

Systematic Review of the Quality of Mindfulness-Based School Interventions

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Abstract

Objective: The purpose of this systematic review was to assess the current literature on mindfulness-based school interventions (MBSIs) by evaluating evidence across specific outcomes for youth.

Methods: We evaluated seventy-three studies with a total sample a total of 11,906 students across five continents, assessing the quality of each study through a robust coding system for evidence-based guidelines. Coders rated studies as 1++ (systematic review) to 4 (expert opinion) for level of evidence. Using the level of evidence, outcomes were assigned a corresponding evidence quality letter grade, from strongest (A) to weakest (D) evidence.

Results: Outcomes fell into the following 11 categories: wellbeing, self-compassion, social functioning, mental health, self-regulation and emotionality, mindful awareness, attentional focus, psychological and physiological stress, problem behaviors, academic performance, and acceptability. Evidence was strongest for the effects of these interventions on increased resilience and reduced anxiety. There was comparable improvement in depression and wellbeing across youth in MBSIs relative to control groups.

Conclusion: This review demonstrates the promise of incorporating mindfulness interventions in school settings for improving certain youth outcomes. We urge researchers interested in MBSIs to study their effectiveness using more rigorous designs (e.g., RCTs with active control groups, multi-method outcome assessment, and follow-up evaluation), to minimize bias and promote higher quality—not just increased quantity—evidence that can be relied upon to guide school-based practice.

Keywords: mindfulness; school-based interventions; youth; systematic review; evidence based practice; school mental health

Many preschool, elementary, and high school students experience problems related to anger, anxiety, depression, and low self-esteem (Barnes et al., 2003; Fisher, 2006; Langer et al., 2015; Mendelson et al., 2010; Rempel, 2012), that negatively influence their academic and social development (Leigh & Clark, 2018; Maughan et al., 2013; Murphy et al., 2015) and have lasting effects on their wellbeing (Steger & Kashdan, 2009). Schools can play a pivotal role in promoting students' mental health and their social, emotional, and behavioral development (Barnes et al., 2003; Fisher, 2006; Mendelson et al., 2010). To address these challenges, many schools have adopted mindfulness-based interventions (MBIs). Studies conducted over the past 15 years have examined the impact of MBIs on mental health, educational performance, and related outcomes in children and adolescents (Kallapiran et al., 2015; Meiklejohn et al., 2012).

Mindfulness-Based Interventions

Mindfulness is the process by which we “pay attention in a particular way: on purpose, in the present moment and nonjudgmentally” (Baer, 2003; Roeser, 2014). Practicing mindfulness typically includes meditation exercises and bringing mindful awareness to daily activities, such as eating and walking. These practices are intended to foster focused attention, coupled with a nonjudgmental attitude toward moment-to-moment experience (Kabat-Zinn, 2003). Mindfulness-based interventions target many aspects of wellbeing, resiliency, and mental health by cultivating a present-centered awareness and acceptance (Gawrysiak et al., 2018; Greeson, 2009; Roeser, 2014). Emotion regulation has been the focus of much MBI research (Chambers et al., 2009; Guendelman et al., 2017; Wisner, 2014). Individuals who have difficulty with emotion regulation have problems processing, experiencing, expressing, and managing emotions effectively (Chambers et al., 2009). The nonjudgmental awareness in mindfulness may facilitate a healthy engagement with emotions, allowing individuals to experience and express their emotions

without *under-engagement* (e.g., experiential avoidance and thought suppression) or *over-engagement* (e.g., worry and rumination; Borkovec, 2002; Bridges et al., 2004; Hayes & Feldman, 2004; Hayes et al., 1996; Ivanovski & Malhi, 2007; Nolen-Hoeksema, 1998; Wegner, 1994). Research indicates that MBI with adults can increase awareness of moment-to-moment experience and promote reflection, empathy, and caring for others (Hölzel et al., 2011).

Mindfulness training with adults can improve stress regulation, resilience, anxiety, and depression (Forkmann et al., 2014; Hofmann et al., 2010; Irving et al., 2009; Klatt et al., 2015; Li & Bressington, 2019; Marcus et al., 2003; Morton et al., 2020; Tang et al., 2007).

Despite extensive empirical support for mindfulness practice with adults, the question of whether MBI also benefits youth remains less clear, as far fewer studies examine mindfulness practice with school-age children and adolescents (Caldwell et al., 2019; Greenberg & Harris, 2012; Zoogman et al., 2015). Mindfulness practices have gained recent worldwide popularity as a school-based intervention (Burke, 2010; Greenberg & Harris, 2012; Zenner et al., 2014). These mindfulness-based school interventions (MBSIs) target a host of outcomes, including increasing awareness, empathy, compassion, gratitude, perspective taking, psychological flexibility, present centeredness, and self-regulation such as regulating behaviors, cognitions, and emotions (Bernay et al., 2016; Eva & Thayer, 2017; Hill & Updegraff, 2012; Moses & Barlow, 2006; Sapthiang et al., 2019; Schonert-Reichl et al., 2014). The practices incorporated in MBSIs include psychoeducation about emotions and mindfulness, as well as specific mindfulness exercises, including awareness of breath, mindful body scans, and awareness of thoughts, feelings, and sensations. MBSIs are often delivered in the context of whole-class instruction (general population of students) or targeted intervention (at-risk or clinical populations; Kuyken et al., 2013; Napoli et al., 2005; Raes et al., 2014).

Mindfulness practices targeting school-age populations include developmentally appropriate adaptations for children and adolescents (Bostic et al., 2015; Carsley et al., 2018). For example, time for practices are shorter, they incorporate multiple sensory modalities into activities, rely on simplified metaphors to communicate difficult concepts, and there is more time for explaining key concepts (Burke, 2010; Felver et al., 2013). Most MBSIs tested in schools are designed to increase resilience to stress and decrease depression and anxiety symptoms (Wisner, 2014). Early studies showed promising results in decreasing anxiety, fatigue, depressive symptoms, stress-related issues, and disorders for various conditions (Bei et al., 2013; Fjorback et al., 2011; Grossman et al., 2004; Piet et al., 2012; Piet & Hougaard, 2011). In the past five years, several systematic reviews and meta-analyses have indicated growing evidence supporting MBSIs.

Previous Reviews of Mindfulness-Based Interventions with Youth

Several meta-analytic reviews include MBIs, delivered across multiple settings including schools. Zoogman et al. (2015) published the first meta-analysis of MBIs with youth, examining the effects observed in 20 peer-reviewed studies published between 2004 and 2011. Their analysis included controlled and non-controlled trials that used a mindfulness intervention with youth between 6 to 21 years-old. All group-based quantitative study designs were included as well as clinical and non-clinical (i.e., those without significant mental health issues) samples. Concentration meditations (e.g., transcendental meditation) and multicomponent interventions (e.g., Acceptance and Commitment Therapy [ACT] and Dialectical Behavior Therapy [DBT]) were excluded in this review, however. Zoogman et al. found MBIs were associated with a small overall treatment effect. Results also showed that MBIs were more effective in improving psychological outcomes than physiological and cognitive outcomes. The improvements were

greater in the clinical population than non-clinical populations. Given their findings, Zoogman et al. (2015) concluded that MBIs with youth were safe and effective for addressing a range of target behaviors, but the small number of studies limited the power to examine subgroup variation.

Kallapiran et al. (2015) also conducted a meta-analysis of MBIs with youth, including 11 studies published through 2014. The analysis varied from Zoogman et al. (2015) in that only randomized-controlled trials (RCTs) targeting mental health outcomes such as depression, anxiety, and stress were considered. ACT studies were also included in this review, as it was considered by the authors to be a mindfulness-based treatment approach. The studies included both clinical and non-clinical samples with youth between 6 to 18 years-old. Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) with non-clinical samples had small effects on stress and depression, but large effects on anxiety. ACT interventions had no effect on anxiety and moderate effects on depression. All other MBIs (i.e., sans MBSR, MBCT, and ACT) with non-clinical samples had a small effect on depression, a moderate effect on stress, and a large effect on anxiety.

A more recent meta-analysis of MBIs conducted by Klingbeil et al. (2017a) focused on single-case design research, including 10 studies published through 2014. Studies in this analysis included multiple-baseline designs with youth between 4 to 18 years-old with disruptive behavior problems. Klingbeil et al. (2017a) found that MBIs had a moderate average therapeutic effect on disruptive behavior during treatment, with larger effects during maintenance phases. Results suggested that MBIs were more effective for youth with autism and intellectual disabilities than for other children. Overall, Klingbeil et al. (2017) established that MBIs are

useful as targeted interventions for decreasing youth disruptive behavior in home and school settings.

In a separate meta-analysis, Klingbeil et al. (2017b) examined treatment effects of MBIs from 76 group-design studies with youth between 4 to 18 years-old. Studies were conducted in school or other settings with both clinical and non-clinical samples. MBIs lead to improvements in both controlled and uncontrolled studies. For the controlled studies, all effect sizes were in the small-to-moderate range for academic achievement, externalizing problems, internalizing problems, negative and positive emotions, physical health, and social competence. This meta-analysis differed from previous ones by including separate analyses to investigate the effects of MBIs after a follow-up period. Results demonstrated larger treatment effects at follow-up than post-treatment. Considering the findings from this meta-analysis along with the previous meta-analyses (reviewed above), there seems to be a clear pattern of evidence suggesting that MBIs are, on the whole, safe and effective for use with youth (generally) as well as in schools (specifically) for improving a variety of valued outcomes.

Purpose of the Present Study

To address the growing interest in MBSIs and to inform those choosing programs, we systematically reviewed published studies of MBSIs for youth in schools (cf. Felter et al., 2016; Zenner et al., 2014). Unlike prior systematic reviews and meta-analyses, our review examined the *quality* of research design and outcome evidence as well as quantity and magnitude of evidence. We used a robust system for grading recommendations in evidence-based guidelines (Harbour & Miller, 2001). We graded evidence based on the methodological rigor of studies to draw conclusions about the state of the science of MBSIs, and to make informed recommendations to advance the field.

Methods

We identified studies through a systematic search of published articles of MBSIs with youth from the first available date until March 2020. The electronic database searched was PsychINFO, using terms related to MBSIs: (school based mindfulness interventions subt.exact(("mindfulness" OR "mindfulness-based interventions" AND "students" OR "preschool students" OR "elementary school students" OR "high school students" OR "adolescent" OR "schools" OR "adolescent development" OR "curriculum" OR "teachers" OR "educational programs" OR "middle school students" OR "elementary school teachers" OR "public school education") NOT ("middle aged" OR "yoga" OR "college students" OR "young adult" OR "occupational stress" OR "parents" OR "chronic pain" OR "drug abuse" OR "neoplasms" OR "parenting" OR "substance-related disorders" OR "relapse prevention" OR "no terms assigned" OR "psychotherapy" OR "test construction" OR "health care services" OR "medical students" OR "mobile phones" OR "adult" OR "pregnancy")) NOT su.exact("Thirties (30-39 yrs)" OR "Middle Age (40-64 yrs)" OR "Aged (65 yrs & older)" OR "Very Old (85 yrs & older)") NOT po.exact("Outpatient" OR "Inpatient" OR "Animal") AND PEER(yes) AND la.exact("English") NOT (rtype.exact("Comment/Reply" OR "Editorial" OR "Erratum/Correction" OR "Review-Book" OR "Letter"). We found 352 articles through this initial search prior to eligibility coding (see Figure 1). In defining MBSIs, we selected only intervention studies that applied mindfulness meditation including DBT (Linehan, 1993) and ACT (Strosahl & Wilson, 1999) as intervention frameworks since they both focus on acceptance and mindfulness.

Extracted Data from Studies

The following information was extracted from each study: (1) country, (2) sample characteristics (sample size, mean age [or age range if mean was not provided], percentage of male and females, ethnicity, whether children were of a special needs population), (3) information on the school level (preschool, elementary, middle, or high school), classroom setting (general education, special education, or alternative school), (4) type of intervention, (5) research design (design [quantitative, qualitative, or mixed]), (6) evaluation design (e.g., RCT, pre-post), (7) whether teacher training was provided, and (8) the findings on outcomes (outcome measures). For the purposes of this study, active and wait-list control groups were categorized collectively.

Eligibility ratings

Two coders assessed eligibility of each journal article for inclusion based on the following criteria: (1) peer reviewed journal article; (2) mindfulness-based school intervention, program, or strategies; (3) mindfulness outcome on teachers or children and/or implementation outcomes; and (4) review paper on school-based mindfulness interventions. Exclusion criteria included: (1) studies focusing only on yoga, creativity, or other approaches not specific to mindfulness; (2) parent-based training on mindfulness; (3) clinic-based mindfulness interventions; (4) student age group ≥ 22 years. Raters reached high inter-rater reliability ($k=0.98$) in determining article eligibility. When raters disagreed, they discussed eligibility to reach a consensus. We identified 73 eligible articles, which incorporated data from 11,906 students across 5 continents (North America, South America, Europe, Asia and Australia). The breakdown of articles by methods was as follows: 19 qualitative, 36 quantitative, and 18 mixed methods. See Appendix A for sample demographics, design and methods.

Evidence ratings

For all eligible articles, two authors independently rated level of evidence for each article on a scale outlined by Harbour & Miller (2001), ranging from 1++ (highest quality, for example, systematic reviews of RCTS to 4 (expert opinion). Ratings of studies included in this review ranged from 2+ (well-conducted case-control study) to 3 (non-analytic studies; for example, case reports), with high inter-rater reliability ($k = 0.91$). Raters discussed the six articles that they initially rated differently until they reached consensus on the ratings. After determining the level of evidence for each article, grading was assigned according to the subcategories each article fell into. Grades of recommendation varied from A (at least one meta-analysis, systematic review, or RCT rated as 1++ and directly applicable to the target population or a systematic review of RCTs and demonstrating overall consistency of results) to D (evidence level of 3 or 4 or studies rated as 2+). See Table 2 for full grading system of recommendations in evidence-based guidelines.

Results

Study Selection

Figure 1 presents the study selection process. Outcomes from studies of MBSIs fit into the following 11 categories determined by the main findings: (1) wellbeing, (2) self-compassion, (3) social functioning, (4) mental health, (5) self-regulation and emotionality, (6) mindful awareness, (7) attentional focus, (8) psychological and physiological stress, (9) problem behaviors, (10) academic performance, and (11) acceptability. See Table 1 for a full breakdown of results.

Wellbeing

Eleven of 73 eligible articles (15%) targeted wellbeing outcomes. Results were mixed regarding wellbeing outcomes, with 44% of studies showing improved wellbeing relative to control groups, and the rest showing no difference.

Self-Compassion

Five of 73 eligible articles (7%) targeted self-compassion outcomes. 100% of studies that examined self-compassion showed greater improvement relative to control groups, with the strongest evidence for higher school self-concept.

Social Functioning

Thirteen of 73 eligible articles (18%) targeted social functioning outcomes. Most studies (85%) that examined social functioning found that MBSIs improved social relationships and social participation as well as reduced social bias, relative to control groups. The highest quality of evidence documented was for improvements in social competence and reduced prejudice towards outgroups, followed by higher empathy.

Mental Health

Twenty-one of 73 eligible articles (29%) targeted mental health outcomes. Most studies reported reduced depression and anxiety symptoms in the intervention group compared with control groups (64% and 80%, respectively). The one study examining suicidality and the one study examining trauma found reduced symptoms. Only one of the three studies examining eating disorder symptoms reported a reduction in symptoms.

The highest quality of evidence suggests that treatment groups were comparable to controls in decreasing depression symptoms. Additionally, the highest quality of evidence documented reduced generalized anxiety disorder symptoms, obsessive compulsive disorder symptoms, panic disorder, and worry, followed by reduced internalizing problems and psychosomatic complaints comparable to controls.

Self-Regulation and Emotionality

Thirty of 73 eligible articles (41%) targeted self-regulation and emotionality outcomes. All studies in this category reported improved self-regulation and emotionality in the MBSI groups compared with control groups. For the self-regulation category, the highest quality studies documented improvements in self- and emotion regulation, coping skills, executive function, cognitive control, and resilience, as well as more frequent relaxed states at school, followed by improvements in emotional awareness and clarity, and self-control. For the emotionality category, the highest quality studies documented higher positive mood and lower negative feelings.

Mindful Awareness

Eleven of 73 eligible articles (15%) targeted mindful awareness outcomes. All studies documented improved perspective taking and having a positive outlook, and most (73%) documented improvements in mindfulness in MBSIs groups compared with control groups. The strongest evidence showed improvements in mindfulness, along with increased awareness of thoughts, feelings, emotions, and bodily sensations, being more present in life as well as decreased mind wandering.

Attentional Focus

Nineteen of 73 eligible articles (26%) targeted attentional focus outcomes, focusing on sustained attention and impulsivity. Most studies (83%) showed improvements in attention in the MBSI versus the control group. The only study examining impulsivity showed reduced impulsivity compared to controls. The highest quality studies found increased attention and concentration, and reduced distractibility, relative to control groups.

Psychological and Physiological Stress

Fourteen of 73 eligible articles (19%) targeted psychological and physiological stress outcomes. Most studies (75%) showed that MBSIs decreased psychological stress, although two studies (17%) showed they increased stress in the MBSI groups relative to control. The studies of the highest quality showed decreased stress levels in the MBSI groups. In terms of physiological stress, all studies showed that stress levels decreased in MBSI groups relative to control groups, with the highest quality studies reporting that MBSIs demonstrated a reduction of cortisol and right amygdala activation to fearful stimulus, as well as improvements in functional connectivity and brain plasticity compared to controls.

Problem Behaviors

Eight of 73 eligible articles (11%) targeted problem behavior outcomes. All studies reported that treatment groups showed reduced problem behaviors such as aggression, disruptive behaviors, conduct behavior, and externalizing problems relative to control groups. The highest quality of studies showed a decrease in aggression specifically.

Academic Performance

Sixteen of 73 eligible articles (22%) targeted academic performance outcomes. In all but one study, MBSIs improved academic performance compared with control groups. One study found that change in reading fluency was comparable across treatment. The strongest evidence was for higher report card grades, auditory-verbal memory, GPA, math performance, math score and social studies score.

Acceptability

Only four of 73 eligible articles (6%) examined acceptability of MBSIs, with all finding that they were highly acceptable.

Discussion

In this systematic review of the quality of existing scientific literature base of MBSIs, the strongest (A grade) evidence across outcome domains indicated that, relative to control groups, MBSIs increased resilience and decreased generalized anxiety, obsessive compulsiveness, panic and worry. Our results are consistent with previous studies where MBSIs have shown an increase in resilience as well as reduced anxiety in adults (Goldberg et al., in press; Guendelman et al., 2017; Hofmann et al., 2010; Hoge et al., 2013; Kemeny et al., 2012; Ramasubramanian, 2017; Rogers, 2013). In addition, these results are in line with recent a meta-analysis where MBIs have demonstrated therapeutic effects targeting these mental health outcomes with youth in both clinical and school settings (Renshaw et al., 2017).

The next tier of evidence (B grade) supported the role of MBSIs in improving self-concept, social competence, self- and emotion regulation, coping, executive function, cognitive control, and mood, as well as reducing social bias and attentional problems. Our review accords with previous studies (Joss et al., 2019; Nejati et al., 2015; Quaglia et al., 2019) and a recent meta-analysis (Renshaw & Cook, 2017) of MBSIs, which strengthens the evidence that MBSIs improve these outcomes for youth (Barnes et al., 2003; Flook et al., 2010; Mendelson et al., 2010). With improved self-concept and social competence, students can pay attention without judgment to what is happening with themselves and with others. This can allow them to become resilient and to confront the challenges they will face in classroom settings, such as exam stress, problems concentrating, and dealing with difficult peers. With mindful practice, students may be better able to increase overall self-care by making constructive changes in their personal and professional lives, allowing for a healthier relationship with oneself and with others (Napoli & Bonifas, 2011).

Strong (B grade) evidence also showed that MBSIs improved mindfulness, awareness of thoughts, feelings, emotions, and bodily sensations, being more present in life, concentration, and attention, as well as reduced mind wandering, distractibility and impulsivity. Our findings on these outcomes are in line with increasing evidence on the benefits of mindfulness for adults (Norris et al., 2018; Rahl et al., 2017; Shapero et al., 2018) and youth (Renshaw, 2020).

Although there is strong (B grade) evidence showing improved attention and reduced mind wandering, there is still insufficient evidence as to how much mindfulness practice is needed to benefit students' attention regulation (Wimmer et al., 2020). Therefore, future studies should focus on the dosage—whether the length of intervention time, number of sessions, or total mindfulness practice time—needed for students to achieve improved attention regulation.

Strong (B grade) evidence also showed that MBSIs improved academic performance, specifically, report card grades, auditory-verbal memory, GPA, math and social studies performance. Consistent with adult studies, MBSIs have shown to improve academic performance with children (Ching et al., 2015; Rosenstreich & Margalit, 2015). It is noteworthy that gender differences in response to mindfulness may also play an important role in youth academic performance. For example, a preliminary analysis indicated a greater increase in both mindfulness and self-compassion for females compared to males (Bluth et al., 2017). Likewise, in terms of academics, girls tend to achieve higher grades than boys (Duckworth et al., 2015; Duckworth & Seligman, 2006). Therefore, future studies are needed to further explore these factors when looking at gender and academic performance in the context of MBSIs.

A smaller group of studies suggested positive changes (B grade) in physiology, neurophysiology, and brain plasticity. MBSIs have shown to result in these physiological changes in adults, although relatively fewer studies examine this connection compared to other

behavioral and mental health outcomes (Creswell et al., 2019). Given our knowledge of brain plasticity in early development, future research in this area with children is especially important (Burke, 2010; Zoogman et al., 2015). Taking into account the potential neurophysiological processes of mindfulness, future studies should also explore the relationships among length and quality of mindfulness practice, developmental stages of students, and their mental health outcomes (Wielgosz et al., 2019). These factors may benefit MBIs in schools by improving memory and language skills (i.e., reading), which can increase academic success (Mundkur, 2005).

Furthermore, it is noteworthy that this review identified comparable wellbeing and depression outcomes (D grade) between treatment and control groups. This is in contrast with prior reviews examining adults and youth, where there are many well-designed RCTs examining the efficacy of mindfulness relative to control conditions that have demonstrated that the intervention is effective in reducing depression and demonstrating improvements in well-being (Goldberg et al., in press; Hofmann & Gómez, 2017; Strauss et al., 2014). Our findings also are inconsistent with a previous meta-analysis with adults (Khouri et al., 2015), which suggested that mindfulness practice improves wellbeing. The inconsistency of our findings with other reviews that did not consider the methodological rigor of studies, highlights an ongoing issue in the field of MBSIs. While our findings suggest that MBSIs are not effective for increasing wellbeing and reducing depression per se, strong evidence suggests MBSIs are effective for increasing resilience and reducing anxiety compared to control treatments.

Limitations and Future Research

There are several areas of notable strengths when considering the literature on MBSIs used in schools. All studies reported on group-based interventions conducted in typical

classrooms during normal school hours, suggesting the generalizability of the results to school-based practice. Another strength is that many studies in this review used components of MBSR, the mindfulness-based intervention with the most empirical support for its effectiveness (Kabat-Zinn, 2003; Klingbeil et al., 2017; Kriakous et al., 2020). Finally, several studies included data on student educational, attentional, and behavioral outcomes, such as student achievement, ability to focus, and grades. Given that this information could be used to select programming that improves student success in schools, findings from this review may be especially relevant to educators and other school-based stakeholders.

Nevertheless, the literature exploring the effects of MBSIs with youth has several limitations. Many studies included in this review relied on small samples, with studies averaging around 35 participants. Small samples can inflate effect sizes. Additionally, many studies did not formally measure intervention fidelity, which is especially important in determining whether the results can be attributed to the intervention and, if so, whether they might be replicated or generalized. To address these limitations, we recommend future MBSI studies to use substantially larger and more diverse samples of students to examine both the immediate and long-term impact of mindfulness training post-treatment. There also are significant limitations in how outcomes were measured. Most studies relied on questionnaire measures to assess for effects (particularly student self-report) and did not include follow-up assessments. Although some studies included used multiple methods (e.g., subjective self-reports, behavioral observations, and objective neurocognitive, and physiological testing), the majority relied on a single method.

A third limitation of studies included in this review was the lack of reporting of participant characteristics. For example, 42% of studies in this review did not provide details

about participant race and ethnicity, which is important given the underrepresentation of racial and ethnic populations in rigorous trials of MBIs (Waldron et al., 2018). Very few studies included students receiving education supports, and only five studies specifically examined the impact of MBSIs on children with disabilities (see Appendix A for more details). Given that most of these studies were conducted through whole class instruction, it is possible that existing mindfulness interventions are not well suited to the specific needs and reality of a classroom for children with disabilities. Attention to specific developmental child characteristics (e.g., cognitive ability, attention span) is therefore required when adapting MBSIs.

Few studies, all of lower quality, investigated the impact of MBSIs on problem behaviors such as aggression, disruptive behaviors, conduct behavior, and externalizing problems. More studies of higher quality are needed to better address these problem behaviors in schools since it has been positively associated with teacher burnout and self-efficacy (Brouwers & Tomic, 2000; Burke et al., 1996). This leads to poor student-teacher relationship, which could affect students learning and achievement (Herman et al., 2018). Likewise, only few studies examined the acceptability of MBSI programs and no studies, to our knowledge, examined the feasibility and appropriateness of child adaptations to adult MBIs. Future work on MBSIs should consider these and other factors known to impact implementation of other school-based or youth-focused programs, such as principal and district buy-in, individual attitudes towards the intervention, organizational climate and culture, as well as implementation climate and leadership (Locke et al., 2016). To facilitate effective implementation and sustainment of MBSIs, studies should use a mixed-methods approach to assess both outcomes and acceptability, adopting methods such as teacher reports on student outcomes, review sessions, observations of training sessions, and student questionnaires and interviews (Zenner et al., 2014).

Finally, despite compelling theory and emerging evidence from adult samples (Gu et al., 2015), no studies examined the mechanisms or active ingredients of mindfulness to understand the key components of MBSIs for producing positive outcomes. These studies are essential to explore the various active ingredients in mindfulness-based interventions such as social support, relaxation, and cognitive behavioral elements. Examining the central construct of mindfulness itself is also important to determine if the development of mindfulness is what leads to the positive changes that have been observed (Shapiro et al., 2006). This is important to advance knowledge on how to best develop, adapt, and implement MBSIs to optimize outcomes. Also, no studies examined the long-term impact of MBSIs after one year, which would be beneficial in learning about the lasting impact that MBSIs have on youth. Future studies should therefore examine both mediating mechanisms and the long-term impact of school-based mindfulness training post-treatment.

We should note several limitations of our review methodology as well. First, we did not include grey/unpublished literature, which may have resulted in missing some relevant studies. Indeed, there may have been a publication bias in the literature included, in that published studies are systematically different from results of unpublished studies due to either non-submission for publication or rejection at review stage. In addition, our review did not separate control group comparisons by wait-list control and active control groups. Since we categorized control groups together, there are limitations in our comparative outcomes.

The study, to our knowledge, is the first to review the studies of MBSIs for youth using a robust system for grading recommendations that takes into account the methodological rigor of studies to determine effectiveness recommendations of MBSIs for producing certain outcomes. Strong evidence (B grade) indicates that MBSIs improve self-compassion, social relationships,

mental health, self-regulation and emotionality, mindful awareness, attentional focus, physiological stress, and academic performance. The strongest evidence (A grade) indicated that MBSIs produce improvements in resilience and anxiety across youth. In addition, the strongest evidence suggests no changes in decreasing depression symptoms and increasing wellbeing across youth receiving MBSIs. Given the difficulties that children and adolescents face in an increasingly demanding world, this review demonstrates the promise of incorporating mindfulness interventions to youth in a school setting. Despite the benefits that MBSIs may have with youth, this area of research is still maturing, with many studies incorporating pre-post design or otherwise less rigorous evaluation methods. Therefore, we urge researchers interested in MBSIs to study their effectiveness using more rigorous designs (e.g., RCTs with active control groups, multi-method outcome assessment, and follow-up evaluation), to minimize bias and promote higher quality—not just increased quantity—evidence that can be relied upon to guide school-based practice.

Compliance with Ethical Standards

Conflict of Interest: The authors have no conflicting or competing interests to declare. There were no funding sources involved in this review.

Author Contributions

MP: conceptualized the research, reviewed the literature, wrote the paper, submitted the manuscript. TR: collaborated in the writing and editing of the final manuscript. JC: reviewed the literature. JG: collaborated in the writing and editing of the final manuscript. EM: conceptualized the research, reviewed the literature, designed measurement approach. ZAD: reviewed the literature. ND: reviewed the literature. HT: reviewed the literature. DM: designed measurement approach, designed analytic approach, and collaborated in the writing and editing of the final manuscript. HN: Developed general research design, conceptualized the research, designed measurement approach, designed analytic approach, conducted data analysis, wrote the results section, and collaborated in the writing and editing of the final manuscript. All authors approved the final version of the manuscript for submission.

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Table 1

Results and Evidence Grades from MBSI studies

Category	Results	References	Grade of Evidence
1) Wellbeing	<i>General wellbeing</i>		
	↑ wellbeing	6, 8, 20, 50	D
	= wellbeing	35, 52, 61, 62, 64	D
	↑ feelings of contentment	68	D
	↓ life satisfaction	9	D
2) Self-compassion	<i>Self-compassion/intrapersonal</i>		
	↑ self-compassion	68	D
	↑ intrapersonal strengths	28	D
	↑ embracing life	20	D
	↑ self-acceptance	3	D
	↑ school self-concept	30	B
	↓ inferiority complex	20	D
3) Social functioning	<i>Social relationships</i>		
	↑ interpersonal problems	41	D
	↑ interpersonal strengths	28	D
	↑ psychosocial functioning	28	D
	↑ relationships with others	42	D
	↑ prosocial behavior	42	D
	= psychosocial adjustment	57	D
	↑ empathy	20, 30	C
	= empathy	32	D
	↑ connection with others	20	D
	= compassion	32	D
	↑ caring/respect for others	21	D
	↑ social competence	26	B
	↑ social skills	2	D
	↓ social problems	19	D
	<i>Social participation</i>		
	↑ collaboration	44	D
	↑ communication	44	D
	↑ participation in activities	21	D
	<i>Social bias</i>		
	↓ Stereotype/prejudice towards Israeli-Palestinian outgroup	66	B

4) Mental health	<i>Depression</i>		
	↓ depressive symptoms	12, 18, 27, 33, 36, 47	D
	= depressive symptoms	34, 52, 61, 62	B
	↓ rumination	11	D
	<i>Anxiety</i>		
	↓ internalizing problems	22, 34, 38, 48	C
	↓ anxiety symptoms	7, 11, 16, 27, 39, 47	D
	↓ GAD	38	A
	↓ state and trait anxiety	2	D
	= anxiety	52, 61, 62	D
	↓ worry	38	A
	↓ panic disorder	38	A
	↓ OCD	38	A
	↓ psychosomatic complaints	13	C
	<i>Suicidality</i>		
	↓ suicidal thoughts	29	C
	<i>Trauma</i>		
	↓ posttraumatic symptoms	39	B
	<i>Eating disorder</i>		
	↓ dietary restraint	24	D
	↓ thin ideal internalization	24	D
	↓ eating disorder symptoms	24	D
	↓ psychosocial impairment	24	D
	= weight/shape concern	52, 61	D
	↓ weight/shape concern	24	D
5) Self-regulation and emotionality	<i>Self-regulation</i>		
	↑ self-regulation	29, 32, 41, 53, 56	B
	↑ emotion regulation	3, 13, 30, 42, 60	B
	↑ resilience	74	A
	↑ coping skills	39	B
	↑ distress tolerance	67	D
	↑ emotional awareness	13	C
	↑ emotional clarity	13	C
	↑ feelings of relaxation	3	D
	↑ relaxed in school	53	B
	↑ calmness	3	D
	↑ self-control	15, 21	C
	↑ effortful control	50	D
	↑ anger management skills	6	D
	↑ executive function	19, 69, 72, 75	C
	↑ cognitive control	30, 45	B
	↑ cognitive inhibition	49	D
	<i>Emotionality</i>		

	↑ positive mood	20, 31	B
	↓ negative feelings	54, 59, 66	B
	↓ negative affect	3, 20, 46	D
	= negative affect	62	D
6) Mindful awareness	<i>Mindfulness</i>		
	↑ mindfulness	35, 54, 56, 59, 67	B
	= mindfulness	61, 63, 64	D
	↑ awareness of thoughts	40	B
	↑ awareness of feelings	40	B
	↑ awareness of emotions	40	B
	↑ awareness of bodily sensations	40	B
	↑ being present in life	40	B
	↑ sense of efficacy	67	D
	↓ mind wandering	30	B
	<i>Positive outlook</i>		
	↑ optimism	4, 56	D
	↑ positive thinking	56	D
	<i>Perspective-taking</i>		
	↑ perspective-taking	30	B
7) Attentional focus	<i>Attention</i>		
	↑ attention	5, 21, 32, 53, 59, 64, 72	B
	↑ selective attention	1	C
	↑ attention awareness	56	D
	↑ concentration	31	B
	↑ controlled thoughts	15	C
	↑ on-task behavior	37, 55	D
	= task-shifted facilitation	24	D
	↓ attention problems	22, 34, 47	B
	↓ distractibility	53	B
	↓ off task behaviors	17, 55	D
	↓ ADHD behaviors	1	C
	<i>Impulsivity</i>		
	↓ impulsivity	51	B

8) Psychological and physiological stress	<i>Psychological stress</i>		
	↓ stress	6, 8, 10, 13, 15, 18, 23, 71	C
	↑ stress	25, 41	D
	= stress	62	D
	<i>Physiological stress</i>		
	↓ stress physiology – cortisol	30	B
	↓ right amygdala activation to fearful stimulus	71	B
	↓ tiredness	3	D
	↓ aches/pains	3	D
	↑ sleep	7	D
	↑ functional connectivity	71	B
	↑ brain plasticity	71	B
9) Problem behaviors	↓ aggression	19, 47, 51	C
	↓ disruptive behaviors	14	D
	↓ conduct behavior	42, 43, 47	D
	↓ externalizing problems	22, 48	D
10) Academic performance	<i>General academic performance</i>		
	↑ school specific efficacy	41	D
	↑ academic performance	2, 26, 27	C
	↑ creativity	44	D
	↑ critical thinking	44	D
	↑ meta cognition	46	D
	↑ auditory-verbal memory	31	B
	↑ GPA	70	B
	↑ data-driven information processing	49	D
	↑ academically engaged behavior	17	D
	↑ positive attitudes towards academic subjects	59	D
	↓ test anxiety	1	C
	↓ cognitive errors	45	C
	<i>Math</i>		
	↑ math performance	30	B
	↑ math score	70	B
	<i>Reading</i>		
	↑ grades in reading	43	C
	= reading fluency	65	D
	<i>Science</i>		
	↑ grades in science	43	C
	<i>Social studies</i>		
	↑ social studies score	70	B

11) Acceptability	↑ satisfaction with program	25	D
	↑ understanding and willingness to use strategies	25	D
	↑ acceptance of mindfulness	6, 7, 52	B

Note. ↑ increase, ↓ decrease, = no change, GAD = Generalized Anxiety Disorder, OCD = Obsessive Compulsive Disorder. See Appendix B for numbered list of included studies.

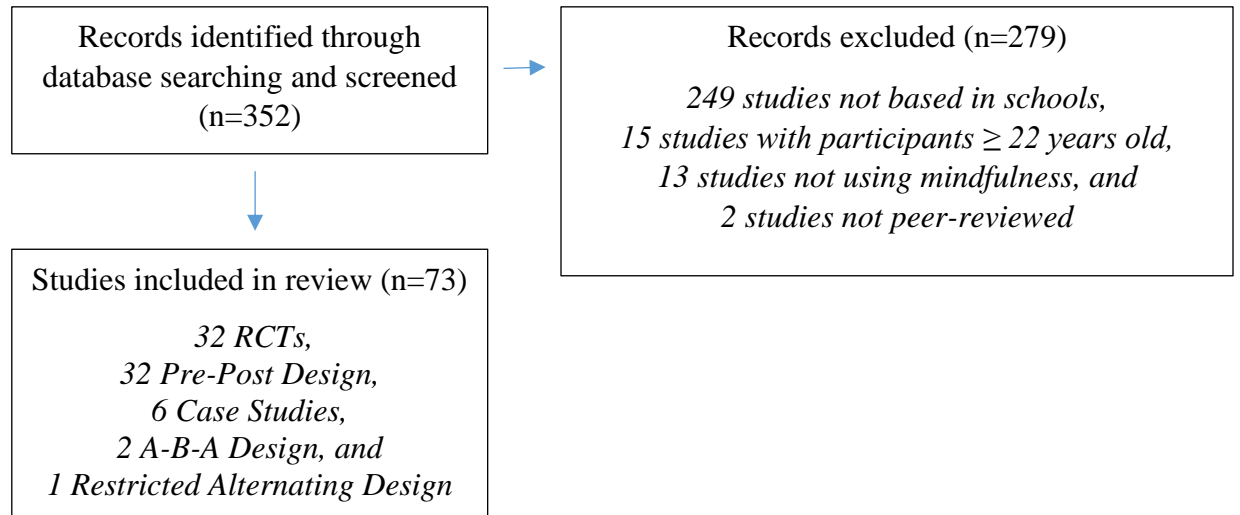
Table 2

Harbour & Miller (2001) Revised Grading system for Recommendations in Evidence-based Guidelines

<p>Levels of evidence</p> <ul style="list-style-type: none"> • 1++ High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias • 1+ Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias • 1– Meta-analyses, systematic reviews or RCTs, or RCTs with a high risk of bias • 2++ High quality systematic reviews of case-control or cohort studies or High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal • 2+ Well conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal • 2– Case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal • 3 Non-analytic studies, eg case reports, case series • 4 Expert opinion <p>Grades of recommendations</p> <ul style="list-style-type: none"> • A At least one meta-analysis, systematic review, or RCT rated as 1++ and directly applicable to the target population or A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+ directly applicable to the target population and demonstrating overall consistency of results • B A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results or Extrapolated evidence from studies rated as 1++ or 1+ • C A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results or Extrapolated evidence from studies rated as 2++ • D Evidence level 3 or 4 or Extrapolated evidence from studies rated as 2+
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Figure 1

Article Screening, Inclusion and Design



Supplementary Materials

Appendix A

Demographics, Design and Methods of Articles Included in Review

Author (year)	Country	Participants: Sample size	Child gender	Child age range	Child ethnicity	Children with special needs? (If yes, specify)	School level	Classroom setting	MBI	Research design	Evaluation design	Teacher training	Evidence rating
1. Napoli et al (2005)	USA	228	120 males 108 females	N/A	N/A	No	Elementary school	General ed	24 week mindfulness training	Quantitative	RCT	Yes	2+
2. Beauchemin et al (2008)	USA	34	71% male	8-12	N/A	Learning Disability	High school	Special ed	5 week mindfulness meditation program	Mixed	Pre-post	Yes	2-
3. Broderick & Metz (2009)	USA	120	All female	M=17.4	93.3% White, 2.5% Hispanic, 2.5% Asian, 1.7% other	No	High school	General ed	Learning to BREATHE	Mixed	Pre-post	No	2-

4. Schonert-Reichl & Lawlor (2010)	Canada	246	48% female	9-13	57% English speaking, 23% east Asian, 20% other (Spanish, Russian, Polish)	No	Elementary school	General ed	Mindfulness Education Program	Quantitative	Pre-post	Yes	2-
5. Wilson & Dixon (2010)	USA	12	5 males, 7 females	M=8	N/A	No	Elementary school	General ed	4 week mindfulness education program	Quantitative	ABA	No	2-
6. Viafora (2011)	USA	38	22 females, 16 males	7-18	34 Latino, 1 White, 1 African American, 2 mixed race/other	No	Middle school and high school	General ed	8 week mindfulness program	Mixed	Pre-post	No	2-
7. Bei et al (2012)	USA	62	All female	13-15	N/A	No	High school	General ed	Six-session program based on Bootzin & Stevens	Quantitative	Pre-post	No	1-

8. van de Weijer-Bergsma et al (2012)	Netherlands	208	110 females, 98 males	8-12	Ethnically diverse	No	Elementary school	General ed	Mindfulkids: 12 week session	Quantitative	RCT	No	1-
9. Tharaldsen (2012)	Norway	40	75% female 25% male	17-21	N/A	No	High school	Vocational and general ed	Conscious Coping Program	Mixed	RCT	No	1-
10. Gould et al (2012)	USA	97	60.8% female, 39.2% male	9.7-10.6	83.5% African American, 4.1% Latino, 4.1% Caucasian, 7.2% other	No	Elementary school	General ed	12 week yoga-inspired mindfulness program	Qualitative	Pre-post	No	1-
11. Sibinga et al (2013)	USA	44	All boys	M=12.5	95% African American	No	Middle school	General ed	MBSR 12-session programs	Quantitative	RCT	No	1-
12. Raes et al (2013)	Belgium	408	68% female 33% male	13-20	N/A	No	High school	General ed	Combined elements of MBCT/ MBSR	Quantitative	RCT	No	1+

13. Metz et al (2013)	USA	244	34.9% male, 65.1% female	M=16.5	90% White, 10% other (Latino, Black, Asian or Native American)	No	High school	General ed	Learning to BREATHE	Quantitative	Pre-post	Yes	2+
14. Klatt et al (2013)	USA	41	16 boys 25 girls	M=8.54	8 Caucasian, 18 African American, 11 Somali, 4 Hispanic	No	Elementary school	General ed	Move-Into-Learning (MIL) 8 week intervention	Qualitative	Pre-post	No	2-
15. Wisner (2013)	USA	35	19 boys 16 girls	15-19	34 Caucasian, 1 African American	No	High school	Alternative school	Mindfulness meditation program: 8 week intervention	Qualitative	Pre-post	No	2+
16. Lagor et al (2013)	USA	15	9 females, 6 males	8-18	11 African American, 2 White, 1 biracial, 1 Latino	No	Middle school and high school	Special ed	8 week mindfulness group intervention	Mixed	Pre-post	No	2-
17. Felver et al (2013)	USA	3	All male	8-9	N/A	No	Elementary school	General ed	Soles of the Feet (SOF)	Qualitative	Case study	No	3

18. Livheim (2014)	Australia & Sweden	Australia study: 66, Sweden: 32	Australia: 8 male, 58 female Sweden : 9 male, 23 female	Australia: 12-18, Sweden: 14-15	Australian and Swedish	No	High school	General ed and one alternative school	Australia: ACT Experiential Adolescent Group - 8 week program, Sweden: 6 week ACT group sessions	Quantitative	Pre-post	No	1-
19. Parker (2014)	USA	71	30 boys, 41 girls	9-11	64 European-American, 14 African American, 23 other	No	Elementary	General ed	Master Mind 4 week program	Quantitative	Pre-post	Yes	1-
20. Le & Trieu (2014)	Vietnam	10	N/A	15-18	Vietnamese	No	High school	General Ed	Mind Body Awareness Project	Qualitative	Case study	No	3
21. Black & Fernando (2014)	USA	409	N/A	N/A	52.3 % Hispanic, 28.0 % Black, 15.0 % Asian, 4.3 % White, and .4 % other	No	Elementary school	General ed	5-week mindfulness based curriculum	Quantitative	Pre-post	No	2-

22. Britton et al (2014)	USA	101	55 boys, 46 girls	M=11.79	N/A	No	Middle school	General ed	6 week mindfulness education program	Qualitative	RCT	Yes	1-
23. Costello & Lawler (2014)	Ireland	63	17 boys, 46 girls	11-12	N/A	No	Middle school	General ed	5-week school-based mindfulness program	Mixed	Case study	Yes	2-
24. Atkinson & Wade (2015)	Australia	347	All female	14-18	Caucasian (84%), with the remainder identifying as Asian (8%), African (1%), or Other (4%)	No	High school	General ed	Based off of the "body project" - mindfulness, acceptance based practice, MBCT	Quantitative	RCT	No	1-
25. Shapiro et al (2015)	Canada	565	57.52% female, 42.48% male	14-16	N/A	No	High school	General ed	Stressoff Strategies: CBT and mindfulness based techniques	Mixed	Pre-post	No	1-

26. Flook et al (2015)	USA	68	34 girls (50.0%) and 33 boys (48.5%)	M = 4.67	40 White (58.8%), 8 Hispanic (11.8%), 4 African American (5.9%), 7 Asian/Pacific Islander (10.3%), 8 "Other"/mixed ethnicity children (11.8%)	No	Elementary school	General ed	12-week mindfulness-based Kindness Curriculum	Quantitative	RCT	No	1+
27. Bennett & Dorjee (2015)	UK	23	N/A	16-18	N/A	No	High school	General ed	MBSR	Mixed	Pre-post	No	1-
28. Wisner & Starzec (2015)	USA	19	10 boys 9 girls	15-17	17 Caucasian, 1 African American, 1 Hispanic, 1 European American	No	High school	Alternative school	Mindfulness practices (mindfulness skills and journal entries)	Qualitative	Pre-post	No	2-
29. Le & Gobert (2015)	USA	8	5 males	15-20	Native American	No	High school	General ed	Mind Body Awareness Project (MBA)	Mixed	RCT	No	2+

30. Schonert-Reichl et al (2015)	Canada	99	44% female, 46% male	9-11	66 % English speaking, 25% east Asian, 10% other (Russian, Spanish, Polish)	No	Elementary school	General ed	Mindup	Quantitative	RCT	No	1+
31. Ricarte et al (2015)	Spain	45	29 boys, 16 girls	6-13	Spanish	No	Middle school	General ed	6 week MBI	Quantitative	RCT	No	1+
32. Pohlmann-Tynan et al (2015)	USA	29	51% boys, 49% girls	3-5	72% non-white	No	Preschool	General ed	12 week MBI	Qualitative	RCT	No	1-
33. Bluth et al (2015)	USA	27	73% male, 27% female	14-18	54 % Hispanic, 24% African-American, 18% Caucasian, and 3% other	No	High school	Alternative school	Learning to BREATHE	Quantitative	Pre-post	No	2-

34. Crescentini et al (2016)	Italy	16	8 boys 8 girls	7-8	N/A	No	Elementary school	General ed	8 week mindfulness-oriented intervention	Quantitative	RCT	No	1++
35. Bernay et al (2016)	New Zealand	124	53% female and 47% male	9-12	82 European, 36 Asian, 6 other	No	Elementary school	General ed	Pause Breathe Smile: 8 lesson mindfulness module	Mixed	Pre-post	No	1++
36. der Gucht et al (2016)	Belgium	605	70% female	13-20	N/A	No	High school	General ed	8 week MBSR	Quantitative	RCT	No	1-
37. Kasson & Wilson (2016)	USA	21	61.5% male	M= 8.5	N/A	No	Elementary and middle school	General ed	Mindfulness-based strategies with a classroom behavior management treatment package	Quantitative	RCT	Yes	2-

38. Lam (2016)	China	20	11 females 9 male	9-13	Chinese	No	Elementary school	General ed	MBCT - 80 minute weekly group sessions	Quantitative	RCT	No	1++
39. Sibinga et al (2016)	USA	300	50.7% female	M= 12	99.7% African American	No	Elementary and middle school	General ed	MBSR - 12 week program	Quantitative	RCT	No	1+
40. Worthen & Luiselli (2016)	USA	84	50% male 50% female	M=14.5	N/A	No	High school	General ed	Mindfulness: An Eight Week Plan for Finding Peace in a Frantic World	Quantitative	Case study	No	1+
41. Gouda et al (2016)	Germany	29 students, 29 teachers	All female students, N/A teachers	Student M = 16.2, teacher M=45.9	N/A	No	High school	General ed	MBSR	Quantitative	Pre-post	Yes	2-
42. Waldemar et al (2016)	Brazil	132	52.3% male	10-14	52.7% hite	No	Elementary school	General ed	Mindfulness practice	Quantitative	Pre-post	No	2-

43. Bakosh et al (2016)	USA	93	50 male 43 female	N/A	N/A	No	Elementary school	General ed	Mindful-based social emotional learning (MBSEL) program	Mixed	Pre-post	Yes	2+
44. Davenport & Pagnini (2016)	USA	N/A	N/A	N/A	N/A	No	Elementary school	General ed	Langerian Mindfulness	Qualitative	Case study	Yes	3
45. Milligan et al (2016)	USA	17	10 males 7 females	13-17	N/A	No	High school	General ed	Mindfulness-based martial arts program	Quantitative	Pre-post	No	2+
46. Vickery & Dorjee (2016)	UK	71	36 male	7-9	N/A	No	Elementary school	General ed	Paws B: 8 week intervention	Quantitative	Pre-post	Yes	2-
47. Malboeuf-Hurtubise et al (2016)	Canada	14	8 girls, 6 boys	M=10.7	N/A	Learning Disability	Elementary school	Special ed	8 week MBI	Qualitative	Pre-post	No	2-

48. Fung et al (2016)	USA	19	8 boys, 11 girls	12-14	Asian and Latino	No	Elementary and middle school	General ed	12 week MBI	Qualitative	RCT	No	1-
49. Wimmer et al (2016)	Germany	34	16 male, 18 female	M=10.8	N/A	No	Elementary school	General ed	Mindfulness and concentration training	Quantitative	Pre-post	Yes	2-
50. Terjestam et al (2016)	Sweden	358	173 girls, 185 boys	10-14	N/A	No	High school	General ed	Compass program for 8 weeks	Qualitative	Pre-post	Yes	2-
51. Franco et al (2016)	Spain	27	59% boys, 41% girls	12-19	N/A	No	High school	General ed	Meditación Fluir for 10 weeks	Mixed	RCT	Yes	1+
52. Johnson et al (2016)	Australia	308	47.7% female, 52.3% male	M=13.63	N/A	No	High school	General ed	Dot b intervention	Mixed	RCT	No	1-

53. Thomas & Atkinson (2017)	UK	30	50% female	8-10	Ethnically diverse	No	Elementary school	General ed	Paws.b.	Mixed	RCT	No	1+
54. Dove & Costello (2017)	Australia	57	37 males	9-10	N/A	No	Elementary school	General ed	TRIPLE R: Robust, Resilient, Ready to Go 6 week intervention program	Qualitative	Pre-post	No	2+
55. Rush et al (2017)	USA	33	29 boys 4 girls	8-13	N/A	Emotional disturbance (ED)	Elementary and middle school	Special ed	12 week mind-body curriculum	Quantitative	RCT	No	1-
56. Eva & Thayer (2017)	USA	23	65% male	17-20	75% African American	No	High school	Alternative school	Learning to BREATHE: A Curriculum for Cultivating Emotion regulation, Attention, and Performance	Mixed	Pre-post	No	2-

57. Malboeuf-Hurtubise et al (2017)	Canada	3	2 boys 1 girl	9-10	1 Caucasian, 1 Haitian, 1 Hispanic	No	Elementary school	General ed	8 week MBI	Quantitative	ABA	No	2-
58. Keller et al (2017)	USA	28	64% female, 36% male	10-11	89% Hispanic, 11% Black	No	Elementary school	General ed	10 week mindfulness education program	Qualitative	RCT	Yes	1+
59. Bannirchelvam et al (2017)	Australia	8	4 girls, 4 boys	7-11	N/A	No	Elementary school	General ed	8 week MBI	Qualitative	RCT	No	2-
60. Johnson et al (2017)	Australia	555	45.4% girls, 54.6% boys	M=13.4	N/A	No	High school	General ed	9 week mindfulness education program	Qualitative	RCT	No	1-
61. Burckhardt et al (2017)	Australia	48	58% males, 42% females	14-16	N/A	No	High school	General ed	ACT	Qualitative	RCT	Yes	1-

62. Kieley et al (2017)	USA	45	22 girls, 22 boys, 1 unidentified	8-9	84% Caucasian	No	Elementary school	General ed	30-min classroom lessons from the Mindful Schools, Mindup curricula and original material developed	Mixed	Pre-post	No	2+
63. Emerson et al (2017)	UK	26	14 girls, 12 boys	M=6.6	Mostly White	Autism spectrum disorder, Down syndrome	Elementary school	General ed	4 week mindfulness program	Mixed	Pre-post	No	2-
64. Idler et al (2017)	British Columbia	4	2 girls, 2 boys	8-11	Mostly English	No	Elementary school	General ed	12 week mindfulness and fluency program	Mixed	Restricted Alternating Design	No	3
65. Berger et al (2018)	Israel	224	137 females	8-11	N/A	No	Elementary school	General ed	Call to Care-Israel (C2C-I)	Quantitative	RCT	No	1+

66. Schussler & Greenberg (2018)	USA	21 teachers	N/A	22-73	33% white, 31% Hispanic, 26% African American, 4% Asian American, and 5% mixed background	No	Elementary school	General ed	CARE professional development	Qualitative	Case study	Yes	3
67. Bradley et al (2018)	USA	507 students, 49 teachers	Students: 258 male, 249 female; teachers: 37 female 12 males	Student M = 9.3, teacher M = 45.9	Student: 53% Caucasian, 15.5% Hispanic/Latino, 9.9% Asian/Indian, 8.2% Multiracial, 6.9% African American, 3.2% Asian American, 2.4% Middle Eastern, and 0.4% Native American. Teacher: 87.8% Caucasian, 2.0% Hispanic/Latino, 2.0% African American,	No	Elementary and middle school	General ed	Four Pillars of Wellbeing Curriculum	Quantitative	Pre-post	Yes	2-

					and 8.2% Other								
68. Zelazo et al (2018)	USA	218	101 males 117 females	47-63 months	55% White, 32% more than one race, African American 9%, native American 3%	No	Elementary school	General ed	Mindfulness and reflection training: 6 week intervention	Quantitative	RCT	Yes	2-
69. Bakosh et al (2018)	USA	337	161 girls, 176 boys	6-11	74% Hispanic (school 1); 97% White (school 2)	No	Elementary school	General ed	Audio-guided MBI and MBSR-adapted program for 10 weeks	Qualitative	RCT	Yes	1+
70. Bauer et al (2019)	USA	40	70% female, 30% male	M=11.76	10% Hispanic, 32.5% African American, 52.5% White, and 5% other or multiple racial identities	No	Middle school	General ed	8 week mindfulness program	Quantitative	RCT	No	1+

71. Janz et al (2019)	Australia	55	34 boys, 21 girls	M=6.3	8% indigenous Australian, 23% had a language background other than English	No	Elementary school	General ed	Calmspace	Quantitative	RCT	Yes	1++
72. Volanen et al (2020)	Finland	3519	1,752 boys, girls 1,750	12-15	Finnish	No	Middle school	General ed	9 week MBI - healthy learning mind	Quantitative	RCT	No	1++
73. Juliano et al (2020)	USA	27	77.8% boys	M=13.60	88.9 % White, 3.7 % African American, 4.4% Hispanic	Autism Spectrum Disorder	Middle and high school	General ed	8 week MBI – Mindful Schools	Quantitative	Pre-Post	No	1-

Note. N/A means not available, MBI = Mindfulness Based Interventions, ACT = Acceptance and Commitment Therapy, MBSR = Mindfulness-based stress reduction, MBCT = Mindfulness-Based Cognitive Therapy

Appendix B

Numbered List of Included Studies from Table 1

1. Napoli, D. M., Krech, P. R., & Holley, L. C. (2005). Mindfulness training for elementary school students. *Journal of Applied School Psychology*, 21(1), 99–125.
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2. Beauchemin, J., Hutchins, T. L., & Patterson, F. (2008). Mindfulness meditation may lessen anxiety, promote social skills, and improve academic performance among adolescents with learning disabilities. *Complementary Health Practice Review*, 13(1), 34–45. <https://doi.org/10.1177/1533210107311624>
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4. Schonert-Reichl, K. A., & Lawlor, M. S. (2010). The effects of a mindfulness-based education program on pre- and early adolescents' well-being and social and emotional competence. *Mindfulness*, 1(3), 137–151. <https://doi.org/10.1007/s12671-010-0011-8>
5. Wilson, A. N., & Dixon, M. R. (2010). A mindfulness approach to improving classroom attention. *Journal of Behavioral Health and Medicine*, 1(2), 137.
<https://doi.org/10.1037/h0100547>
6. Viafora, D. P., Mathiesen, S. G., & Unsworth, S. J. (2015). Teaching mindfulness to middle school students and homeless youth in school classrooms. *Journal of Child and Family Studies*, 24(5), 1179–1191. <https://doi.org/10.1007/s10826-014-9926-3>
7. Bei, B., Byrne, M. L., Ivens, C., Waloszek, J., Woods, M. J., Dudgeon, P., Murray, G., Nicholas, C. L., Trinder, J., & Allen, N. B. (2013). Pilot study of a mindfulness-based, multi-component, in-school group sleep intervention in adolescent girls. *Early Intervention in Psychiatry*, 7(2), 213–220. <https://doi.org/10.1111/j.1751-7893.2012.00382.x>
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11. Sibinga, E. M. S., Perry-Parrish, C., Chung, S., Johnson, S. B., Smith, M., & Ellen, J. M. (2013). School-based mindfulness instruction for urban male youth: A small randomized controlled trial. *Preventive Medicine*, 57(6), 799–801.
<https://doi.org/10.1016/j.ypmed.2013.08.027>

12. Raes, F., Griffith, J. W., Van der Gucht, K., & Williams, J. M. G. (2014). School-based prevention and reduction of depression in adolescents: A cluster-randomized controlled trial of a mindfulness group program. *Mindfulness*, 5(5), 477–486.
<https://doi.org/10.1007/s12671-013-0202-1>
13. Metz, S. M., Frank, J. L., Reibel, D., Cantrell, T., Sanders, R., & Broderick, P. C. (2013). The effectiveness of the learning to BREATHE program on adolescent emotion regulation. *Research in Human Development*, 10(3), 252–272.
<https://doi.org/10.1080/15427609.2013.818488>
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