Mindfulness-Based Interventions for Teachers: A Meta-Analysis of the Emerging Evidence-Base

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Abstract

Teachers report high levels of occupational stress, which is associated with teacher turnover and potential negative consequences for students. Mindfulness-based interventions (MBIs) may improve the protective factors that buffer educators against occupational stress. Although previous meta-analytic reviews synthesized the effects of MBIs for healthy and clinical samples of adults, this study was the first to synthesize the effects of MBIs for teachers (grades pre-K through 12). A total of 347 effect sizes from 29 studies (N = 1,493) were synthesized using meta-regression with robust variance estimation. Overall, MBIs had a medium treatment effect on teacher outcomes (g = .601, SE = .089). Visual and statistical evidence of publication bias suggested this estimate may be positively biased. Three potential study-level moderators for overall effects were also examined, but none were statistically significant. MBIs were associated with small-to-medium positive effects on therapeutic processes and therapeutic outcomes. MBIs had the smallest effects on measures of classroom climate and instructional practices. Overall, findings were similar to other meta-analytic reviews of MBIs for non-clinical adult populations and working professionals. The literature on MBIs for teachers appears to have similar gaps as research on MBIs for adults (e.g., Davison & Kaszniak, 2015), including the primary use of self-report measures, the lack of active treatment comparisons, and rare reporting of treatment fidelity data. Directions for future research and implications are discussed.

Keywords: *mindfulness, meta-analysis, educators, teachers, schools*

Impact and Implications Statement: This meta-analytic review of 29 studies found that mindfulness-based interventions with teachers are promising for promoting mindfulness, increasing psychological wellbeing, and decreasing psychological distress. Schools interested in addressing these teacher outcomes could consider adopting mindfulness-based interventions. More research is needed regarding the effects of MBIs for teachers on classroom climate, teacher practices, and student achievement.

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The application of mindfulness-based interventions (MBIs) in schools is growing rapidly. School-based MBIs can be divided into direct (i.e., targeting youth), indirect (i.e., targeting adults to address youth outcomes), or combined approaches (Meiklejohn et al., 2012). Indirect applications are promising due to widespread recognition of (a) the overwhelming demands placed on teachers (Roeser, Skinner, Beers, & Jennings, 2012), (b) teachers reporting high stress and low job satisfaction (Markow, Macia, & Lee, 2013; Richards, 2012), and (c) evidence linking student outcomes with teachers' self-efficacy (Zee & Komen, 2016), teachers' social-emotional competence (Jennings & Greenberg, 2009), and supportive teacher-student relationships (Roorda, Koomen, Split, & Oort, 2011). Previous meta-analytic reviews of MBIs for healthy adults (e.g., Khoury et al., 2015), working professionals (Virgili, 2015), and practitioners in helping professions (Burton, Burgess, Dean, Koutsopoulo, & High-Jones, 2017) provide indirect evidence supporting the use of MBIs with teachers. Yet, decisions to implement MBIs for teachers should be based on direct evidence, not indirect evidence. To date, there has yet to be a meta-analysis of the effects of MBIs with teachers who work in pre-K–12 schools. The purpose of this study was to fill this gap in the literature by conducting a meta-analytic review of MBIs with primary and secondary teachers.

Theoretical Underpinnings of MBIs for Teachers

Mindfulness has been defined as a two-component construct consisting of "the self-regulation of attention so that it is maintained on immediate experience," which is accompanied by "a particular orientation toward one's experiences in the present moment, an orientation that is characterized by curiosity, openness, and acceptance" (Bishop et al., 2004, p. 232). When

adopted for therapeutic purposes, the key assumption underlying this definition is that mindfulness can be operationalized and learned like any other skill. MBIs can then be understood as any technique that trains mindfulness skills for the purpose of obtaining desirable outcomes (Renshaw & Cook, 2017). Because mindfulness training is often included as one of many components within broader skill-training programs or treatment approaches (e.g., dialectical behavior therapy), we defined MBIs more narrowly for the present meta-analysis as any intervention that trains mindfulness skills as the primary therapeutic component.

Mindfulness is posited to be one of several desired professional dispositions for effective teaching (Jennings & Greenberg, 2009). There are at least two theories outlining the mechanisms of change for MBIs with teachers (Roeser et al., 2012; Shapiro, Rechtschaffen, & de Sousa, 2016). Both theories are built upon research demonstrating the causal effects of mindfulness on biological, psychological, and behavioral outcomes for adults (e.g., Chiesa, Serretti, & Jakobsen, 2013; Holzel et al., 2011) and are aligned with correlational evidence indicating that mindfulness and its mechanisms of change (e.g., emotional regulation) are linked to decreased teacher stress and burnout (e.g., Abenavoli, Jennings, Greenberg, Harris, & Katz, 2013).

Shapiro and colleagues' (2016) theory identified intention, attention, and attitude as the three core components of mindfulness practice. When teachers practice mindfulness, there are three hypothesized benefits that may lead to improved student outcomes. The first is improvements in teachers' self-care, whereas the second is teaching more mindfully. According to Shapiro et al. (2016), mindfulness practice improves teachers' sustained attention and acceptance, which, in turn, facilitates improved attitudes toward students as well as increased self-compassion, empathy for others, and emotional regulation. A third benefit is that mindfulness training provides a foundation for teachers to deliver MBIs to students—suggesting

that teachers who practice mindfulness will be better able to teach mindfulness to students, resulting in a more mindful classroom that promotes learning (Shapiro et al., 2016).

Roeser and colleagues' (2012) theory was informed by research on the SMART-in-Education and Cultivating Emotional Balance Training (CEBT) programs. They posited that providing teachers with mindfulness training will result in improvements in both mindfulness and related skills (i.e., emotional regulation and self-compassion). Teachers' development of these skills is posited to lead to improved resilience, work engagement, and prosocial dispositions. Roeser (2016) further suggested that improvements in these skills contribute to collateral improvements in classroom climate and instructional practices, which, in turn, enhance student outcomes by facilitating academic motivation and engagement.

The theories posited by Roeser et al. (2012) and Shapiro et al. (2016) to account for the effects of MBIs with teachers have several shared components. First, both suggest that use of mindfulness practices, resulting from the formal training of mindfulness skills, facilitate the development of mindful states and traits. Second, both theories posit that teachers' practice of mindfulness leads to improvements in theoretically-related social-emotional competencies, which we refer to as the *mechanisms of mindfulness*, and which help to reduce distress and improve wellbeing (Jennings & Greenberg, 2009). Finally, both theories hypothesize that reductions in distress and improvements in wellbeing allow for positive changes in classroom climate and instructional practices, which is the primary contributor to desirable changes in student outcomes. We made use of these theories by reviewing and synthesizing study outcomes in a conceptually similar fashion—dividing them into *first-order therapeutic processes* (i.e., mindfulness), *second-order therapeutic processes* (i.e., mechanisms of mindfulness, such as emotion regulation and self-compassion), *first-order primary outcomes* (i.e., psychological

distress, wellbeing, and physiological indicators), and *second-order primary outcomes* (i.e., classroom climate and instructional practices). Although *third-order outcomes* (i.e., student achievement and performance) are also explicitly mentioned in these theories, they have yet to be investigated in existing studies of MBIs with teachers.

Ultimately, from the perspective of these theories, mindfulness can be understood as a pivotal or facilitative teaching skill—one that has collateral effects on other teaching skills that are not directly targeted by MBIs. In this way, MBIs are not establishing new skills that are directly contributing to teachers' wellbeing (e.g., specific emotional and behavioral regulation strategies) or teaching success (e.g., effective instruction and classroom management strategies); rather, they are establishing a particular skillset (i.e., mindfulness) that helps teachers make more effective use of previously acquired wellbeing-promoting and teaching repertoires. Thus, "mindful teachers" are not simply teachers who practice mindfulness: they are teachers who use mindfulness to enhance their wellbeing and teaching behavior.

Evidence Supporting MBIs with Teachers

Three systematic reviews have investigated the empirical support for using MBIs with teachers. Lomas, Medina, Ivtzan, Rupprecht, and Eiroa-Orosa (2017) reviewed 17 intervention studies, published before January 2016, which delivered MBIs to undergraduates studying education, elementary and secondary teachers, and post-secondary teachers. Lomas et al. (2017) reported the number of studies that assessed 11 different outcomes and, of those, the number of studies that showed improvement related to the MBI. For example, MBIs were associated with improvements in mindfulness (12 of 14 studies), stress and strain (4 of 6 studies), and burnout and resilience (4 of 7 studies).

Emerson et al. (2017) systematically reviewed 12 peer-reviewed studies, published before October 2015, targeting in-service or pre-service teachers. A variety of quantitative and qualitative designs were used across the included studies. Interventions included modified mindfulness-based stress-reduction (MBSR), SMART-in-Education, and the Cultivating Awareness Resilience in Education (CARE) program. The most commonly studied outcome was psychological distress (k = 11; d = 0.01 to 2.12), followed by mindfulness and self-compassion (k = 8; d = 0.04 to 1.77). There was also some evidence of improvements in teachers' self-efficacy (k = 5; d = 0.07 to 0.87). Emerson et al. (2017) concluded that the most promising effects of MBIs were observed for measures of emotional regulation (k = 4; d = 0.43 to 1.56).

Hwang, Bartlett, Greben, and Hand (2017) reviewed 16 studies of MBIs delivered solely to in-service teachers, that were published prior to 2015. In the 10 studies that used quantitative designs, MBIs were associated with reductions in stress and burnout (d = 0.25 to 0.90) and psychological distress (d = .53 to 1.74) as well as increases in self-efficacy (d = .52 to .66), mindfulness (d = .33 to 1.85), and self-compassion (d = 0.75 to 1.13). One study reported a positive effect on classroom organization (d = .28).

Gaps in the Literature and Purpose

Findings from these three systematic reviews suggest that MBIs generally have positive effects for teachers, but the reviews are not without limitations. First, literature searches were conducted in January 2016 or earlier, and research in this area is growing rapidly. Second, all three reviews excluded unpublished articles and articles written in languages other than English. Third, systematic reviews do not allow for the aggregation of effect sizes. Across all three reviews, the range of effect sizes was inconsistent and sometimes negligible within and across outcome domains. Thus, there is a warrant for a more rigorous quantitative synthesis of the

available evidence. The purpose of the present study was to address these gaps in the literature by conducting the first meta-analysis of controlled studies evaluating the use of MBIs with teachers in grades pre-K through 12. Four research questions guided our analysis:

1. What is the overall treatment effect (i.e., across all outcome domains) of MBIs with teachers at post-treatment?
2. How is the overall treatment effect of MBIs moderated by the following study-level characteristics: (a) randomization, (b) interventionist, and (c) dosage?
3. What is the specific effect of MBIs with teachers on the following therapeutic process domains: (a) mindfulness and (b) mechanisms of mindfulness?
4. What is the specific effect on MBIs with teachers on the following treatment outcome domains: (a) psychological wellbeing, (b) psychological distress, (c) physiological indicators, and (d) classroom climate and instructional practices?

Method

Search Strategies

We conducted a comprehensive search for MBI studies targeting teachers using the following electronic databases: PsycINFO, ERIC, PubMed, Academic Search Complete, and ProQuest Dissertation and Theses (abstracts only). The search occurred in April 2018 (including advance online publications) and there were no criteria regarding publication timeframe. Specific content keywords included “mindfulness” and mindful,” which were each combined with “intervention”, “training”, and “prevention.” These search terms were paired with the population keywords “teachers” and “educators”. Next, we conducted an ancestral review of the references in the culled articles as well as published systematic reviews, conceptual articles, and chapters related to using MBIs with teachers. Finally, we searched websites of popular teacher-focused

MBIs, including the CARE; SMART-in-Education; Inner Resilience; Mindfulness, Courage, and Reflection for Educators; and Mindfulness and Emotional Well-Being programs. A total of 1,477 articles were identified, and after removing duplicates, a total of 751 articles were screened for inclusion. See Figure 1 for a PRISMA flow diagram of search results. A table containing search results by databases and terms is available in the supplemental online materials.

Inclusion and Exclusion Criteria

Both authors screened each manuscript independently and discussed whether each study met inclusion criteria for the meta-analysis. The key inclusion criterion was the provision of a MBI with teachers who worked in a pre-K–12 setting. As mentioned above, we defined MBIs as any intervention that trains mindfulness skills as the primary therapeutic component for obtaining desirable outcomes. Determination of the "primary" nature of mindfulness training within a given intervention was deferred to the self-identification of such by the authors of each original study, not by any secondary analysis conducted by the researchers. Thus, although many included studies used treatment packages that had one or more "secondary" therapeutic components beyond mindfulness training (e.g., psychoeducation or other skill training), all were self-identified by the original study authors as training mindfulness as the primary therapeutic component. Relatedly, we did not explicitly operationalize or analyze the types of exercises that were used for training mindfulness skills within each study. Although there are several common exercises used for this purpose (e.g., mindful breathing, movement/yoga, body scans, eating), these are considered to be illustrative (rather than exhaustive) of the more generalized skill of mindfulness. For this reason, any intervention that was self-identified by the authors as training mindfulness skills using any relevant exercises was included within our analysis. Studies of

interventions that incorporated other meditation exercises without training mindfulness (k = 5) and interventions that used mindfulness as secondary components (k = 6) were excluded.

We also excluded studies of MBIs targeting post-secondary students enrolled in teaching programs (k = 8), educators working in post-secondary institutions (k = 3), and studies that included teachers within broader adult samples (k = 4). Non-intervention studies of mindfulness or non-empirical articles were excluded (k = 10). Finally, we excluded studies using single-case designs (k = 2), purely qualitative methods (k = 20), and pre–post designs with no control group (k = 8).

All other intervention studies were eligible for inclusion, including peer-reviewed articles, technical reports, and theses or dissertations. There were no inclusion criteria regarding (a) types of outcome variables examined, (b) geographical or cultural restrictions, or (c) language of publication. Studies published in languages other than English were translated using Google Translate. Cevasco (2017) met all criteria but did not present quantitative results for teachers. Ultimately, 29 studies met all of the above criteria and were coded for inclusion in the meta-analysis.

Study Coding

Studies were coded based on 27 items related to intervention and interventionist characteristics, setting and participant characteristics, program length and dosage, outside practice recommendations, intervention fidelity data, and use of random assignment. A full description of these codes and the training procedures for study coding can be found in the supplemental online materials. A doctoral student in school psychology independently coded 21 of 29 studies (72%). Interrater agreement (i.e., agreements / [agreements + disagreements]) was 94.48% (range = 76.19% to 100%). The code with the most disagreements was dosage, as

reviewers sometimes disagreed regarding which components were formalized aspects of the MBI and therefore warranted inclusion within the dosage calculation. All disagreements were discussed and resolved, with both reviewers agreeing on a final code prior to data analysis.

Moderators. Three moderators were coded for analysis. First, we coded whether random assignment occurred at the participant level. Studies that randomized schools into treatment groups were considered non-randomized. Second, we coded the type of interventionist, which was operationalized as either "program developers" or "other" (i.e., trained professionals who did not develop the program). Third, dosage was coded as a continuous variable representing the total number of formalized intervention hours. Dosage estimates only included formal program components and excluded optional components (e.g., recommendations for additional practice or reported independent practice time). Whole day retreats were estimated as 7 hours when the length was not specified. We imputed values for two studies (Jennings, Foltz et al., 2011; Jenaabadi et al., 2017) that did not provide enough information to calculate dosage (see supplemental online materials).

Outcomes. Outcomes were coded based on the theoretical models of mindfulness for teachers described above. Both authors independently coded each outcome measure as representing one of five outcome domains. Two outcome domains—mindfulness and the theorized mechanisms of mindfulness—pertained to therapeutic processes. Whereas the other outcome domains—physiological indicators, psychological distress, psychological wellbeing, and classroom climate and instructional practices—pertained to primary and secondary treatment outcomes. Full descriptions of each outcome domain are provided in the supplemental online materials. Interrater agreement for the outcome coding was 98.85%. The four disagreements were discussed and resolved by both authors agreeing on a single code per outcome measure.

Data Analyses

Effect size estimation. We used the Comprehensive Meta-Analysis program (Borenstein, Hedges, Higgins, & Rothstein, 2015) to calculate effect sizes for each outcome measure in the included studies. Treatment effects were estimated using the standardized mean difference statistic, corrected for small sample bias (*g*; Hedges, 1981). Positive effect sizes represent results favoring the treatment group over the control group. More information on effect size estimation is presented in the supplemental online materials. We excluded selected outcomes in two studies when there was not enough information to calculate effect sizes in the article (Benn, Akiva, Arel, & Roeser, 2012; Kemeny et al., 2012).

Effect size synthesis. All meta-analytic and meta-regression analyses were conducted in R (R Development Core Team, 2015) using the robumeta (Fisher & Tipton, 2015) and metafor (Viechtbauer, 2010) packages. All quantitative syntheses used random-effects models. Robust variance estimation was used to account for the statistical dependency resulting from studies including multiple effect sizes. Robust variance estimation uses information from each outcome measure and may provide a more accurate estimate of the standard errors for the treatment effects (Hedges et al., 2010; Moeyaert et al., 2016). Robust variance estimation also uses approximately inverse weights, which were calculated using the correlated effects method. The correlation between effect sizes was set at $\rho = .50$ and we conducted sensitivity analyses to determine the impact of using alternative values between $\rho = .0$ and $\rho = 1$ (see the supplementary online materials for a full presentation of results from these analyses). Estimates of between-study heterogeneity and the associated degrees of freedom were adjusted for small sample sizes (Tipton, 2015). Significance testing using robust variance estimation is considered unbiased when the adjusted degrees of freedom is greater than 4 (Tanner-Smith & Tipton, 2014).

Estimated between-study heterogeneity (T^2) was reported for all models. Robust variation estimation methods do not provide *Q* tests regarding the significance of the heterogeneity (Tanner-Smith & Tipton, 2014). I^2 values indicate the proportion of variance that reflects true heterogeneity in effect sizes rather than sampling error (Borenstein et al., 2009). Due to the number of comparisons made (.05 / 10), the criterion for statistical significance was set at $\alpha = .005$.

Overall treatment effect. The average overall treatment effect of MBIs with teachers at post-test was calculated by fitting an intercept-only meta-regression model. This effect size represents the omnibus effect that MBIs had across all outcomes included in the studies. Effect sizes were coded so that a positive effect size indicated that participants receiving the MBI benefited compared to the control group. Not enough studies included follow-up assessments to allow for a separate synthesis of treatment effects at follow-up.

Potential moderators of overall treatment effect. A series of mixed effects meta-regression models with robust variance estimation were used to examine the potential moderating effects of randomization, interventionist, and dosage on the overall treatment effect of MBI with teachers. All models were fit with an intercept value and all moderators were coded at the study level. Dosage was centered around the grand mean ($M = 24.421$ hours).

Treatment effects on therapeutic processes. We conducted a series of exploratory meta-analyses to examine the treatment effect of MBIs across therapeutic process domains. As described above, we considered mindfulness outcomes as the first-order therapeutic process and the hypothesized mechanisms of mindfulness outcomes (e.g., self-compassion, emotional regulation) as second-order therapeutic processes.

Treatment effects on therapeutic outcomes. We conceptualized changes in teachers' psychological wellbeing and psychological distress as first-order primary outcomes. Variables measuring classroom climate and teacher practices were conceptualized as second-order primary outcomes. Measures of student outcomes, which were conceptualized as third-order primary outcomes, were only included in three studies. Therefore, we did not include measures of student outcome variables in the meta-analytic synthesis.

Publication bias. Methods for assessing publication bias in models using robust variance estimation are not available (Zelinsky & Shadish, 2018). To examine publication bias, we calculated an unweighted average effect size for each study. The resulting synthetic effect size can be considered independent and is suitable for use in traditional meta-analytic analyses (Hedges et al., 2010). We then fit a random effects model to synthesize the study-level average effects. Between-study heterogeneity was estimated using restricted maximum likelihood with adjusted standard errors (Knapp & Hartung, 2003). The potential of publication bias was assessed via visual inspection of a funnel plot and by testing the asymmetry using nonparametric (Begg & Mazumdar, 1994) and regression tests (Egger et al., 1997). Finally, we used the trim and fill method (Duval & Tweedie, 2000) to estimate the number of missing studies and calculate an adjusted effect size. We did not evaluate whether publication status was a moderator of effect size due to the difference in number of published studies and unpublished studies.

Results

Overview of Included Studies

Of the 29 controlled studies included in our review, three studies were unpublished (Bakosh, 2013; James, 2016; Simon et al., 2009). Four studies were published in Spanish and Jenaabadi et al. (2017) was published in Persian. A table containing the descriptive and

moderator information for the included studies is provided in the supplemental online materials. There were 18 randomized-controlled trials, two studies that randomized at the school level, and nine quasi-experimental designs. Interventions evaluated in multiple studies included SMART-in-Education ($k = 4$), Flow Meditation ($k = 4$), standard or adapted versions of MBSR ($k = 4$), CARE ($k = 3$), and CEBT ($k = 2$).

MBIs were delivered in 2 to 36 weeks ($M = 10.18$, $SD = 7.28$) and dosage ranged from 1.67 hours to 74.75 hours ($M = 24.42$, $SD = 16.07$). Thirteen studies included at least one full-day intervention session. Homework was mentioned in 21 of 29 studies, with 14 studies reporting homework was assigned without specifying recommended practice duration. Seven studies reported the recommended length of personal practice and frequency—ranging from 15 to 40 minutes ($M = 28.96$) per session, 6 to 7 days per week. Six studies reported the average number of minutes participants practiced weekly ($M = 127.54$, $SD = 62.25$). Program developers implemented the interventions in 16 of the studies (69.57%). Seven studies reported that treatment fidelity data were collected with five studies reporting quantitative fidelity data.

Overall Treatment Effect

The first research question examined the overall treatment effect of MBIs across all outcomes. We fit an intercept only meta-regression model using robust variance estimation with adjustments for small sample sizes (see Table 3). We extracted 347 effect sizes from the 29 studies included in the analysis ($N = 1{,}493$). The number of outcome measures per study ranged from 2 to 31 ($M = 12$). The average overall treatment effect, $g = .601$, 95% CI [.418, .784], was statistically significant ($p < .001$). Between-study heterogeneity was small, $T^2 = .225$, with approximately 72% of the variance ($I^2 = 72.525$) attributable to true heterogeneity rather than random error. A sensitivity analysis regarding the assumed correlation between within-study

effect sizes (from ρ = 0 to ρ = 1) had little impact on estimates of the effect size, between-study heterogeneity, and no impact on the estimated standard error (see supplemental online materials).

Potential Moderators of Overall Treatment Effect

Three mixed-effects meta-regression models with robust variance estimation were used to determine whether (a) randomization, (b) interventionist, and (c) intervention dosage predicted heterogeneity in the overall treatment effects. No moderators were statistically significant at the $p < .005$ level (see Table 1), although significance tests for moderators are often underpowered (Borenstein et al., 2009). Average effects were relatively the same in randomized ($g = 0.634$) versus nonrandomized ($g = 0.577$) studies. Treatment effects were smaller in studies where MBIs were delivered by the program developers ($g = .511$) compared to other trained staff ($g = .706$). Finally, increasing the dose of the intervention beyond the sample average ($M = 24.421$ hours) had a negligible impact ($b = -.011$) on the observed effect size. Across all models, the estimated between-study heterogeneity was relatively unchanged from the unconditional model. Varying the assumed correlation between within-study effect sizes had a negligible impact on the effect size, standard error, and between-study heterogeneity estimates in each moderator analysis (see supplemental online materials).

Treatment Effects by Therapeutic Processes

A series of exploratory meta-analyses were conducted to estimate the treatment effect of MBIs with teachers on therapeutic processes (see Table 2). MBIs had a medium treatment effect on the first-order therapeutic process of mindfulness ($k = 17$ $n = 1{,}001$), $g = .694$, 95% CI [.424, .965] and a smaller treatment effect on measures of the second-order mechanisms of mindfulness ($k = 13$, $n = 769$), $g = .444$, 95% CI [.217, .670]. The effects of MBIs on mindfulness ($p < .001$) and mechanisms of mindfulness ($p = .001$) were both statistically significant. Varying the

correlation between outcomes had a negligible impact on the treatment effect, standard error, and between-study heterogeneity estimates across both therapeutic processes (see supplemental online materials).

Treatment Effects by Primary Outcomes

We evaluated the effect of MBIs on four primary teacher outcomes (see Table 2). Varying the correlation between outcomes had a negligible impact on the treatment effect, standard error, and between-study heterogeneity estimates across all four models (see supplemental online materials). On the first-order primary outcome of psychological wellbeing (k = 23, n = 1,248), MBIs were associated with a small-to-medium treatment effect, g = .431, 95% CI [.254, .608]. On the first-order primary outcome of psychological distress (k = 27, n = 1,469), MBIs had a medium treatment effect, g = .551, 95% CI [.368, .734]. The effects of MBIs on psychological wellbeing and psychological distress were statistically significant ($p < .001$) and moderately heterogeneous. MBIs had a medium effect on physiological indicators (k = 12, n = 734), g = .617, 95% CI [0.2, 1.03], but this effect was not statistically significant (p = .008) after adjusting for the number of comparisons. There was a relatively large amount between study heterogeneity (Table 2).

Results for the second-order primary outcome of classroom climate and teaching practices (k = 8, n = 536) showed a small treatment effect, g = .314, 95% CI [.152, .477], which was not statistically significant (p = .006). Results obtained using robust variance estimation are likely biased, given that the associated *df* were less than four (Tipton, 2015). Therefore, we fit a random-effects model using restricted maximum likelihood and adjusted standard errors (Knapp & Hartung, 2003), using an unweighted average within study effect size for classroom climate and teaching practices. The treatment effect of MBIs for this model was the same, g = .314.

However, the standard error and corresponding 95% CI [.202, .426] was smaller and the effect was statistically significant, $t(7) = 6.63$, $p < .001$.

Publication Bias

To investigate publication bias, we re-estimated the overall treatment effect size by calculating an unweighted average effect size for each study (Hedges et al., 2010) and synthesizing the 29 synthetic effect sizes using a random-effects model. Between-study heterogeneity was estimated using restricted maximum likelihood estimation with adjusted standard errors (Knapp & Hartung, 2003). Full details regarding the models fit to evaluate publication bias are presented in the supplemental online materials. The overall treatment effect, $g = .577$ ($SE = .096$), was statistically significant ($p < .001$). There was a small, statistically significant ($p < .001$) amount of between-study heterogeneity, $T^2 = .107$ ($SE = .551$).

There was visual and statistical evidence of publication bias. A gap in the lower left-hand side of the funnel plot was indicative of publication bias (see the supplemental online materials). A nonparametric rank-test (tau = .325, $p = .013$) and regression test ($t(27) = 3.024$, $p = .005$) both indicated a statistically significant relationship between observed effect sizes and standard errors. Applying the trim and fill method (R_0 estimator; Duval & Tweedie, 2000) indicated that nine studies were missing on the left side of the funnel plot. Including these nine studies reduced the overall effect size to $g = .333$, 95% CI [0.109, 0.558]. Between-study heterogeneity ($T^2 = .373$, $SE = .114$) was statistically significant ($p < .001$).

Discussion

Teaching is a stressful profession with the stress leading to untoward effects on teachers and classrooms (Jennings & Greenberg, 2009). Recent systematic reviews indicated that MBIs are promising approaches to decreasing teachers' stress and promoting teachers' well-being

(Emerson et al., 2017; Hwang et al., 2017; Lomas et al., 2017). This study extended these findings by (a) synthesizing an overall treatment effect, (b) exploring potential moderators of the overall treatment effect, and (c) exploring the effect of MBIs on therapeutic processes and primary outcomes specified in existing theories regarding MBIs for teachers (Roeser, 2016; Shapiro et al., 2016). Moreover, we did not limit studies to those published in peer reviewed journals and written in English. As such, our search (conducted April 2018) resulted in 19 to 21 more studies than the three previous reviews on this topic.

We identified 29 controlled studies (N = 1,493) that met the inclusion criteria. Results indicated that MBIs with teachers had a medium and significant overall treatment effect, suggesting that this approach to intervention is generally effective for improving targeted outcomes with this population. Overall effects for teachers (g = .601) were similar to findings in previous meta-analytic reviews of MBIs with healthy adult populations (g = .53; Khoury et al., 2015) and working professionals (g = .68; Virgili, 2015). MBIs targeting teachers were associated with larger effects than MBIs targeting health care professionals (r = .34; Burton et al., 2017) or youth (g = .322; Klingbeil et al., 2017).

Analyses testing potential moderators yielded non-significant findings. Results suggest that interventionists with formal training in mindfulness can deliver MBIs to teachers with similar effectiveness as program developers. In the broader mindfulness literature, personal mindfulness practice and training in delivering MBIs are considered requisites for interventionists (e.g., Crane et al., 2012). Although two studies evaluated the use of self-guided mindfulness programs delivered using audio recordings (Bakosh, 2013) or mobile phone applications (James, 2016), the current results do not suggest that untrained school staff without

an established personal mindfulness practice can effectively deliver MBIs to support teacher outcomes.

There may also be a point of diminishing returns for MBI dosage, as there was a slight negative effect of increasing the formal intervention time beyond 24 hours. These moderator findings should be considered tentative, however, due to the small number of studies included in our analysis. As the research base of MBIs with teachers continues to grow, investigation of these and other potential moderators (e.g., specific program types, intervention components, or implementation fidelity) may help identify variables that optimize the use of MBIs with teachers.

MBIs had the largest effects on participants' self-reported mindfulness and smaller effects on theorized mechanisms of mindfulness. MBIs had fairly consistent, medium effects on the primary outcomes of psychological wellbeing, psychological distress, and physiological indicators. Although few studies included measures of classroom climate or instructional practices, MBIs had small positive effects on these outcomes. Taken together, results from this meta-analysis indicate that MBIs have small-to-medium effects on the therapeutic processes and primary outcomes that are posited in the theories of mindfulness mentioned above (Roeser, 2016; Shapiro et al., 2016). Due to the small number of studies included in our analysis, we did not test whether changes in therapeutic processes mediated the effects of MBIs on primary teacher outcomes. Three studies (Crain et al., 2016; Roeser et al., 2013; Rupprecht et al., 2018) provided initial support linking changes in therapeutic processes to improvements in teacher outcomes, but further research is needed to validate these theories.

Gaps in the Literature and Implications for Future Research

Research on MBIs with teachers is incipient and there were some methodological and conceptual issues that emerged across several studies. Our discussion here is brief, as similar

criticisms were identified in previous reviews of MBIs with teachers (Emerson et al., 2017; Hwang et al., 2017) and MBIs in general (Davidson & Kaszniak, 2015). First, with some exceptions (e.g., Roeser et al., 2013; Jennings et al., 2017), most studies used small sample sizes. Second, the majority of studies relied on self-report measures, which are susceptible to response bias. To bolster the quality of outcome data, future research could corroborate self-report data with behavioral measures (e.g., physiological indices of stress, tests of attention), direct observations of classroom variables, or informant-report measures (e.g., student perceptions of classroom climate).

Third, although we only included controlled studies, none of the studies compared the effects of MBIs with an alternative treatment approach. Thus, these results do not permit inferences regarding the value-added effects of one MBI in relation to another (e.g., CARE vs. SMART-in-Education) or comparisons with other evidence-based interventions to improve teacher outcomes (e.g., Iancu et al., 2017). To address this issue, future research should compare MBIs to other interventions targeting teacher wellbeing, along with testing the differential effectiveness of distinct MBI programs. Such evidence is key to informing a true science-based practice of MBIs in schools (Felver et al., 2016; Renshaw & Cook, 2017).

Third, treatment integrity data was only reported in five studies (17.24%). Our findings were similar to results from a broader review of MBIs conducted in schools (Gould, Dariotis, Greenberg, & Mendelson, 2016). This is problematic, as evidence of treatment fidelity is essential for identifying evidence-based practices and determining essential components and secondary components that can be modified to fit the needs of different service delivery contexts (Sanetti & Kratochwill, 2009).

Fourth, the characteristics and components of the MBIs included within our analysis varied widely. For example, CARE and SMART-in-Education have similar dosages but different formats (Jennings et al., 2017). The majority of MBIs also included several "secondary" or non-mindfulness components within the treatment package, yet few provided a detailed operationalization of all intervention components beyond mindfulness. Fifth, few studies provided information about the time participants spent practicing mindfulness outside of formal sessions, or participants' fluency with mindfulness skills prior to beginning the intervention. Such variables may moderate the effectiveness of MBIs for teachers and could therefore be tested in future meta-analyses, if future studies report these data (Davidson & Kaszniak, 2015). As the research base of MBIs with teachers grows, both component analyses and moderator studies will be necessary to optimize the use of this intervention approach in schools (Renshaw & Cook, 2017).

Limitations

The results and interpretations offered above should be considered in light of a few key methodological limitations. First, we were unable to estimate several effect sizes from Benn et al. (2012) and Kemeny et al. (2012), and we were unable to obtain additional information from these authors. We also excluded single-case design studies. Excluding these data, along with other studies that combined teachers with other working professionals, may have biased the current results. Despite including dissertations and other grey literature in our search, visual statistical methods of assessing publication bias suggested that these results may have been influenced by publication bias. Trim and fill results indicated the overall treatment effect may be an overestimate. As research in this area continues, these initial meta-analytic results should be revisited to determine the extent to which these results were biased.

Second, the therapeutic process and outcome domains targeted in the exploratory analyses are broad, limiting the conclusions that can be drawn about the targeted effects of MBIs with teachers. Continued research in this area would allow for a more nuanced analysis of the effects of MBIs on more particular teacher outcomes, such as comparisons between constructs we identified as psychological wellbeing (e.g., adaptive coping, positive affect) or psychological distress (e.g., perceived stress, depression, burnout). Similarly, we were unable to investigate whether MBIs might activate some theoretical process variables (e.g., self-regulation and self-compassion) to a greater-or-lesser extent than others, as these were grouped into only two categories (i.e., mindfulness and mechanisms of mindfulness). We expect that continued growth in this line of research and refinement of target outcomes will allow for process and outcome domains to be investigated with greater precision in future meta-analyses.

Implications for Practice

Considering the limitations reviewed above, a conservative implication for practice is that MBIs may have, on average, a medium treatment effect on teachers' self-reported outcomes and a smaller effect on classroom climate and instructional practices. Given our analysis did not include measures of student outcomes, nothing can be said about the effects of MBIs with teachers on this key outcome domain. We expect, however, that future research demonstrating desirable effects on student outcomes would provide a stronger warrant for schools to adopt MBIs for teachers.

Finally, participants in the 29 studies included in our analysis were all volunteers. Although this is consistent with theories of mindfulness that emphasize voluntary personal practice (e.g., Kabat-Zinn, 2003), these results do not generalize to situations in which districts might use MBIs as mandatory professional development. The majority of MBIs included in this

study also required a substantial amount of formal training time (M = 24.42 hours) and often incorporated at least one full-day retreat, which may be unfeasible for professional development purposes. To date, there is also little empirical guidance regarding how schools can implement MBIs with fidelity, or regarding how to optimize the composition of MBIs for use with teachers. Given the broader pattern of meta-analytic findings indicating positive treatment effects of MBIs with working professionals (e.g., Virgili, 2015), however, we anticipate that additional research will clarify both the potentially pivotal nature of mindfulness skills for improving teacher outcomes as well as the practical aspects contributing to the differential effectiveness of MBIs in schools. The results from this initial meta-analytic review should be replicated and extended as more methodologically rigorous studies are conducted evaluating MBIs with teachers.

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*Denotes study included in meta-analysis

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Table 1

Moderator Meta-Regression Analyses for Overall Treatment Effect

Categorical Moderator	Level	*k*	*m*	*n*	*g* (*SE*)	95% CI *LL*	95% CI *UL*	*t*	*df*	*p*	Heterogeneity T^2	Heterogeneity I^2
Person-Level Assignment	Intercept (Non-Random)	12	141	492	.557 (.128)	.274	.839	4.35	10.80	.001	.237	72.973
	Randomized	17	206	1,001	.077 (.180)	-.295	.450	.430	23.00	.671		
Interventionist	Intercept (Program Developer)	14	190	749	.511 (.119)	.255	.767	4.30	13.5	<.001	.237	72.628
	Other	15	157	744	.195 (.178)	-.172	.561	1.09	25.7	.284		
Continuous Moderator		*k*	*m*	*n*	*b* (SE)	*LL*	*UL*	*t*	*df*	*p*	T^2	I^2
Dosage	Intercept	29	347	1,493	.608 (.087)	.429	.786	6.98	25.82	<.001	.207	70.372
	Hours				-.011 (.005)	-.023	.001	-2.30	5.45	.067		

Note. Each model was fit separately. Dosage was grand-mean centered (M = 24.421). m = number of measures; k = number of studies; n = number of participants

Table 2

Treatment Effects for MBIs with Teachers

				Treatment Effects					Heterogeneity	
Outcome Domain	*m*	*k*	*n*	*g (SE)*	95% CI	*t*	*df*	*p*	T^2	I^2
Mindfulness	50	17	1,001	.694 (.127)	.424, .965	5.48	15	<.001	.167	68.818
Mechanisms of Mindfulness	31	13	769	.444 (.103)	.217, .670	4.32	10.9	.001	.084	52.462
Psychological Wellbeing	66	23	1,248	.431 (.085)	.254, .608	5.06	21	<.001	.132	62.595
Psychological Distress	116	27	1,469	.551 (.089)	.368, .734	6.2	25	<.001	.175	68.806
Physiological Indicators	42	12	765	.617 (.188)	.200, 1.030	3.28	10.4	.008	.274	79.000
Classroom Climate and Instructional Practices	42	8	536	.314 (.057)	.152, .477	5.50	3.76	.006[a]	0	0
Overall Treatment Effect	**347**	**29**	**1,493**	**.601 (.089)**	**.418, .784**	**6.73**	**26.9**	**<.001**	**.226**	**72.525**

Note. m = number of measures, *k* = number of studies, *n* = number of participants; [a] = *p* values when *df* < 4 are likely biased and should not be trusted (Tipton, 2015). Results for Classroom Climate and Instructional Practices, estimated using an unweighted synthetic effect size were nearly identical.

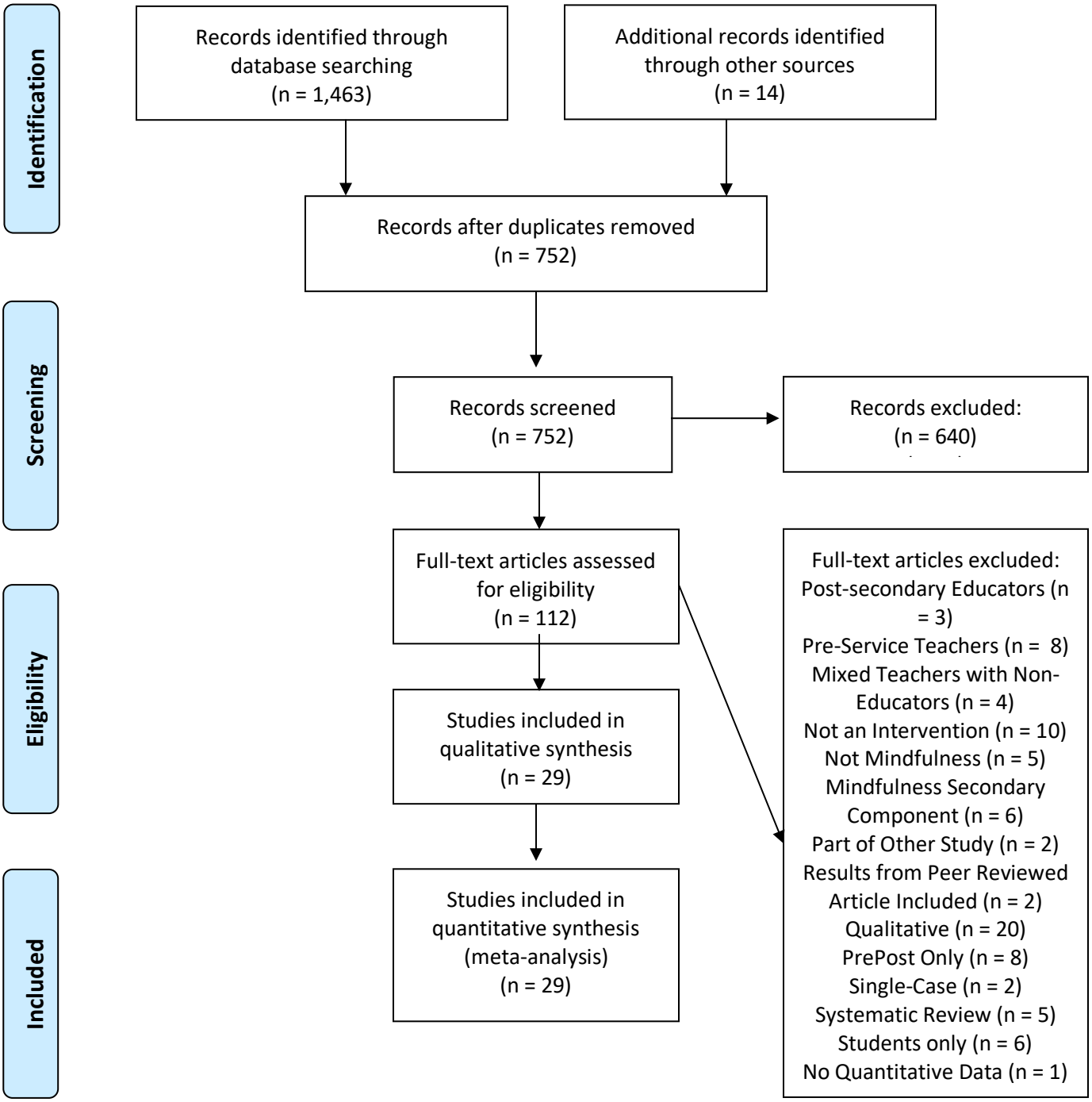

Figure 1. PRISMA diagram showing flow of articles that were found, included or excluded, and then entered into the qualitative or quantitative analysis.

Mindfulness-Based Interventions for Teachers: A Meta-Analysis of the Emerging Evidence-Base

Supplemental Online Material

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Author note: Supplemental online material to accompany the paper by the same title, which is accepted for publication in *School Psychology Quarterly.* The final article will be available, upon publication, via its DOI: 10.1037/spq0000291. Correspondence should be addressed to David Klingbeil at dklingbeil@austin.utexas.edu.

Supplemental Online Material

Search Results

The Table below shows the number of articles called when applying each successive iteration of the search terms by database. Please contact the corresponding author for copies of the .ris files.

Table S1 – Search results by databases and terms

Databases	Search Terms	Articles Culled
PsychInfo, Academic Search Complete, Medline (Pub Med), ERIC	Mindful + Educators + Intervention	38
	Mindful + Educators + Prevention	21
	Mindful + Educators + Training	66
	Mindful + Teachers + Intervention	87
	Mindful + Teachers + Prevention	32
	Mindful + Teachers + Training	120
	Mindfulness + Educators + Intervention	85
	Mindfulness + Educators + Prevention	35
	Mindfulness + Educators + Training	91
	Mindfulness + Teachers + Intervention	310
	Mindfulness + Teachers + Prevention	99
	Mindfulness + Teachers + Training	273
ProQuest Theses and Dissertations Global (Abstract Only)	Mindful + Educators + Intervention	7
	Mindful + Educators + Prevention	0
	Mindful + Educators + Training	8
	Mindful + Teachers + Intervention	21
	Mindful + Teachers + Prevention	0
	Mindful + Teachers + Training	23
	Mindfulness + Educators + Intervention	12
	Mindfulness + Educators + Prevention	4
	Mindfulness + Educators + Training	15
	Mindfulness + Teachers + Intervention	62
	Mindfulness + Teachers + Prevention	3
	Mindfulness + Teachers + Training	51
	Total Database Search	1,463

Table S2 – Descriptive and moderator information

Study	*n*	Intervention	Dosage (Hrs)	Randomized	Interventionist	Therapeutic Processes	Therapeutic Outcomes
Ancona & Mendelson (2014)	43	Holistic Life Foundation Curriculum	4.5	No (School Level)	Program Developer(s)		DISTRESS
Andaur Rodriguez & Berger Silvia (2018)	43	Mindfulness-Based Self-Care Workshop	12	No	Program Developer(s)		DISTRESS, WELL
Bakosh (2013)	16	Inner Explorer Program	7.5	Yes	Other	MF	DISTRESS
Benn et al. (2012)	25	SMART-in-Education	36	Yes	Other	MECH	WELL
Beshai et al. (2016)	89	.b Foundations Course	10	No	Other	MF, MECH	DISTRESS, WELL
Crain et al. (2016)	113	SMART-in-Education	36	Yes	Program Developer(s)	MF	DISTRESS, PHYS, WELL
de Carvalho et al. (2016)	20	MindUP	50	Yes	Other	MF, MECH	DISTRESS, WELL
de la Fuente et al. (2010)	17	Flow Meditation	15	Yes	Program Developer(s)		PHYS
Delgado et al. (2010)	37	Mindfulness & Human Values Training	30	No	Program Developer(s)	MECH	DISTRESS, PHYS, WELL
Flook et al. (2013)	18	Adapted Mindfulness-Based Stress Reduction	26	Yes	Other	MF, MECH	CLASS, DISTRESS, PHYS, WELL
Franco et al. (2010)	68	Flow Meditation	15	Yes	Other		DISTRESS, WELL
Franco Justo (2010)	42	Flow Meditation	15	Yes	Program Developer(s)		DISTRESS, WELL

Study	*n*	Intervention	Dosage (Hrs)	Randomized	Interventionist	Therapeutic Processes	Therapeutic Outcomes
Frank et al. (2015)	36	Adapted Mindfulness-Based Stress Reduction	16	No	Other	MF, MECH	DISTRESS, PHYS, WELL
Gouda et al. (2016)	29	Mindfulness-Based Stress Reduction	24	No	Other	MF, MECH	DISTRESS, WELL
Harris et al. (2015)	64	Community Approach to Learning Mindfully	21.33	No (School Level)	Other	MF, MECH	CLASS, PHYS, DISTRESS, WELL
James (2016)	30	Headspace Mobile Phone Application	1.67	Yes	Other	MF	DISTRESS, WELL
Jenaabadi et al. (2017)	30	Mindfulness Education Training	12	No	Program Developer(s)		DISTRESS, WELL
Jennings et al. (2013)	48	Cultivating Awareness and Resilience in Education	30	Yes	Program Developer(s)	MF, MECH	CLASS, DISTRESS, PHYS, WELL
Jennings et al. (2017)	224	Cultivating Awareness and Resilience in Education	31	Yes	Other	MF, MECH	CLASS, DISTRESS, PHYS, WELL
Jennings, Foltz, et al. (2011)[2]	32	Cultivating Emotional Balance Training	42	Yes	Program Developer(s)	MF	CLASS, DISTRESS, WELL
Jennings, Snowberg et al. (2011)[2]	39	Cultivating Awareness and Resilience in Education	32	Yes	Program Developer(s)	MF	CLASS, DISTRESS, PHYS, WELL
Kemeny et al. (2012)	79	Cultivating Emotional Balance Training	42	Yes	Program Developer(s)		DISTRESS, WELL
Manas et al. (2011)	31	Flow Meditation	15	Yes	Program Developer(s)		DISTRESS, PHYS
Ramsey & Jones (2015)[1]	37	Mindfulness Training Workshop	7	No	Other		DISTRESS
Reiser & McCarthy (2018)	43	Stress Prevention and Mindfulness Group	8	No	Program Developer(s)	MF	DISTRESS, WELL

Study	*n*	Intervention	Dosage (Hrs)	Randomized	Interventionist	Therapeutic Processes	Therapeutic Outcomes
Roeser et al. (2013)	102	SMART-in-Education	36	Yes	Program Developer(s)	MF, MECH	DISTRESS, PHYS
Rupprecht et al. (2017)	31	Mindfulness-Based Stress Reduction	24	No	Other	MF	DISTRESS, PHYS, WELL
Simon et al. (2009)	57	Inner Resilience Program	74.75	Yes	Other	MF, MECH	CLASS, DISTRESS, WELL
Taylor et al. (2016)	56	SMART-in-Education	36	Yes	Program Developer(s)	MECH	CLASS, DISTRESS, WELL

Note. [1] = Study 1 only; [2] = Study 2 only; *n* = analytic sample reported in study; NR = Not Reported; MF = Mindfulness; MECH = Mechanisms of Mindfulness; CLASS = Classroom Climate and Instructional Practices; DISTRESS = Psychological Distress, PHYS = Physiological Indicators; WELL = Psychological Wellbeing;

Study Coding

Included studies were coded on 27 items (see Appendix). First, we coded setting information including the country and urbanicity of the study location. Second, we coded aspects related to the participants. This included the range of grades taught by participants, whether non-teachers were included (yes or no), sample size, sex (percent female), race (percent White), age (*M* and range), teaching experience (*M* and range) and whether participants had previous experience with meditation.

Third, we coded several aspects of the intervention. This included the name of the intervention, the intervention approach (i.e., combined or indirect), who delivered the intervention and the interventionists' experience with mindfulness. We coded the duration of the intervention (weeks) and treatment dosage (minutes per session x multiple sessions) of all formalized intervention sessions. Whole day retreats were estimated as 7 hours when the exact length was not specified. Sessions delivered after post-test assessments were not included in the treatment dosage. We also coded whether outside practice was recommended or required (i.e., yes or no), the frequency and amount of recommended practice, and the actual practice reported by participants (*M* minutes per day and times per week). Last, we coded where the intervention occurred, when the intervention occurred, and whether a full-day retreat was included (i.e., yes or no).

Finally, we recorded whether fidelity information was measured and the method of assessment (direct observation, interview, self-report). When data were presented, we recorded quantitative (e.g., percentage of steps completed) or qualitative descriptors (e.g., high adherence) of treatment fidelity. Last, we coded whether random assignment was used, and if so, whether randomization occurred at the participant or cluster level.

IOA training procedures. The first author trained a doctoral student in school psychology on the coding scheme during a 45-minute session. Next, both reviewers independently coded two MBI studies that were excluded from the analysis to ensure reliability and clarify/modify codes, if needed.

Moderator Coding

We imputed values for studies that did not provide enough information to calculate dosage. Dosage for Jennings, Foltz et al. (2011) was imputed from another study of the same intervention (Kemeny et al., 2012). Jenaabadi and colleagues (2017) only reported there were 8 sessions, and we imputed a session length of 90 minutes. Dosage in deCarvalho et al. (2016) was calculated as 50 hours because teachers were trained in mindfulness first (25 hours) and then delivered MindUP to their students (25 hours) before completing the post-test measures.

Outcome Coding

Mindfulness. This domain included only self-report measures of mindfulness. The Five Factor Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2008) was used almost exclusively. The Freiburg Mindfulness Inventory and the Mindful Attention Awareness Scale were used sparingly.

Mechanisms of mindfulness. Researchers used a variety of measures that pertained to the theoretical mechanisms of mindfulness. These included measures of emotion regulation, self-compassion, sustained attention, self-regulation, and emotional processing. Roeser et al. (2013), Delgado et al. (2010), and Flook et al. (2013) used performance-based measures of proposed mechanisms (i.e., working memory tasks, tests of sustained attention), all others were derived from self-report rating scales.

Physiological indicators. This domain included outcomes pertaining to health and subjective health complaints, behavioral indicators of health (e.g., sick leave, days absent), and outcomes related to sleep (e.g., insomnia, sleep quality). In addition, this domain included physiological indicators such as breathing rate, cortisol levels, skin conductance, blood pressure, and heart rate.

Psychological distress. This domain included measures of negative affect, psychological distress, somatization, or internalizing problems (e.g., anxiety, depression), stress, and job-related stress (e.g., task-related hurry). This domain also included physiological measures of stress, including cortisol, heart rate, and blood pressure. Researchers also included several measures of burnout and related issues (e.g., depersonalization, exhaustion) and maladaptive coping strategies (e.g., avoidance). Several studies also included indices of negative affect, psychological distress or internalizing problems (e.g., anxiety, depression). Most measures included in this domain, excepting the physiological indicators, were also self-report.

Psychological wellbeing. This domain included measures of general self-efficacy, job satisfaction, and personal accomplishment. Measures of adaptive coping strategies, forgiveness, positive emotions (e.g., self-kindness, calmness), and general positive affect were also included. Only a few studies include measures of work engagement or mental well-being. Taylor et al. (2016) interviewed participants and analyzed their responses to quantify prosocial dispositions toward a challenging students. Measures in this domain were all self-report with one exception, Gouda et al. (2016) used a drawing task to measure creative thinking. While we included measures of teaching self-efficacy in this domain, ratings pertaining to specific instructional practices were included in the classroom climate domain.

Classroom climate and teacher practices. Outcomes in this domain were related to classroom practices and classroom climate. Several studies used the Classroom Assessment Scoring System (Pianta, La Paro, & Hamre, 2003) to directly observe teachers' classroom organization, instructional support, and behavior management. Self-report measures of teachers' perceptions of classroom management, instructional practices, and student engagement were also used. Researchers also used measures of classroom climate (negative or positive), teacher-student relationships, and teachers' emotional support of students. Student perspectives (i.e., informant report) were included in Simon, Harnett, Nagler, and Thomas (2009).

Effect Size Extraction

We used unstandardized means and standard deviations to calculate Hedges' *g* for all outcome measures in 27 studies. The published standardized mean differences and corresponding sample sizes were used to calculate Hedges' *g* in two studies (Jennings, Snowberg et al., 2011; Kemeny et al., 2012). We were unable to extract effect sizes for all of the reported outcomes in two studies. Benn, Akiva, Arel, and Roeser (2012) combined results for teachers and parents for measures of mindfulness, distress, and well-being. We only included effects that were reported for teachers separately from parents. We could only extract the effect size for depression from Kemeny et al. (2012) because the other were presented within a figure, averaged across time periods (making the presented *F* values unsuitable) or presented as changes between pre-test and post-test, which would result in a *d* value standardized in a different metric (Morris & DeShon, 2002). The corresponding authors of each study did not respond to requests for additional information, and therefore, the rest of the effect sizes were excluded.

Additional Descriptive Information

In the studies that provided demographic information, participants were primarily White (k = 14; M = 77.61%, range = 33% to 99%) and female (k = 24; M = 84.83%, range = 57% to 100%). The average age of participants was reported in 20 studies (M = 41.75, range = 27 to 48). Average years of teaching experience was reported in 13 studies (M = 12.22, range = 4 to 17). Five studies included other school staff (e.g., paraprofessionals, learning support staff) along with teachers and Jennings, Snowberg et al. (2011) included student teachers and their mentor teachers.

The location of the interventions was not reported in 17 studies. In the remaining studies, MBIs were delivered in school settings (k = 9) or other training centers (k = 3). Interventions were delivered at varied times, including before (k = 1) or after school (k = 6) or after school combined with weekend sessions (k = 4). It was less common for interventions to be delivered solely on weekends (k = 2) or during the school day (k = 3).

Sensitivity Analyses

Robust variance estimation, using the correlation method of determining model weights, requires researchers to specify the correlation between within study effect sizes (Tipton, 2015). The robumeta package (Fisher & Tipton, 2015) allows users to test the sensitivity of the selected correlation. All models presented in the manuscript were fitted using a between effect-size correlation of $\rho = 0.5$. Below we provide the results of the sensitivity analyses for each of the models presented in the manuscript.

Overall model. As stated in the manuscript, the overall treatment effect (setting ρ = 0.5) was g = .601 (SE = 0.089). Between-study heterogeneity was small, T^2 =.225.

Table S3 – Overall model

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.6008	.6009	.6010	.6010	.6011	.6012
SE	.0893	.0893	.0893	.0893	.0893	.0893
T^2	.6008	.6009	.6010	.6010	.6011	.6012

Moderator analyses. As shown in Table 2 in the manuscript, we evaluated whether person-level randomization, interventionist, and dosage explained significant heterogeneity in the overall treatment effect of MBIs for teachers. These effects were estimated setting ρ = 0.5.

Table S4 – Randomization

		ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
Intercept (non-random)	*g*	.5568	.5569	.5569	.5570	.5570	.5571
	SE	.1280	.1280	.1280	.1280	.1280	.1280
Randomized	*g*	.0769	.0710	.0773	.0774	.0776	.0778
	SE	.1799	.1799	.1800	.1801	.1801	.1802
	T^2	.2380	.2358	.2369	.2379	.2390	.2400

Table S5 – Interventionist

		ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
Intercept (Program Developer)	*g*	.4930	.4930	.4930	.4940	.4940	.4940
	SE	.1100	.1110	.1110	.1110	.1110	.1110
Other	*g*	.2520	.2520	.2520	.2520	.2520	.2520
	SE	.1780	.1780	.1780	.1780	.1780	.1780
	T^2	.2320	.2330	.2340	.2350	.2360	.2370

Table S6 – Dosage

		ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
Intercept	*g*	.6072	.6073	.6075	.6076	.6078	.6079
	SE	.0869	.0869	.0870	.0870	.0870	.0871
Dosage	*g*	-.0111	-.0111	-.0112	-.0112	-.0112	-.0112
	SE	.0049	.0049	.0049	.0049	.0049	.0049
	T^2	.2047	.2058	.2068	.209	.2089	.2100

Therapeutic process and outcomes. As shown in Table 3 in the manuscript, we conducted exploratory meta-analyses on therapeutic processes (mindfulness and mechanisms of mindfulness) and four primary outcomes (psychological wellbeing, psychological distress, physiological indicators, and classroom climate and practices). These effects were estimated setting ρ = 0.5.

Table S7 – Mindfulness

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.6940	.6940	.6940	.6950	.6950	.6950
SE	.1270	.1270	.1270	.1270	.1270	.1270
T^2	.1670	.1670	.1670	.1680	.1680	.1680

Table S8 – Mechanisms of mindfulness

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.4437	.4438	.4438	.4439	.4439	.4439
SE	.1028	.1028	.1028	.1027	.1027	.1027
T^2	.0826	.0829	.0833	.0837	.0841	.0845

Table S9 – Psychological distress

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.5511	.5511	.5511	.5512	.5512	.5512
SE	.0889	.0889	.0889	.0889	.0889	.0888
T^2	.1744	.1747	.1751	.1755	.1758	.1762

Table S10 – Psychological wellbeing

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.4310	.4310	.4310	.4310	.4310	.4310
SE	.0852	.0852	.0852	.0852	.0852	.0852
T^2	.1312	.1314	.1316	.1319	.1321	.1323

Table S11 – Physiological indicators

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.6170	.6170	.6170	.6170	.6180	.6180
SE	.1880	.1880	.1880	.1880	.1880	.1880
T^2	.2720	.2720	.2730	.2740	.2750	.2750

Table S12 – Classroom climate and teaching practices

	ρ = 0	ρ = 0.2	ρ = 0.4	ρ = 0.6	ρ = 0.8	ρ = 1.0
g	.3140	.3140	.3140	.3140	.3140	.3140
SE	.0571	.0571	.0571	.0571	.0571	.0571
T^2	.0000	.0000	.0000	.0000	.0000	.0000

Publication Bias

The table below shows the estimated treatment effects when using an unweighted average effect size for each of the 29 studies included in the meta-analysis, along with the results when applying trim and fill methods to estimate the number of missing studies that may have resulted due to publication bias. Table S13 (below) shows the overall treatment effect estimated using (a) an unweighted synthetic effect, and (b) an overall treatment effect derived using trim and fill methods (Duval & Tweedie, 2000). Results from the trim and fill analysis (using the R_0 estimator) indicated that 9 studies were missing.

Table S13 – Models resulting from publication bias analyses

		Treatment Effects					Heterogeneity				
Model	*k*	*g (SE)*	95% CI	*t*	*df*	*p*	*Q*	*df*	*p*	T^2 (*SE*)	I^2
Unweighted Average	29	.577 (.096)	.424, .965	5.48	28	<.001	70.431	28	< .001	.107 (.055)	56.03
Trim and fill (R0 estimator)	38	.333 (.115)	.108, .558	6.757	37	<.001	158.910	37	< .001	.373 (.114)	80.42

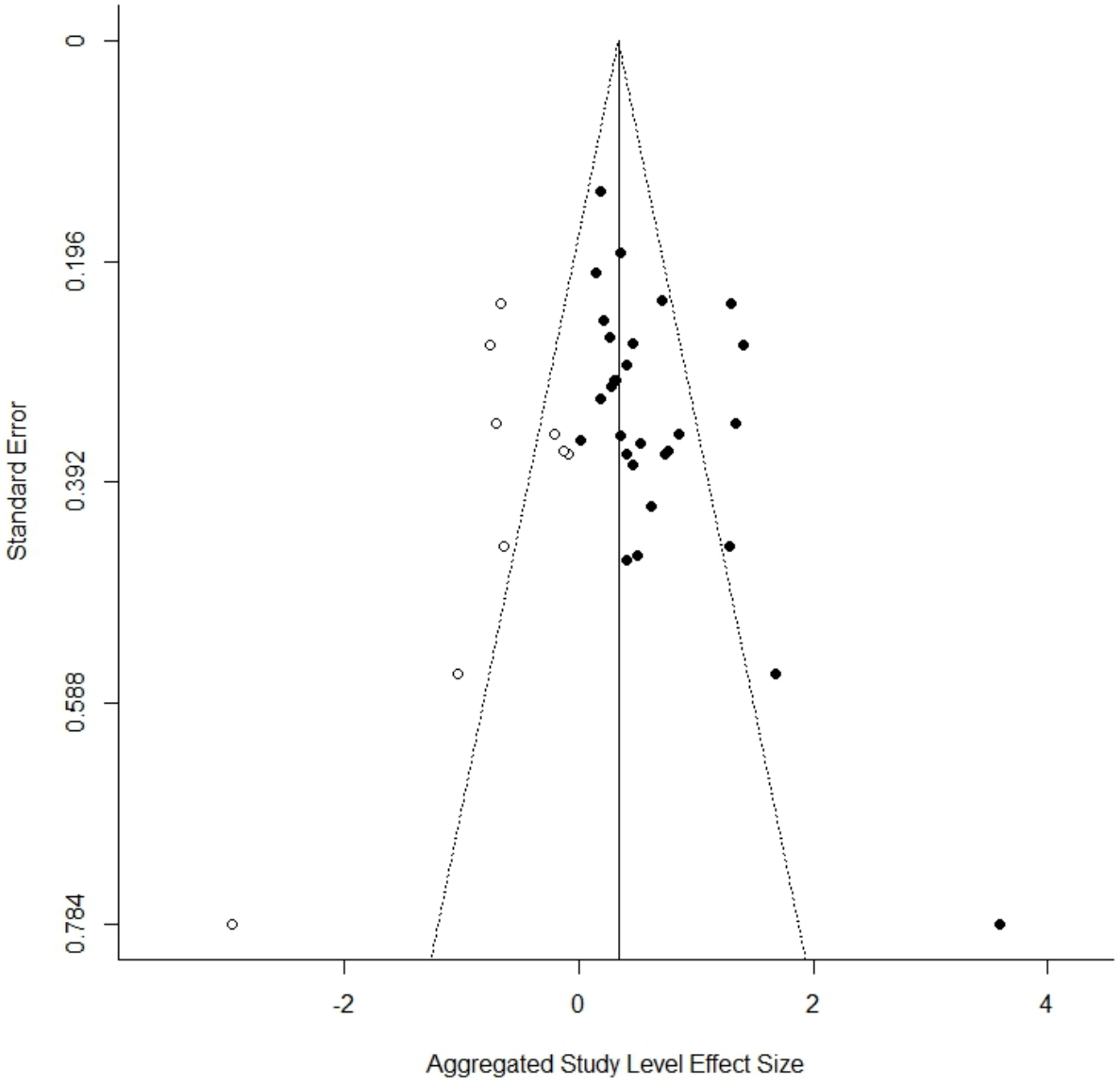

Figure S1. Funnel plot of effect sizes aggregated at study level plotted against the inverse standard error. The gap on the lower left side of the funnel plot is indicative of publication bias. The trim and fill method, conducted using the R_0 estimator, indicated there were 9 missing studies (white dots).

Appendix – Full Study Coding Scheme

Category	Description	Notes
Intervention Name	Write out the full name of the program.	For MBSR programs, indicate if Adapted MBSR or Standard MBSR. If program says based on MBSR, but then lists a different name, report the different name.
Indirect/Combined	Indirect = Targeted Teachers Only Combined = Targeted Teachers and Youth	Consider combined if the researchers trained students: a) at the same time as teachers or b) after training teachers
Urbanicity	Locale of Study (e.g., Small City, Mid-Sized City, Large City, Urban, Suburban, Rural)	List Descriptor Verbatim If multiple sites used, list all that apply
Country	Country of Study	List Country in Which Study took Place If multiple countries, list all that apply
Grade Range	List Grade Range that **Participants** Taught	If range is given, list upper and lower end (e.g., Elementary and Secondary Schools)
Included Non-Teachers	Did they include non-teachers in the sample (e.g., paraprofessionals, counselors, administrators)	Indicate Yes or No
Sample Size	N of Teachers	List starting sample size, before attrition

Category	Description	Notes
Sex (Female)	List Percentage of Sample Identified as Female	List %
Race (White)	List percentage of Sample identified as White	List % (If other descriptor used but no percentage given, leave blank)
Age M	List Reported Mean Age	
Age Range	List Range of Sample Participants' Age	List lowest age to highest age. For example: 25 to 50 If they indicate "or more" indicate + (May use exclusionary criteria)
Experience M	List reported Mean Years' of Teaching Experience	
Experience Range	List Range of Teachers Years' of Experience	Student teachers = 0 Years Experience If they indicate "or more" indicate +
Interventionist Training and Description	Confirm	Also confirm NR if not indicated
Previous Mediation Experience	Percentage of Teachers with Previous Mediation Experience	If study excluded teachers that had previous experience, indicate 0.
Length (Weeks)	Number of Weeks Intervention Occurred	List (Estimate from Presented Data when necessary…e.g., November to January)

Category	Description	Notes
Formal Dosage	Total N of Minutes (min per session x number of sessions)	Only include formal sessions, not home practice. Whole day retreats are coded as 7 additional hours when required (and no other time is given) For combined studies, just include teacher training Don't include follow-up sessions, if after post-test measurement/analyses
Outside Practice Recommendations	Indicate Yes, if outside practice was recommended, assigned, or required. Also indicate Yes if article mentions materials were given for home practice.	Yes or No
Outside Practice Time	Indicate daily time required	If range, indicate minimum to maximum reported. If average given, report that If weekly practice recommended, divide by 7
Outside Practice Frequency	Indicate number of days per week	Indicate 7 if daily practice recommended

Category	Description	Notes
Reported Outside Practice (Average min per day; Frequency)	Indicate Average Daily Practice Reported, and Times per week	Not recommended, actually reported by participants. 25 m; daily 10 m; weekly If only indicate number of practice sessions, then list that. 3 sessions; weekly
When	Indicate when formal sessions occurred	Options (Indicate all that apply): *Before School* *After School* *Weekend* *During the School Day* *Other (list)* *NR*
Where	Indicate where formal sessions occurred	If multiple locations, list all. For example: Program Sessions (at school), weekend retreat (training center).
Full day retreat	Yes or No	*Was there a full day retreat included?*
Implementation Integrity	Implementation Integrity (Did the interventionists deliver with fidelity)	If fidelity was measured, indicate how. Examples include: Direct Observations, Interviews, self-report If multiple types, list all

Category	Description	Notes
Fidelity Reported	Reported Fidelity	If percentage given list that. For example: 94%. Otherwise list descriptor (e.g., “high”). If multiple types list all. For example: Observation (high); Interview (high)
RCT	Was the Study an RCT?	Indicate: Yes Yes – Cluster Level No