35–63)	48 (27–64)
Years of teaching experience, median (range)	12 (3–35)	10 (4–32)	16 (2–33)	11 (1–28)

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ing memory capacity (see Conway et al., 2005)—is the sum of all recalled letters, from letter sets that were recalled completely, in the correct order. For instance, if a participant correctly recalled 4 letters in a set size of 4, 5 letters in a set size of 5, and 4 letters in a set size of 7, that person's Ospan score would be 9 (4 + 5 + 0). We call this measure the Ospan stringent score. The Ospan total score is also used to measure WMC and measures the total number of letters recalled in the correct position—regardless of whether the entire set was remembered correctly. In the above example, the Ospan total score would be 13 (4 + 5 + 4). The Ospan total score is a less stringent measure of working memory capacity in the sense that recall can be partial. Finally, the Ospan math errors score records the number of math distractor problems that the teachers said were correct that were in fact wrong. This measure allows one to examine trade-offs between accuracy on this aspect of the task and the recall of letters. The Ospan task was delivered to teachers on a Dell Latitude E6500 portable laptop computer with a 17-in. screen and an Intel Core 2 duo processor that was set up in their classroom. The task runs automatically with E-Prime 1.0 (http://www.pstnet.com/).

Occupational self-compassion. We modified Neff's (2003) global self-compassion items to refer specifically to teachers' tendencies to have compassion for themselves in their role as teachers. Teachers were administered 13 modified items from Neff's (2003) original scale, including items that assessed self-kindness, self-judgment, common humanity, isolation, and overidentification with difficulties. The items tapping "mindfulness" in Neff's original version of the Self-Compassion Scale were excluded to avoid item content overlap. Sample items include "When I feel inadequate in my role as a teacher in some way, I try to remind myself that most teachers experience feelings of inadequacy," and "When I'm really struggling with my teaching, I tend to feel like other teachers must be having an easier time of it" (reversed). Items were rated on 5-point metrics of frequency (1 = *almost never,* 5 = *almost always*), and scales were computed as the mean frequency across the 13 items. Neff, Kirkpatrick, and Rude (2007) found self-reported self-compassion was related to clinician's ratings of psychological functioning, reduction of anxiety under conditions of threat in the laboratory, and natural language usage when discussing weaknesses. Overall self-compassion scales were statistically reliable at each time point in the study (Cronbach's alphas > .89).

Occupational stress. Teachers' *self-reported job stress* was assessed with seven items drawn from a longer inventory of teacher stress (Lambert, McCarthy, & Abbott-Shim, 2001) and two items that asked if they felt overwhelmed with regard to the social–emotional and academic needs of their students (Roeser & Midgely, 1997). Items tapped teachers' level of agreement that particular aspects of their work, including things such as completion of paperwork and reports, time pressures, and student discipline problems "puts a lot of stress on me" (1 = *strongly disagree*, 5 = *strongly agree*). Overall occupational stress scales were computed as the means of all items and were statistically reliable (Cronbach's alphas > .70).

Occupational burnout. Burnout was conceptualized and measured with the Maslach Burnout Inventory (Maslach et al., 2001). The inventory consists of 22 items that assess the frequency of symptoms in three domains over the past few months: emotional exhaustion, depersonalization, and lack of personal accomplishment (Maslach & Jackson, 1981; Maslach, Jackson, & Leiter, 1997). For this study, these items were assessed on 7-point metrics (1 = *never,* 2 = *a few times,* 3 = *once a month or less,* 4 = *a few times a month,* 5 = *once a week,* 6 = *a few times a week,* 7 = *everyday*). Overall occupational burnout scales were computed as the average frequency of symptoms across the 22 items. These scales were statistically reliable at all time points in the study (Cronbach's alphas > .90).

Symptoms of anxiety and depression. Because stress can manifest as anxiety and depression (American Psychological Association, 2012), we assessed symptoms of anxiety and depression in the U.S. sample at baseline/post-program/follow-up. Teachers completed the State subscale of the State–Trait Anxiety Inventory (STAI) for Adults (Kendall, Finch, Auerbach, Hooke, & Mikulka, 1976) and the Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1996). Both scales are well-validated clinical measures (e.g., Beck, Steer, & Garbin, 1988). The 20 STAI items assess the extent to which individuals have been feeling a particular a symptom during the last few days, including the day of assessment (1 = *not at all,* 4 = *very much*). Items were summed into a total anxiety scale that had a range from 20 to 80. Higher scores indicated greater anxiety during the last few days. Teachers also completed the 19 items of the BDI. For each item, respondents pick one statement from a group of four that best describes how often they have felt a particular symptom in the past week, including the day of assessment (0 = *not at all* to 3 = *very much*). Items were summed to form total depression scores (0–57), with higher scores indicating greater symptoms of depression in the past week. Scales were statistically reliable at each time point (Cronbach's alphas > .90).

Teacher absences from work. We also used teachers' self-reported number of days absent from work due to illness as a behavioral indicator of stress and burnout. At baseline, teachers reported on work absences from the beginning of the school year until approximately April (7 months). The post-program measure examined work absences between April and June (3 months). The follow-up measure was assessed in October and measured absences since the beginning of the new school year (2 months).

Physiological indicators of stress. Physiological indicators of sympathetic nervous arousal and limbic-hypothalamic-pituitary-adrenal (L-HPA) axis functioning were assessed via diurnal cortisol rhythms on a working Monday (Canada sample only) and blood pressures and resting heart rates on a workday afternoon.

Salivary cortisol. Salivary cortisol was collected at baseline and post-program in the Canadian sample only with a home stress kit. Cortisol follows a natural rhythm, with a morning rise to peak occurring 30 minutes after awakening and a decline thereafter until bedtime (Weitzman et al., 1971). High levels of stress are associated with higher cortisol levels throughout the day, especially in the morning (Pruessner, Hellhammer, & Kirschbaum, 1999), so we were particularly interested in assessing study group differences in cortisol levels at waking and 30 minutes later (e.g., the cortisol awakening response).

Teachers' cortisol was measured in their saliva. Saliva was collected with oral cotton rolls (Cat# 5001.02, Salimetrics) on a Monday during a regular workweek upon awakening, 30 minutes after waking, and at bedtime. Teachers were instructed not to eat, drink, or smoke 30 minutes prior to saliva collection, to make sure their hands were washed prior to placing the cotton roll in their mouths, and to write the times of the saliva collection on the tube.

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Samples were stored in the refrigerator prior to teachers' mailing the samples to the laboratory at the University of British Columbia in a prepaid, overnight express mail envelope. Research has shown that cortisol samples are not affected by return in regular mail (Clements & Parker, 1998). Once the samples arrived, they were stored at −20°C until they were assayed in duplicate with the Salimetrics High Sensitivity Salivary Cortisol Enzyme Immunoassay Kit (Salimetrics, LCC, Pennsylvania). Intra- and interassay coefficients of variation were 3.65% and 6.41%, respectively.

Blood pressure and resting heart rate. Blood pressure (BP) measures the pressure in the arteries at the beginning (systolic) and end (diastolic) of the cardiac cycle in millimeters of mercury (mm HG; Perloff et al., 1993). High BP is a correlate of stress (Dimsdale, 2008). Resting heart rate (HR) was measured as the number of beats per minute (bpm) of the heart when one is at rest, with higher scores potentially indicative of great stress and cardiovascular risk (Fox et al., 2007). In Canada, trained research assistants measured teachers' BP and resting HRs in their classrooms after the school day was over. BP and HR were assessed on participants' left wrists at baseline and post-program with an over-the-counter portable blood pressure monitoring device (Microlife 3AX1–4U Wrist Blood Pressure Monitor). This device has been approved for use with adults by the British Hypertension Society, is safe for nonclinical use, and provides both blood pressure and heart rate measures (Cuckson, Reinders, Shabeeh, & Shennan, 2002).

In the U.S., all participating teachers had their BPs and resting HRs assessed by a registered nurse at baseline/post-program/follow-up in private rooms in the central school district office after a working school day. BP was measured with the auscultatory method on the upper left arm. Resting HR was taken on the left wrist by placing two fingers on the thumb side of the wrist, looking at a stopwatch, and counting the number of beats in 15 seconds and multiplying it by 4 to derive the resting HR per minute score.

Program acceptability and feasibility measures. At the conclusion of the mindfulness training in Canada and the U.S., teachers completed a MT program evaluation survey and turned in their daily mindfulness practice journals. Post-program mindfulness training surveys were collected from 53 of 54 (98%) teachers who were in the mindfulness training. Survey questions were used to assess the acceptability of the program in terms of teachers' perceptions of (a) whether or not what they learned in the program matched the stated goals of the program; (b) the program instructor in terms of her domain-specific expertise, genuineness, effectiveness at presenting material, and trustworthiness (1 = *not at all,* 5 = *very much*); (c) the clarity of instructions the instructor provided for home practice and on the take-home CDs (1 = *not at all,* 5 = *very much*); (d) the usefulness of the home meditation practices, workbook, and CDs (1 = *not at all,* 5 = *very much*); (e) the level of professional and personal benefit participants felt they had derived from the program (1 = *benefited not at all,* 5 = *benefited a great amount*) and (f) whether or not participants would recommend the MT program to peers or school principals (yes or no).

Measures of program feasibility included (a) teachers' self-reported minutes of daily practice taken from their journals; (b) teachers' weekly attendance at sessions (assessed by facilitator reports); and (c) whether or not each teacher completed the program. Thirty-six of the 54 (67%) teachers in the mindfulness training returned their daily mindfulness practice journals. We assessed the feasibility of the 15 min/day of home practice by examining how many of the two thirds of teachers who reported their practice journals actually met this guideline. We assessed the feasibility of participants' attendance at the program in terms of the percentage who actually completed the MT. The mindfulness instructor for the program decided for purposes of this study that if participants completed three quarters (8 of 11) of the sessions, they had "completed the program."

Equivalence of Groups Following Randomization

Study participants were assessed at baseline prior to randomization. To ensure equivalence of the MT and waitlist-control groups in both research sites following randomization, we compared the resultant groups on demographic and baseline measures. First, we examined chi-square statistics and cross-tabulations with adjusted standardized residuals used to examine the comparability of the two samples (Canada, U.S.) with respect to sex (female, male) and school level (elementary, secondary). Results of these analyses showed the samples were equivalent with respect to the sex and school level of teachers in each condition (see Table 1).

Next, analyses of variance (ANOVAs) were used to examine group differences by study condition (mindfulness training vs. waitlist control), research site (Canada vs. United States), and their interaction in teachers' age and years of teaching experience. Results showed that the Canadian sample was younger than the U.S. sample (M_{CANADA} = 44.63 years, SD = 9.55 vs. M_{USA} = 48.95 years, SD = 8.59), $F(1,108 = 6.20$, $p = .01)$. However, results also showed there were no differences in teachers' age by condition following randomization in either sample (see Table 1). No differences by condition, site, or their interaction were found with respect to teachers' years of teaching experience.

In addition to assessing demographic variables, we assessed group equivalence after randomization on all outcome measures. Simple ANOVAs on baseline measures of study outcomes were conducted with study condition, research site, and their interaction as the between-subjects factors (see Table 2). Results showed no main effects of condition, site, or their interaction for baseline measures of mindfulness, occupational self-compassion, or occupational stress. In contrast, participants in both sites who were randomized to the control condition reported higher levels of occupational burnout at baseline than did those in the mindfulness condition. We also found that those in the U.S. sample showed lower systolic and diastolic blood pressures and had fewer sick days from work at baseline than did those in the Canadian sample (median number of sick days in first 7 months of the school year at baseline was 4.5 in Canada and 1 in the U.S.). There was not, however, a significant interaction of research site by study condition on teacher absences from work. Overall, analyses of group differences in demographic characteristics and baseline measures of outcomes following randomization suggest few differences. Therefore, we regard these analyses as an empirical warrant for our decision to combine the MT and control groups across sites, given the general lack of site by condition interactions in baseline measures.

Results

Program Acceptability

Our first research question was (a) whether or not teachers perceived the MT as acceptable in terms of providing benefit and

Table 2
ANOVA Results for Baseline Comparisons of Outcome Measures by Study Condition (Mindfulness Training or Waitlist Control) and Research Site (Canada vs. United States): Combined Sample Means (SDs) and F Values

Baseline measure	Combined mindfulness groups ($n = 54$)	Combined control groups ($n = 59$)	F value main effect: Study condition	F value main effect: Research site	F value two-way interaction: Condition by site
Mindfulness	3.30 (0.51)	3.13 (0.58)	2.55	0.25	1.31
Occupational self-compassion	3.11 (0.65)	2.90 (0.70)	2.61	0.17	0.13
Occupational stress	3.41 (0.69)	3.61 (0.66)	2.58	1.73	2.52
Occupational burnout	2.74 (0.80)	3.19 (0.88)	**7**.48**	0.29	0.07
Systolic blood pressure	121.09 (16.93)	120.06 (12.33)	0.29	**7**.79**	0.26
Diastolic blood pressure	76.97 (11.42)	78.19 (10.15)	0.18	15.29**	0.13
Resting heart rate	70.94 (11.42)	67.41 (8.43)	3.49	0.12	0.07
Sick days from work	3.03 (3.67)	3.85 (4.67)	0.63	17.27**	1.10

** $p < .01$.

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(b) whether or not teachers found the program feasible in terms of their ability to do the home practices and to attend weekly sessions and complete the program. Results from the program evaluation survey showed that teachers, on average, said what they learned in the MT and what the stated goals and objectives of the MT were "matched well." In addition, on average, participants all "strongly agreed" that the instructor for the MT "demonstrated good knowledge of the subject matter" (expert knowledge, $M = 4.98$, $SD = 0.14$), "was a good role model for what was being taught" (genuineness, $M = 4.94$, $SD = 0.24$), and "was effective in presentation of material" (effectiveness; $M = 4.83$, $SD = 0.38$) and that participants "developed a faith in their ability to trust and learn from the instructor" (trustworthiness, $M = 4.88$, $SD = 0.48$). Teachers, on average, also said the home mindfulness practice instructions and CDs were all "very clear" and that the home meditation practice, workbook, and CDs were "very useful." On average, teachers reported receiving "quite a bit" of professional benefit ($M = 4.10$, $SD = 0.85$) and slightly greater personal benefit ($M = 4.58$, $SD = 0.57$) from the program. In all, 98% of the teachers who underwent MT said they would recommend the program to peers and school principals.

Program Feasibility

Analyses of attendance data showed that, on average, participants who did not drop out of the program attended 92%, or 10, of the 11 sessions: Range = 64% (4 absences) − 100% (no absences); mode = 91% (1 absence). Overall, 52 of 60 teachers (87%) who began the mindfulness training completed the program by attending eight or more of the 11 sessions (6 dropouts, 2 participants with 4 absences).[2]

Amount of home practice was examined for the 60% of teachers who returned their daily mindfulness practice journals. Thus, these statistics are based on two thirds of the sample who were motivated enough to keep and return these journals. Results showed an average of 16 minutes of home practice/day across the 8 weeks of the intervention in Canada ($M = 16.15$, $SD = 1.23$) and 15 minutes/day in the U.S. sample ($M = 15.37$, $SD = 5.00$). These results suggest that, on average, two thirds of the MT participants who did not drop out of the study showed compliance with the home practice guidelines.

Program Efficacy

Our next research question focused on program efficacy: whether or not randomization to MT was associated with hypothesized outcomes. To assess program efficacy, we conducted three analyses. First, we ran simple analysis of covariance (ANCOVA) models in which we examined the effect of randomization on mean levels of outcomes at post-program and follow-up, controlling for baseline measures of each outcome. These models test the effects of the randomization on changes in outcome over time. Results of these models are presented in Tables 3, 4, 5, and 6. In addition, where study condition emerged as a significant effect, we ran secondary ANCOVA models that included the interaction of study condition by research site as an effect to see if the effect of randomization to MT on outcome generalized to one or both of the research sites. Finally, with relatively small samples such as those in these studies, some have argued that effect sizes provide a better estimate of intervention impact than of statistical significance (Thompson, 1996; Valentine & Cooper, 2003). Thus, we calculated effect sizes for each outcome in this study at post-program and follow-up using the following formula:

$$\text{Cohen's } d = \frac{\text{difference in unadjusted means}}{\text{pooled within-group standard deviation of unadjusted means.}}$$

Cohen's (1988) d provides an estimate of the impact of randomization to intervention on outcomes without accounting for baseline measures. In a meta-analysis of over 800 meta-analyses in education in which the effect sizes of various programs on student achievement were examined, Hattie (2009) recommended that a "small" effect size be defined as .20, a "medium" effect size be defined as .40, and a "large" effect size be defined as .60 (see also

[2] Two participants withdrew from the intervention condition prior to completion in the Canadian study. The reasons for program withdrawal in Canada were the onset of a personal difficulty unrelated to the program ($n = 1$) and reason unknown ($n = 1$). Four participants withdrew in the US study prior to program completion. The reasons for withdrawal in the US sample were onset of major health crisis ($n = 1$), perception of MT as being too much of a time commitment ($n = 2$), and reason unknown ($n = 1$). All withdrawals occurred within the first 1 - 2 weeks of the program

Table 3
Effects of Randomization on Teachers' Mindfulness and Occupational Self-Compassion at Post-Program and Follow-Up: Unadjusted Group Means (SDs), ANCOVA F-Values, and Effect Sizes (Cohen's d) for Condition

Construct and measure[a]	Time[b]	Mindfulness group *M* (*SD*)	Control group *M* (*SD*)	*F*[c]	*df*	*d*[d]
Mindfulness (1–5)	T1	3.30 (0.51)	3.13 (0.58)			
	T2	3.61 (0.49)	3.18 (0.62)	16.92**	1, 109	.79
	T3	3.65 (0.54)	3.15 (0.62)	17.37**	1, 95	.87
Occupational self-compassion (1–5)	T1	3.11 (0.65)	2.90 (0.70)			
	T2	3.45 (0.51)	2.93 (0.70)	31.14**	1, 107	.85
	T3	3.46 (0.52)	3.09 (0.68)	13.43**	1, 95	.62

Note. *df* = degrees of freedom, between groups ($N_{GROUPS} - 1$), total ($N_{INDIVIDUALS} - 1$).
[a] Scale ranges given in parentheses. [b] T1 = baseline; T2 = post-mindfulness training, T3 = 3-month follow-up. [c] Based on analysis of covariance (ANCOVA) with condition (intervention vs. control) as the between-subjects factor and baseline measure of dependent measure as covariate. [d] Effect sizes were calculated as Cohen's *d* with covariate adjusted means using the following formula: *d* = difference in unadjusted means/pooled within-group standard deviation of unadjusted means.
** $p < .01$.

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Valentine & Cooper, 2003). We adopt these conventions here. Intervention effect sizes are presented in Tables 3–6.

Intervention Effects on Teacher Mindfulness, Self-Compassion, and Focused Attention

Simple ANCOVA results revealed that teachers in MT reported greater mindfulness and occupational self-compassion at post-program and 3-month follow-up than did controls after controlling for baseline measures. The effect sizes for teachers' mindfulness and self-compassion at post-program and follow-up were large (see Table 3).

Secondary ANCOVAs for teacher mindfulness revealed a significant interaction effect of research site by condition at 3-month follow-up: interaction effect, $F(1, 84) = 4.91$, $p < .05$. Teachers in the intervention condition in United States reported greater mindfulness at 3-month follow-up than did those in the control condition after controlling for the other variables in the model (estimated marginal $M_{INTERVENTION} = 3.73$, $SE = .10$ vs. estimated marginal $M_{CONTROL} = 3.10$, $SE = .09$) than did the teachers in Canada (estimated marginal $M_{INTERVENTION} = 3.51$, $SE = .10$ vs. estimated marginal $M_{CONTROL} = 3.31$, $SE = .09$). Post hoc analyses showed nonetheless that mindfulness scores were higher among teachers in the intervention conditions at both research sites ($p < .05$).

Similarly, secondary ANCOVAs for teacher self-compassion revealed a significant interaction of research site by condition at 3-month follow-up: interaction effect, $F(1, 84) = 6.28$, $p < .05$. Teachers in the intervention condition in United States reported greater occupational self-compassion at 3-month follow-up compared to controls (estimated marginal $M_{INTERVENTION} = 3.56$, $SE = .08$ vs. estimated marginal $M_{CONTROL} = 3.07$, $SE = .08$) than did the teachers in Canada (estimated marginal $M_{INTERVENTION} = 3.40$, $SE = .09$ vs. estimated marginal $M_{CONTROL} = 3.31$, $SE = .08$). In this case, post hoc analyses showed that self-compassion was only greater among teachers in the intervention condition in the United States at 3-month follow-up ($p < .05$).

Next, we examined differences by study condition in the behavioral measure of attention and working memory capacity that was assessed in the Canadian sample only at baseline and post-program (see Table 4). Simple ANCOVA results on the Ospan task controlling for baseline measures showed that Canadian teachers who were randomized to mindfulness training, compared to control teachers, showed marginally significantly higher Ospan stringent scores ($p = .06$) and significantly higher Ospan total scores ($p =$

Table 4
Effects of Randomization on Teachers' Focused Attention/Working Memory Capacity at Post-Program (Canadian Sample Only)

Construct and measure[a]	Time[b]	Mindfulness group *M* (*SD*)	Control group *M* (*SD*)	*F*[c]	*df*	*d*[d]
Operation span stringent score (0–45)	T1	32.08 (19.32)	33.23 (15.07)			
	T2	40.96 (18.72)	36.23 (15.80)	3.65†	1, 55	.28
Operation span total score (0–60)	T1	49.72 (15.38)	53.50 (10.92)			
	T2	57.16 (12.55)	55.40 (10.93)	4.75*	1, 55	.15
Errors on math distractor problems (0–20)	T1	8.92 (7.63)	5.07 (3.97)			
	T2	8.12 (7.11)	6.17 (5.09)	1.43	1, 55	.33

Note. *df* = degrees of freedom, between groups ($N_{GROUPS} - 1$), total ($N_{INDIVIDUALS} - 1$).
[a] Scale ranges given in parentheses. [b] T1 = baseline; T2 = post-mindfulness training. [c] Based on analysis of covariance (ANCOVA) with condition (intervention vs. control) as the between-subjects factor and baseline measure of dependent measure as covariate. [d] Effect sizes were calculated as Cohen's *d* with covariate adjusted means using the following formula: *d* = difference in unadjusted means/pooled within-group standard deviation of unadjusted means.
† $p < .06$. * $p < .05$.

Table 5
Effects of Randomization on Teachers' Symptoms of Stress and Burnout and Anxiety and Depression at Post-Program and Follow-Up

Construct and measure[a]	Time[b]	Mindfulness group *M* (*SD*)	Control group *M* (*SD*)	*F*[c]	*df*	*d*[d]
Occupational stress (1–5)	T1	3.41 (0.69)	3.61 (0.66)			
	T2	3.19 (0.60)	3.56 (0.70)	8.92**	1, 109	−0.57
	T3	3.04 (0.64)	3.49 (0.60)	12.86**	1, 95	−0.73
Occupational burnout (1–7)	T1	2.74 (0.80)	3.19 (0.88)			
	T2	2.57 (0.81)	3.20 (0.86)	14.96**	1, 108	−0.76
	T3	2.48 (0.77)	3.05 (0.95)	10.26**	1, 94	−0.68
Anxiety symptoms (20–80)	T1	44.93 (13.66)	47.74 (10.28)			
	T2	38.78 (12.84)	47.02 (10.77)	7.11**	1, 53	−0.71
	T3	34.68 (8.79)	46.71 (13.27)	10.20**	1, 43	−1.10
Depression symptoms (0–57)	T1	27.46 (7.15)	30.57 (5.22)			
	T2	22.93 (5.21)	29.22 (6.77)	10.67**	1, 53	−1.06
	T3	21.09 (4.32)	28.43 (5.28)	15.32**	1, 43	−1.56

Note. Symptoms of stress and burnout were assessed for both U.S. and Canadian samples; anxiety and depression were assessed for the U.S. sample only. *df* = degrees of freedom: between groups ($N_{GROUPS} - 1$), total ($N_{INDIVIDUALS} - 1$).
[a] Scale ranges given in parentheses. [b] T1 = baseline; T2 = post-mindfulness training; T3 = 3-month follow-up. [c] Based on ANCOVA with condition (intervention vs. control) as the between-subjects factor and baseline measure of dependent measure as covariate. [d] Effect sizes were calculated as Cohen's *d* with covariate adjusted means using the following formula: *d* = difference in unadjusted means/pooled within-group standard deviation of unadjusted means.
** $p < .01$.

.03) at post-program after controlling for baseline measures (see Figure 2). No significant differences were found for the average number of errors teachers in each group made when checking the math distractor questions ($p = .32$). Together, these results suggest that MT teachers' greater recall of the letter sequences was not a function of their failing to attend to the math problems. The effect size for intervention with regard to increases in teachers' attention/working memory capacity was small ($d = .28$, Ospan stringent score).

Table 6
Effects of Randomization on Teachers' Workday Cortisol Levels, Blood Pressure, and Resting Heart Rates at Post-Program and Follow-Up

Construct and measure[a]	Time[b]	Mindfulness group *M* (*SD*)	Control group *M* (*SD*)	*F*[c]	*df*	*d*[d]
Cortisol at awakening (nmol/l)	T1	9.39 (5.37)	9.74 (7.46)			
	T2	10.06 (5.89)	11.40 (6.43)	1.27	1, 47	−0.22
	T3	9.73 (6.08)	10.08 (6.92)	0.00	1, 46	−0.05
Cortisol 30 min post-awakening (nmol/l)	T1	15.78 (9.49)	15.39 (9.62)			
	T2	15.30 (6.40)	16.93 (9.64)	0.25	1, 51	−0.20
	T3	14.65 (7.85)	16.70 (7.97)	0.64	1, 48	−0.26
Cortisol at bedtime (nmol/l)	T1	1.47 (1.82)	1.51 (2.73)			
	T2	1.25 (1.49)	0.91 (0.69)	1.75	1, 48	0.31
	T3	1.34 (1.19)	1.77 (4.72)	0.11	1, 45	−0.12
Systolic blood pressure (mm Hg)	T1	121.05 (17.45)	119.70 (12.07)			
	T2	119.77 (14.90)	119.15 (12.34)	0.04	1, 97	0.05
	T3	118.40 (15.37)	115.32 (13.15)	0.01	1, 46	0.22
Diastolic blood pressure (mm Hg)	T1	76.87 (11.67)	78.16 (9.82)			
	T2	75.95 (11.67)	74.28 (9.88)	2.27	1, 97	0.16
	T3	72.35 (10.64)	72.14 (8.60)	0.00	1, 46	0.02
Resting heart rate (bpm)	T1	71.44 (11.71)	67.48 (8.81)			
	T2	70.24 (8.89)	69.58 (9.97)	1.33	1, 97	0.07
	T3	71.63 (8.22)	67.77 (11.43)	0.67	1, 46	0.40

Note. Cortisol levels were tested in the Canadian sample only; blood pressure and resting heart rates were tested in the U.S. and Canadian samples pre/post, and at follow-up in the U.S. sample only. *df* = degrees of freedom: between groups ($N_{GROUPS} - 1$), total ($N_{INDIVIDUALS} - 1$); bpm = beats per minute.
[a] Scale unit descriptions given in parentheses. [b] T1 = baseline; T2 = post-mindfulness training; T3 = 3-month follow-up. [c] Based on analysis of covariance with condition (intervention vs. control) as the between-subjects factor and baseline measure of dependent measure as covariate. [d] Effect sizes were calculated as Cohen's *d* with covariate adjusted means using the following formula: *d* = difference in unadjusted means/pooled within-group standard deviation of unadjusted means.

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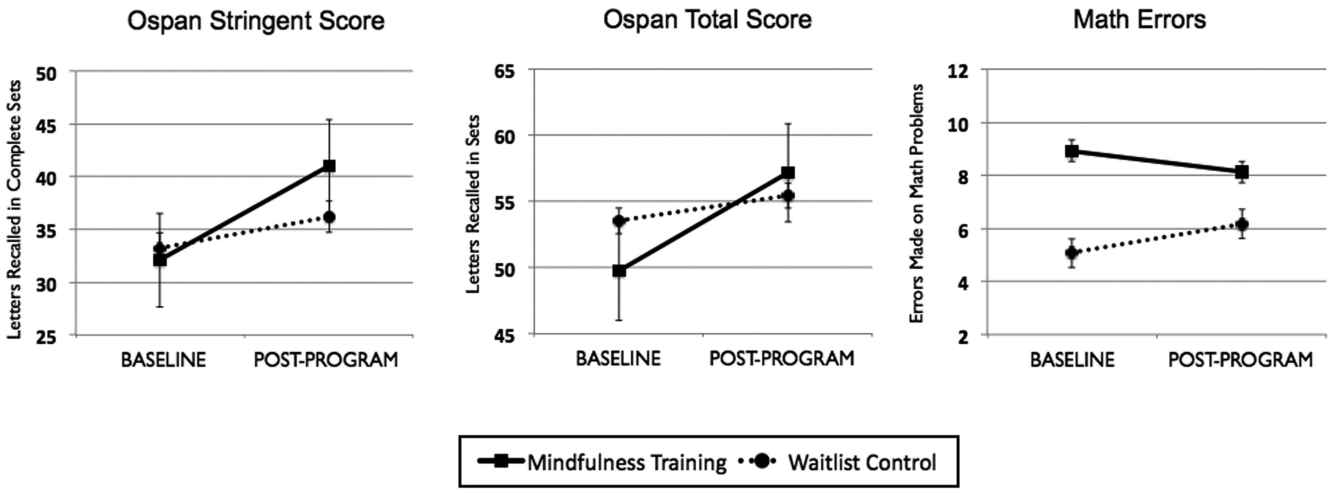

Figure 2. Teachers' focused attention and working memory capacity by study condition (Canadian sample only). Error bars = ± 1 standard error.

Intervention Effects on Teacher Stress, Burnout, Anxiety, and Depression

The second research question focused on whether randomization to MT was associated with changes in teachers' occupational stress and burnout. Simple ANCOVA results revealed that teachers in MT reported significantly less occupational stress and burnout at post-program and 3-month follow-up than did those in the control condition after controlling for baseline measures. The effect sizes for intervention with regard to reductions in teachers' stress and burnout at post-program and follow-up were large (see Table 5).

Secondary ANCOVAs revealed a nonsignificant condition by research site interaction for job stress. In contrast, secondary ANCOVAs of occupational burnout revealed significant interaction effects of condition by research site at post-program (interaction effect, $F(1, 95) = 4.17$, $p < .05$) and 3-month follow-up (interaction effect, $F(1, 84) = 6.11$, $p < .05$). At both times, teachers in the MT condition in United States reported fewer symptoms of burnout compared to those in the control condition (post-program: estimated marginal $M_{\text{INTERVENTION}} = 2.52$, $SE = .10$ vs. estimated marginal $M_{\text{CONTROL}} = 3.05$, $SE = .10$; 3-month follow-up: estimated marginal $M_{\text{INTERVENTION}} = 2.52$, $SE = .15$ vs. estimated marginal $M_{\text{CONTROL}} = 3.18$, $SE = .15$) than did teachers in Canada (post-program: estimated marginal $M_{\text{INTERVENTION}} = 2.81$, $SE = .11$ vs. estimated marginal $M_{\text{CONTROL}} = 2.94$, $SE = .10$; 3-month follow-up: estimated marginal $M_{\text{INTERVENTION}} = 2.63$, $SE = .16$ vs. estimated marginal $M_{\text{CONTROL}} = 2.57$, $SE = .14$). Post hoc analyses revealed that group differences in burnout symptoms between the MT condition and the control condition were significant in the U.S. ($p < .01$) and marginally significant in Canada ($p < .08$) at post-program, but they were significant only in the U.S. ($p < .01$) at 3-month follow-up.

Simple ANCOVAs showed the effects of randomization on the number of days teachers were absent from work due to sickness were nonsignificant after controlling for baseline sick days. A small effect size of intervention on absences was seen at post-program, however, with teachers in the MT condition showing fewer work absences (Cohen's $d = .31$).

In the U.S. study only, we assessed teachers' symptoms of anxiety and depression as another indicator of stress. Simple ANCOVA results showed that teachers in MT reported significantly fewer symptoms of anxiety and depression at post-program and follow-up than did those in wait-list control after controlling for baseline measures. The effect sizes for intervention-related reductions in teachers' symptoms of anxiety and depression were large (see Table 5).

Intervention Effects on Teacher Cortisol, Blood Pressure, and Resting Heart Rate

Simple ANCOVAs and effect sizes were used to examine the effects of randomization on Canadian teachers' cortisol levels during working Mondays (see Table 6). Results showed no statistically significant differences due to intervention on teachers' waking, peak, and bedtime levels of cortisol at post-program and 3-month follow-up after controlling for baseline cortisol levels. Small effect sizes for intervention with regard to reductions in cortisol were found, however. Teachers in the intervention showed lower levels of waking cortisol at post-program (Cohen's $d = -.22$) and follow-up (Cohen's $d = -.20$) and lower levels of cortisol 30 minutes after awakening at post-program (Cohen's $d = -.05$) and at follow-up (Cohen's $d = -.22$) than did those in the control group.

Simple ANCOVA results revealed that there were no statistically significant effects of study condition on teachers' systolic or diastolic blood pressures or on teachers' resting heart rates at post-program after controlling for baseline measures. At follow-up, blood pressure and resting HR were collected in the U.S. sample only. Analyses of data in the U.S. using simple ANCOVAs showed similar results at 3-month follow-up: There were no statistically significant differences due to study condition for teachers' systolic or diastolic blood pressures or resting HRs after controlling for baseline measures.

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Mediational Analyses of Intervention Effects

Our final research question was whether or not post-program differences in teachers' mindfulness and self-compassion mediated the effects of randomization to MT on reductions in stress and burnout at 3-month follow-up. No meditational analyses were conducted for focused attention/working memory, given that this measure was assessed only in Canada. Four models were tested with Sobel's (1982) test:

1. Mindfulness Training (T1) → Mindfulness (T2) → Job Stress + Burnout (T3)
2. Mindfulness Training (T1) → Self-Compassion (T2) → Job Stress + Burnout (T3)
3. Mindfulness Training (T1) → Mindfulness (T2) → Anxiety + Depression (T3)
4. Mindfulness Training (T1) → Self-Compassion (T2) → Anxiety + Depression (T3)

In addition, because the Sobel test has been criticized for its use when assumptions of normality and large sample size are violated, we sought to confirm the indirect effects yielded by this method by using the bootstrapping model proposed by Preacher and Hayes (2004). Results are presented in Figures 3, 4, 5, and 6. Mediational analyses showed that group differences in teachers' mindfulness and self-compassion at post-program due to randomization to MT were significant mediators of the effects of MT on teachers' stress, burnout, anxiety, and depression at 3-month follow-up.

Discussion

The overall aim of this research was to determine whether a mindfulness program aimed at stress reduction for teachers was feasible and acceptable and whether randomization to the program was efficacious with respect to helping teachers to reduce job stress and feelings of burnout. Furthermore, we were interested in knowing if intervention-related changes in teacher mindfulness and occupational self-compassion might help explain the long-term stress-reduction impacts of MT. Overall, the results of two randomized, waitlist-control field trials in public school districts in Canada and the United States suggest (a) that MT is both feasible and efficacious in these regards and (b) that it is through the skills of mindfulness and a self-compassionate mind-set that teachers

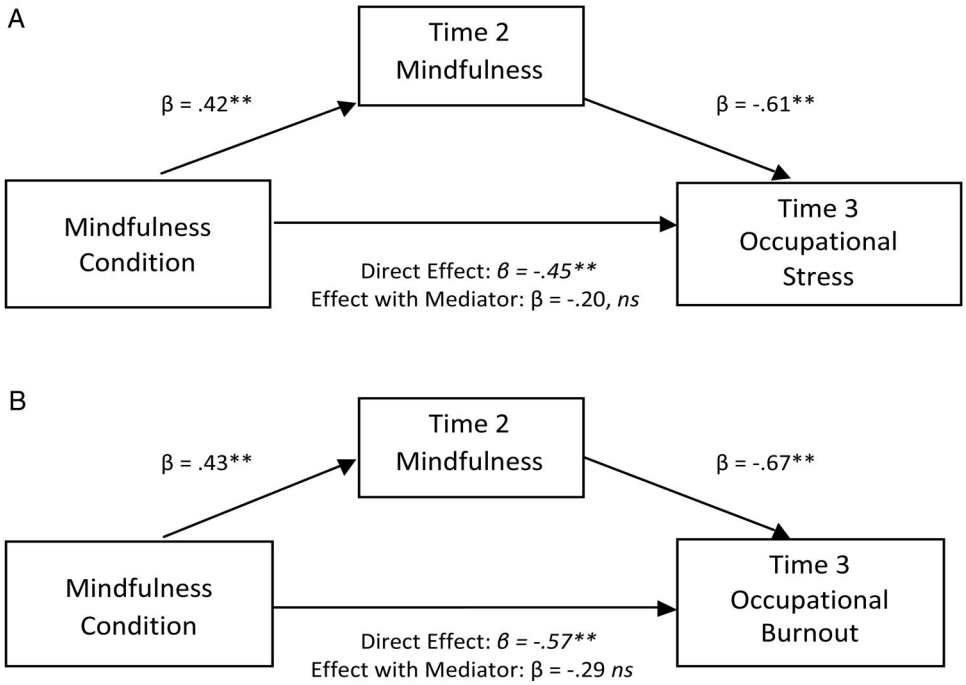

Figure 3. Mediation analyses: Group differences in teacher mindfulness post-program due to intervention mediate reductions in stress and burnout at 3-month follow-up. A: Test for mediated effect of mindfulness training (MT) on teachers' occupational stress at follow-up (T3) through teachers' mindfulness at post-program (T2). The indirect effect of randomization to the mindfulness condition on occupational stress is $-.26^{**}$ based on a cross-product and the normal distribution and $-.26$ (95% CI [$-.11$, $-.43$]) using 5,000 bootstrap re-samples. The indirect effect accounted for 10% of the variance in stress at follow-up. $N = 95$. B: Test for mediated effect of MT on teachers' symptoms of occupational burnout at follow-up (T3) through teachers' mindfulness at post-program (T2). The indirect effect of intervention condition on occupational burnout is $-.29^{**}$ using a cross-product and the normal distribution and $-.29$ (95% CI [$-.11$, $-.49$]) using 5,000 bootstrap resamples. The indirect effect accounted for 9% of the variance in burnout at follow-up. CI = confidence interval; *ns* = nonsignificant, $n = 94$. $^{*}p < .05$. $^{**}p < .01$.

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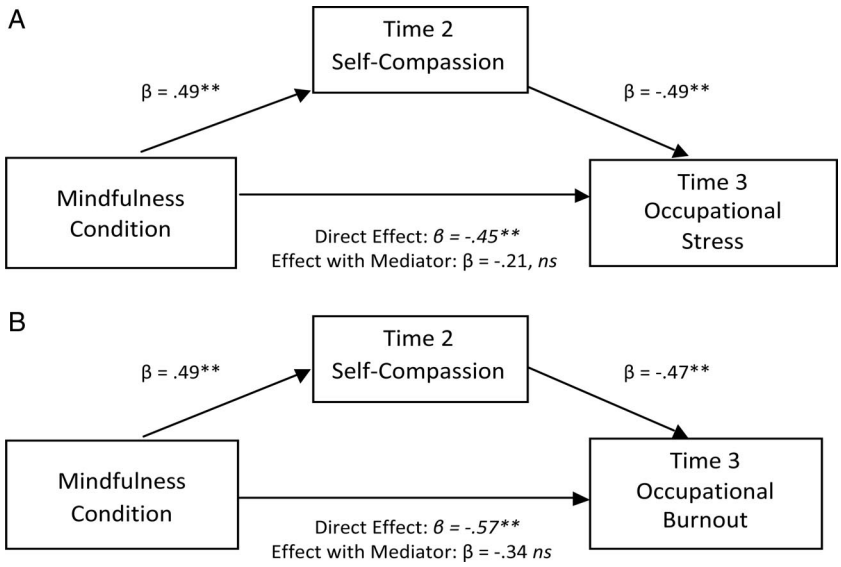

Figure 4. Mediation analyses: Group differences in teacher self-compassion post-program due to intervention mediate reductions in stress and burnout at 3-month follow-up. A: Test for mediated effect of mindfulness training (MT) on teachers' occupational stress at follow-up (T3) through teachers' self-compassion at post-program (T2). The indirect effect of intervention condition on occupational burnout is $-.24^{**}$ based on a cross-product and the normal distribution and −.24 (95% CI [−.11, −.42]) using 5,000 bootstrap re-samples. The indirect effect accounted for 10% of the variance in stress at follow-up. $n = 94$. B: Test of mediated effect of MT on teachers' symptoms of occupational burnout at follow-up (T3) through teachers' self-compassion at post-program (T2). The indirect effect of intervention condition on occupational burnout is $-.23^{**}$ using a cross-product and the normal distribution and −.23 (95% CI [−.08, −.43]) using 5,000 bootstrap resamples. The indirect effect accounted for 7% of the variance in stress at follow-up. $n = 94$. CI = confidence interval; *ns* = nonsignificant, $^{**}p < .01$.

can more effectively manage stress on the job and, by inference, better attend to the interpersonal and instructional complexities of teaching and learning.

With regard to program feasibility, participants indicated strong acceptance of the MT program in terms of program goals; the quality of the instructor, curriculum and home practices; and, ultimately, program benefits. Over 90% of teachers who enrolled in the mindfulness training attended the majority of sessions and 87% completed the program. The vast majority of participants said that they would recommend the program to peers and school principals, given the benefit they derived from it. Finally, among those two thirds of the teachers who were motivated enough to return their daily practice journals, we found high compliance with regard to the 15 minutes of suggested daily home mindfulness practice.

With regard to program efficacy, results of this study confirmed our hypotheses concerning program effects on mindfulness, self-compassion, and focused attention; as well as stress and symptoms of burnout (see Figure 1). Teachers in the mindfulness training condition reported greater mindfulness at post-program and follow-up than did those in the control condition, including greater awareness of sensations, feelings and thoughts; less judgment and reactivity; and greater awareness of one's actions and reasons for action. In addition, teachers in the intervention condition in Canada showed greater improvements on an objective measure of focused attention and working memory capacity that paralleled subjective increases in self-reported mindfulness over time. Finally, teachers randomized to MT showed a greater endorsement of a self-compassionate mind-set at post-program and follow-up. This mind-set was characterized by a diminishment of self-judgment, self-criticism, and the personalization of stressful events and by an increase in self-acceptance, self-kindness, and a recognition of the shared experience of difficulty and setbacks that teachers experience in their daily lives on the job.

These results provide basic evidence for program efficacy: MT is associated with increases in teachers' self-reported mindfulness, performance on a measure of focused attention, and self-reported measures of self-compassion. Nonetheless, the effect sizes with regard to intervention-related changes in an objective measure of attention were small. Thus, these results would be strengthened by future replications, larger samples, and research that employs other behavioral and third-person measures of focused attention. These findings are in line with other recent studies showing the beneficial effects of MT on focused attention and working memory (Jha, Krompinger, & Baime, 2007; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; Lutz, Slagter, Dunne, & Davidson, 2008) and self-compassion (Benn et al., 2012).

Results also showed that, compared to those in the control condition, teachers in the intervention condition reported large declines in occupational stress and symptoms of burnout, anxiety, and depression. The size of these program effects were large and on par with those reported in a meta-analysis of occupational stress management interventions that rely on cognitive-behavioral techniques (Richardson & Rothstein, 2008). Our hypothesis that mind-

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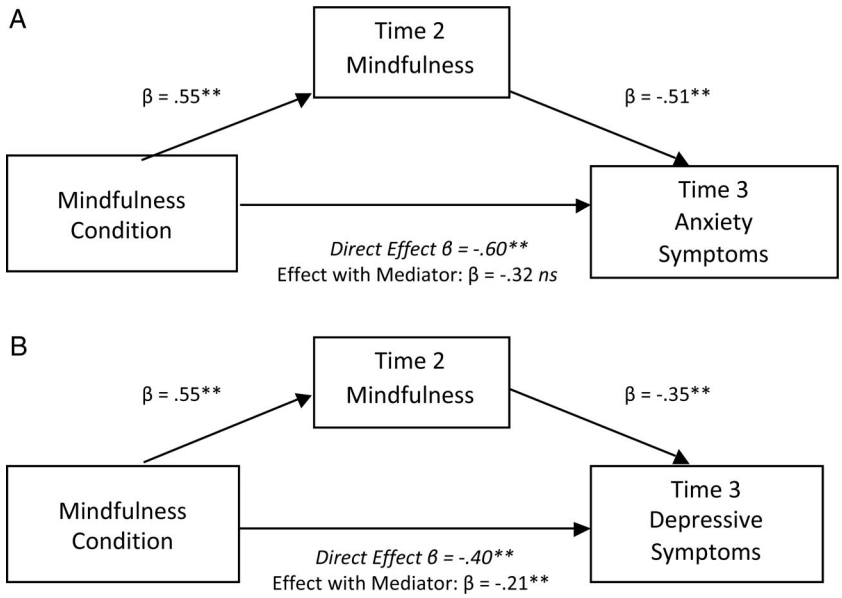

Figure 5. Mediation analyses: Group differences in teacher mindfulness post-program due to intervention mediate reductions in anxiety and depression at 3-month follow-up (U.S. sample only). A: Test of mediated effect of mindfulness training (MT) on U.S. teachers' symptoms of anxiety at follow-up (T3) through teachers' mindfulness at post-program (T2). The indirect effect of intervention condition on anxiety symptoms is $-.28^{**}$ based on a cross-product and the normal distribution and $-.28$ (95% CI [$-.10$, $-.46$]) using 5,000 bootstrap re-samples. The indirect effect accounted for 18% of the variance in anxiety symptoms at follow-up. $n = 43$. B: Test of mediated effect of MT on U.S. teachers' depressive symptoms at follow-up (T3) through teachers' mindfulness at post-program (T2). The indirect effect of intervention condition on anxiety symptoms is $-.19^{**}$ based on a cross-product and the normal distribution and $-.19$ (95% CI [$-.05$, $-.34$]) using 5,000 bootstrap resamples. The indirect effect accounted for 28% of the variance in depressive symptoms at follow-up. $n = 43$. CI = confidence interval; *ns* = nonsignificant. $^{**}p < .01$.

fulness training would be associated with reduced work absences was not supported (Darr & Johns, 2008). We found a small effect size for intervention on absences at post-program, but this was not a statistically significant difference. Thus, the relation of MT to work absences requires further investigation with larger samples and with objective measures of teacher absences collected from school records.

Overall, these findings are consistent with those other recent uncontrolled and controlled studies in which similar effects of mindfulness training on reducing teachers' stress, anxiety and depression were found (Benn et al., 2012; Franco, Mañas, Cangas, Moreno, & Gallego, 2010; Gold et al., 2010; Kemeny et al., 2012; Winzelberg & Luskin, 1999). Investigating the implications of such findings not only for the health and well-being of the teachers but also for outcomes such as district health care costs, classroom climate, and student engagement and achievement is an important next step in this work (see Figure 1).

In addition to finding evidence of mean-level differences in these indicators at post-program and outcome, we found support for the hypothesis that post-program-related changes in teacher mindfulness and self-compassion due to MT could plausibly account for the effects of the intervention on reductions in stress, burnout, anxiety, and depression at 3-month follow-up. These results are consistent with the logic model that guides this work: that mindfulness, focused attention, and self-compassion are the key program outcomes that provide the resources for teachers to more effectively cope with work stress (see Figure 1). Nonetheless, the models may be causally misspecified. It may well be that changes in teacher well-being at post-program mediated changes in mindfulness and self-compassion rather than the other way around, or that some unmeasured third variable accounted for changes in both. Future studies are needed to test the various hypothesized pathways of MT's influence on teachers.

It is important to note that, in contrast to these positive findings, the physiological indicators of stress we measured in teachers—blood pressure, resting heart rate, and cortisol levels—did not show statistically significant differences between the MT and control groups. Thus, although teachers in MT reported feeling subjectively less stressed out, anxious, depressed, exhausted, and burned out due to their jobs, biological indicators of L-HPA axis activity and sympathetic nervous system function did not show statistically significant differences at outcome that paralleled these self-reports. This may have been a function of the small sample sizes in this report, the imperfect field measurement of these variables in this study, actual null findings, or some combination thereof. For instance, the results for teachers' Monday cortisol levels were not significantly different at outcome, but an examination of the effect sizes did show small intervention effects that were in the predicted direction on these measures (e.g., Pruessner et al., 1999). Further investigation of the effects of MT on teacher cortisol with larger samples and under specific conditions

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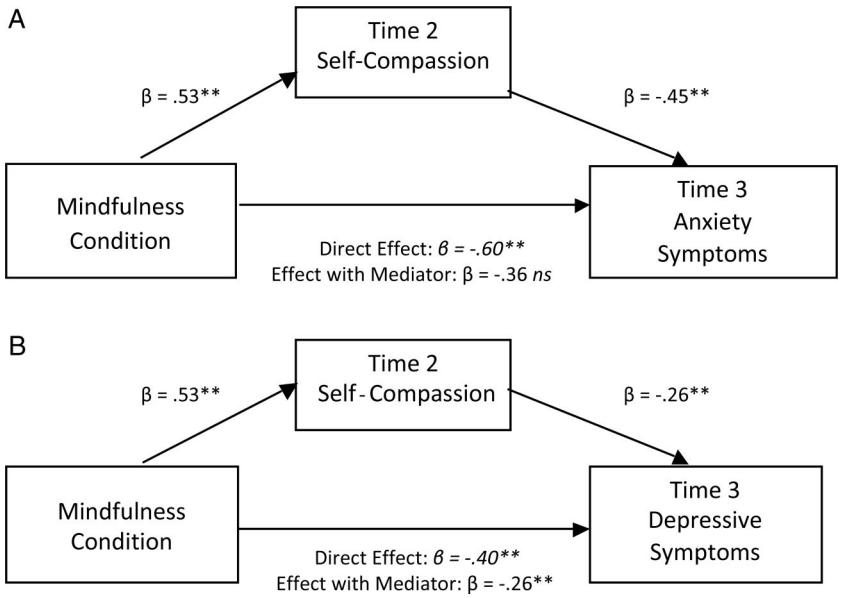

Figure 6. Mediation analyses: Group differences in teacher self-compassion post-program due to intervention mediate reductions in anxiety and depression at 3-month follow-up (U.S. sample only). A: Test of mediated effect of mindfulness training (MT) on U.S. teachers' symptoms of anxiety at follow-up (T3) through teachers' self-compassion at post-program (T2). The indirect effect of intervention condition on anxiety symptoms is $-.24^{*}$ based on a cross-product and the normal distribution and $-.24$ (95% CI [$-.01$, $-.47$]) using 5,000 bootstrap re-samples. The indirect effect accounted for 17% of the variance in anxiety symptoms at follow-up. $n = 43$. B: Test of mediated effect of MT on U.S. teachers' depressive symptoms at follow-up (T3) through teachers' self-compassion at post-program (T2). The indirect effect of intervention condition on depressive symptoms is $-.14^{*}$ based on a cross-product and the normal distribution and $-.14$ (95% CI [$-.03$, $-.26$]) using 5,000 bootstrap resamples. The indirect effect accounted for 24% of the variance in depressive symptoms at follow-up. $n = 43$. CI = confidence interval; *ns* = nonsignificant. $^{**}p < .01$.

in which the L-HPA axis is taxed is warranted. Biological assays other than cortisol may be desirable in this regard, as might be certain kinds of suppression tests that render the functioning of the L-HPA axis more visible (Pruessner et al., 1999).

Finally, we note that the effects of the mindfulness training reported herein were by and large similar across Canada and the United States (when comparable measures were administered). It was the case that teachers in the U.S. seemed to benefit more from MT in terms of a self-compassionate attitude and symptoms of burnout, but overall the pattern of results was similar. This suggests that there was high fidelity of program implementation across sites and essentially a replication of program effects in two different settings when taught by the same instructor. It is important to note, however, that the same MT has shown efficacy when taught by four other instructors in the Midwest who were trained by the same instructor (Benn et al., 2012). Thus, this lends even more support to the generalizability of program effects and the capacity to scale up the number of instructors who can deliver this intervention to teachers. Because the core of the program is Jon Kabat-Zinn's mindfulness-based stress reduction (MSBR) program (Grossman et al., 2004), there is a large pool of instructors across the world who are MBSR trained and who can therefore receive some additional training and be ready to deliver this education-focused MT.

Study Limitations

Several limitations are important to note. First, the key efficacy findings reported here were based primarily on teacher self-report data. We cannot rule out social desirability in these measures and findings. Further investigation into the findings reported here using (a) a wide array of behavioral measures of attention and emotion regulation (Jha et al., 2010), (b) biological measures of cortisol that are easier to collect in the field (e.g., hair) as well as other measures such as heart rate variability (Matousek, Dobkin, & Pruessner, 2010), (c) second-person assessments of the target individual by spouses or supervisors, and (d) third-person observational measures of teachers' classroom teaching and interactions with students (Pianta & Hamre, 2009) are needed in the future. Second, the results reported here warrant further investigation using active control groups with equally motivated and enthusiastic instructors to increase the rigor of the study design and inferences to be drawn from it (MacCoon et al., 2012). Third, these studies included a motivated sample of teachers—those interested in and motivated enough to sign up for an 8-week stress reduction program. The extent of the appeal of this kind of professional development program is unknown among public school teachers today, though our sense from working in the field is that the need is great. At the same time, this kind of PD is more accepted and more needed in certain parts of the U.S. and Canada than in others.

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Investigating the market appeal and return on investment of PD programs like this in different locales with respect to district-employee-related financial outcomes and student-achievement-related outcomes are two important avenues for future research. Studies of MT among teachers that use larger, more ethnically and geographically diverse samples are needed to increase the statistical power of these studies and to increase the generalizability of results. Fourth, the mediation models we causally specified may not be correct. Alternative models should be tested in the future. Finally, the challenge regarding how to faithfully implement, scale, and sustain this kind of professional development program for broader audiences of public school teachers remains.

Summary

The results of two randomized trials suggest that mindfulness training holds promise for the improvement of teaching and learning in public schools by assisting teachers in managing job stress and feelings of burnout more effectively (Jennings & Greenberg, 2009; Roeser, Skinner, et al., 2012). By helping teachers to develop self-regulatory resources to meet the cognitive, social, and emotional demands of teaching, mindfulness training also may help teachers to conserve precious motivational and self-regulatory resources for investment in relationships with students and classroom teaching rather than coping and defense. Preliminary results suggest that the 8-week mindfulness training for teachers under investigation here was acceptable, feasible, and efficacious with respect to helping teachers to reduce stress and symptoms of occupational burnout. Furthermore, mindfulness and occupational self-compassion emerged as key self-regulatory resources that increased after MT and that appeared to partially mediate the stress-reduction impacts of the MT over time. Examining potential downstream effects of reductions in teacher stress and burnout on teaching practice, classroom climate, and student outcomes and increasing the rigor of study designs and the use of objective third-person measures while doing so, represent two key next steps in this emerging line of research.

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