



A Systematic Review of Mindfulness-Based Interventions in Low-Income Schools

Shira C. Segal¹ · Shruti S. Vyas¹ · Candice M. Monson¹

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Abstract

Objectives Low-income youth are at greater risk for persistent exposure to environmental stressors and they face a number of barriers to accessing mental health treatment. Furthermore, it is unclear whether interventions developed for youth more generally are effective for this vulnerable population. The objective of this systematic review was to review and summarize the effectiveness of mindfulness-based interventions delivered in low-income schools (Grades 3–9) on psychological functioning.

Methods Searches were conducted in PsycINFO, Web of Science, PubMed, Scopus, and MEDLINE, which led to the inclusion of eight studies in the current review (seven unique samples). Study interventions, methodologies, and individual characteristics were reviewed and summarized.

Results Findings were inconsistent across studies, but some improvements were reported for externalizing and internalizing symptoms, emotional regulation, and perceived stress. Feasibility data were limited, with findings of high enrollment and retention, moderate levels of student-reported satisfaction, and low adherence to at-home practice.

Conclusions Although diverse interventions were delivered across studies, these results suggest that school-based mindfulness interventions may have potential for increasing access to intervention for low-income youth. Strengths and limitations of the literature are reviewed, and future directions are discussed.

Keywords Mindfulness · School · Low-socioeconomic · Review · Mental health · Youth

Mindfulness-based interventions have gained traction over the past few decades in the domain of psychological well-being (Choudhury and Moses 2016). Mindfulness meditation, as historically tied to Buddhist practice, has been practiced for centuries (Thera 1962); comparatively, the adoption of mindfulness into contemporary psychology is a more recent phenomenon. In the latter setting, mindfulness has been defined as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn 2003, p. 145). In a clinical context, mindfulness training can be effective for psychiatric disorders by training individuals in meta-cognitive capacities that enable increased awareness of distressing thoughts and feelings, which inform more adaptive ways of responding (Bishop et al. 2004).

Mindfulness-based interventions have garnered support over the years as being effective in the treatment of a variety of psychological disorders in adults, and for decreasing stress and anxiety in healthy individuals. For example, in a meta-analysis of 39 studies including 1140 participants, Hofmann et al. (2010) found that engagement in mindfulness-based therapies led to large improvements in mood and anxiety symptoms among individuals with mood and anxiety disorders, and moderate improvements in mood and anxiety across the overall sample (i.e., individuals with a range of other psychiatric or medical conditions). Additional reviews have found further evidence of the effectiveness of mindfulness-based interventions in reducing symptoms of anxiety and depression when administered as a targeted intervention within clinical populations (i.e., medium effect sizes from pre- to post-intervention comparisons and compared to waitlist, while noting smaller or inconsistent results when compared to other specific active treatments such as behavioral therapies, pharmacological treatment, exercise and yoga; Goyal et al. 2014; Khoury et al. 2013). Furthermore, mindfulness-based interventions have also been found to be moderately effective at improving mental health symptoms when administered at a more general level

✉ Shira C. Segal
shira.segal@ryerson.ca

¹ Department of Psychology, Ryerson University, 350 Victoria St., Toronto, ON M5B 2K3, Canada

to non-clinical adult populations (Khoury et al. 2013). More recently, mindfulness-based interventions have been adapted for use with children and adolescents (Semple and Lee 2014), and they have been found to be effective at improving mental health symptoms (e.g., anxiety, stress, depression) when delivered as a targeted intervention for clinical samples (Biegel et al. 2009; Chi et al. 2018) and non-clinical samples (Kallapiran et al. 2015). In the first meta-analysis published on mindfulness interventions with youth, Zoogman et al. (2015) found an overall small effect size for mindfulness interventions compared to active controls for a range of outcomes. This effect was almost double in size for psychological symptoms and nearly three times as large for clinical compared to non-clinical samples, which suggests that these interventions may have particular utility for clinical populations.

In the context of mental health treatment for youth, there are a number of barriers that children and adolescents face that prevent them from accessing care. Reardon et al. (2017) identified the cost of treatment, inconvenient location or timing of services, and limited knowledge surrounding where or how to access services as common barriers. Given that many children spend a significant portion of their time at school, finding ways to weave preventive interventions into the routine school day holds promise as an efficient solution to increase access to services and to promote large-scale dissemination of these interventions. Mindfulness-based interventions are no stranger to the school setting; a number of systematic reviews and meta-analyses have reported on outcomes from empirical investigations of mindfulness in school settings, citing small to moderate effects for improvements in students' mental health and general well-being (Carsley et al. 2018; Felver et al. 2016; cf. Zenner et al. 2014, who found small and insignificant effects regarding the improvement of emotional problems).

One area that has received less focus in the literature is the implementation of these interventions in low-income neighborhoods. Youth from impoverished neighborhoods and communities are at greater risk for persistent exposure to environmental stressors, and they face more serious repercussions associated with such exposure (Parker et al. 1988). Persistent exposure to stressful life experiences in childhood can negatively impact psychological well-being and functioning (Evans and Kim 2013; Grant et al. 2003; Reiss 2013), and may leave children vulnerable to developing poor emotion and self-regulation skills (Choudhury and Moses 2016; Compas 2006). For example, greater levels of environmental stress can have a strong influence on the development and maintenance of both internalizing and externalizing disorders, and children from low-income homes have been estimated to be up to two to three times more likely to develop mental health problems (Compas et al. 2001; Grant et al. 2006). Youth growing up in low-income households may also experience greater household chaos, family discord, and less responsive parenting compared to economically advantaged youth, which further impacts stress and coping (Evans 2004).

In addition, underprivileged youth experience greatly reduced social support and access to treatment, which further exacerbates the consequences of these issues (Evans 2004; Jakovljevic et al. 2016; Parker et al. 1988). Many of the common barriers to mental health treatment (i.e., the cost of service, transportation to appointments; Owens et al. 2002; Reardon et al. 2017) would likely be intensified in this population. Therefore, providing programming that promotes mental health through practical and convenient modes of access, such as the school system, is critical. The ability to seamlessly implement preventive interventions into the routine schedule of the school day could be of great benefit to underprivileged youth. Previous reviews have found support for positive benefits of school-based mindfulness interventions for general populations of children and adolescents (Carsley et al. 2018; Felver et al. 2016; Zenner et al. 2014), but these interventions have yet to be systematically evaluated regarding their effectiveness for youth living in low-income neighborhoods. Given the direct links between poverty, stress, and risk of poor psychological functioning, mindfulness presents as a fitting intervention to potentially improve psychological outcomes in underprivileged youth.

The purpose of this systematic review is to review and summarize the effectiveness of mindfulness-based interventions administered in low-income schools (students in Grades 1–12). This review will include interventions in which mindfulness-based strategies comprise an explicit and primary focus of the intervention, and it will include studies with pre/post, waitlist, and active control comparisons. The primary outcomes that will be reviewed include psychological functioning (e.g., externalizing/internalizing symptoms, emotion regulation, stress) and the feasibility of implementing these interventions within low-income schools.

Method

Search Strategy

This study followed the procedures outlined by the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Moher et al. 2009). In December 2019, a systematic literature search was conducted to identify articles for inclusion in the review. Searches were performed in the following databases: PsycINFO, Web of Science, PubMed, Scopus, and MEDLINE. The search consisted of the following terms: (“low socioeconomic” or “low income” or “socioeconomic factors” or poverty or poor) and (“Mindfulness-based” or mindfulness) and (intervention or therap*) and (school or “school-based” or education) and (adolescence or teenager or child or children or childhood or school-age). The terms were searched in all fields for all databases aside from Scopus, where the search was narrowed to

the title/abstract/keywords. Given that MEDLINE searches are performed according to MeSH terms, the following suggested MeSH terms were included in the MEDLINE search: school health services, child health services, and child preschool, in addition to the standard search terms.

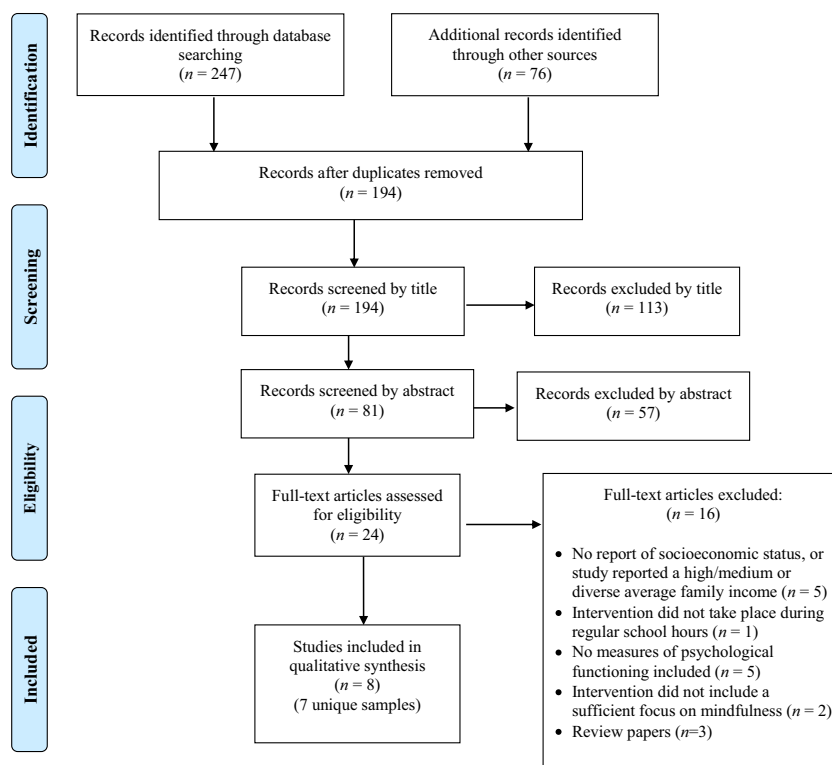
Study Selection

A flow diagram of the study selection process is outlined in Fig. 1. The literature search resulted in the identification of 247 articles. Another 76 articles were identified by searching through systematic reviews and meta-analyses published on the topic of mindfulness-based intervention for children and adolescents in school settings (Carsley et al. 2018; Felver et al. 2016; Zenner et al. 2014). After duplicates were removed, there were 194 articles to screen. An initial screening by title led to the exclusion of 113 articles, and a further screening by abstract led to the exclusion of another 57 articles. Thus, 24 full-text articles were assessed for eligibility. At this stage, articles were excluded based on predetermined eligibility criteria (detailed below). The selection process resulted in the inclusion of eight articles in the current review (included studies have an asterisk in the references). One article (Quach et al. 2017) presented secondary data from an original study (Quach et al. 2016). Thus, seven unique samples were included.

Eligibility Criteria

Inclusion and exclusion criteria were determined prior to conducting the literature review. Studies were included if they were published anytime until December 2019. The initial search included both published and unpublished studies (i.e., dissertations), but unpublished studies were excluded at the abstract screening stage to limit included studies to those that had undergone peer review. Next, studies were screened according to the following criteria: (1) the intervention was implemented in a school setting with students between Grades 1–12; (2) the article explicitly stated that the sample consisted of low-income youth (either by reporting on the socioeconomic status of the participants or the school); (3) outcome measures included psychological functioning (internalizing/externalizing symptoms); (4) students received at least six sessions of the intervention; (5) the intervention included an explicit focus on mindfulness training, rather than mindfulness serving as a subcomponent of another intervention; (6) the study included quantitative data; (7) the article was available in English. There were no eligibility criteria regarding length of follow-up or a specified control group, as the intention was to keep the search broad at this stage of reviewing the literature. Exclusion criteria included studies with a primary focus on substance use or eating disorder symptomatology, as these disorders are considered to be more severe and likely require additional treatment that falls outside the scope of this review.

Fig. 1 Flow diagram of stages of literature review from identification to inclusion in the review



Results

Study Characteristics

General study characteristics are presented in Table 1. All studies were conducted in the USA. Three studies were conducted in Baltimore, MD, two studies were conducted in Los Angeles, CA; one study was conducted in an unnamed Midwestern city; and one study was conducted in an unnamed Southwestern city. All studies indicated that the intervention served low-income youth; either the school was reported to be in a lower-socioeconomic neighborhood, the school was reported to serve a high proportion of low-income families, or 99% of students at the school were eligible for free lunch. In one study, the school was reported to be “tuition free,” based on an application indicating financial need and academic potential.

In terms of study design and control groups, one study utilized a pre/post-intervention design with a single group of participants, whereas the other studies either randomly assigned participants to a waitlist control group ($n = 2$) or active control group (e.g., hatha yoga, standard “resource” period at school, or health education; $n = 4$). Randomization at the individual student level is often a challenge for universally delivered programs in school settings, so randomization often occurs at the classroom level in this context. The mindfulness interventions were administered to students between Grades 7–9 ($n = 5$), Grade 3 ($n = 1$), and in one study the sample spanned Grades 5–8 (the largest range included in the study). The intervention was either administered by graduate students ($n = 3$), a mental health counselor ($n = 1$), or instructors trained in mindfulness ($n = 3$). All interventions were administered during school hours and were either administered during regular class time ($n = 4$), or students were pulled from class to participate in the intervention ($n = 2$). One study mentioned that the intervention and active control groups were integrated into the school day but did not specify a time. Follow-up periods varied by study; the longest follow-up was 3 months ($n = 3$ studies; $n = 1$ study had a 2-month follow-up), and $n = 3$ studies did not have a follow-up period.

Interventions

Two pairs of studies were conducted by the same group of authors (Fung et al. 2016, 2019; Sibinga et al. 2013, 2016). The authors conducted these studies independently but employed the same intervention across both studies. In contrast, Quach et al. (2017) reported on secondary data from the same sample reported by Quach et al. (2016). Quach et al. (2016) implemented a similar intervention to Sibinga et al. (2013, 2016). Otherwise, studies implemented distinct interventions.

MBSR with Developmental Adaptations Sibinga et al. (2013, 2016) and Quach et al. (2016) adapted their interventions from an evidence-based mindfulness intervention, Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn 1990), to make it developmentally appropriate for youth. MBSR has been described as a practice of non-judgmental awareness to the present moment (Kabat-Zinn 1990), which involves (1) a didactic focus on teaching mindfulness, meditation, yoga, and the mind-body connection; (2) experiential sessions focused on practicing mindfulness meditation, yoga, the “body scan,” and instruction to cultivate a mindfulness practice at home; and (3) discussions as a group with an emphasis on identifying barriers to practice and how to implement mindfulness into everyday life. Session content and sequence were unchanged in the version adapted for youth, but concepts were presented in a concrete and simplified manner, and the session length was shortened to fit into students’ school schedules. Quach et al. (2016) additionally provided a recording with guided meditations to encourage home practice.

Learning to BREATHE Fung et al. (2016, 2019) implemented a mindfulness intervention based on the Learning to BREATHE (L2B) curriculum (Broderick 2013). The goal of this program is to help students develop emotion regulation skills, via mindfulness techniques, and gain insight into their thoughts and feelings. This program includes six core themes overall, such as fostering awareness of thoughts, feelings, and physical sensations; noticing and decreasing self-judgment; and integrating mindful practice into everyday routine. Two sessions are dedicated to each of the six themes. Students were provided with audio recorded meditations to encourage home practice.

Move-into-Learning Move-into-Learning (MIL) includes various components, such as yoga, guided mindfulness meditation, and arts-based activities (Klatt et al. 2013). The goal of this program is to improve students’ self-efficacy and skills for managing stress. The components are unified in their attempt to (1) provide opportunity for organized movement with a focus on body awareness; (2) foster a practice of relaxation and mindfulness; and (3) use art as a method of promoting self-expression. The mindfulness component in MIL consists of guided mindfulness meditations.

RAP Club RAP Club, implemented by Mendelson et al. (2015), is a more integrative intervention in that it draws on mindfulness techniques from evidence-supported interventions (Dialectical Behavior Therapy for Adolescents, Miller et al. 2007; Trauma Adaptive Recovery Group Education and Therapy, Ford and Russo 2006; and School-Based Trauma/Grief Group Psychotherapy, Saltzman et al. 2001). The mindfulness component teaches emotion regulation skills, including identifying emotions and responding in a

Table 1 Details of studies included in the review

Authors	School grade	Sample size	Control group	Intervention	Length and duration of training	Target student population	Measures	Significant findings
Fung et al. (2016)	Grades 7–8	<i>N</i> = 19 <i>m</i> = 9	Waitlist	Learning to BREATHE (L2B)	12 sessions (60-min weekly)	At-risk for depression; screening for eligibility	CBCL, YSR, ERQ-CA	Between groups: improvement in parent-reported externalizing symptoms ($\eta^2 = .29$)* compared to waitlist Within-group: improvement in parent-reported externalizing symptoms,* student-reported internalizing symptoms,* and expressive suppression* in mindfulness group
Fung et al. (2019)	Grade 9	<i>N</i> = 145 <i>m</i> = 79	Waitlist	L2B	12 sessions (50-min weekly)	At-risk for depression; screening for eligibility	YSR, PSS, ERQ-CA, EACS, AFQ-Y8, CRSQ	Between groups: Improvement in student-reported internalizing symptoms ($d = .42$)* and perceived stress ($d = .58$)* compared to waitlist Within-group: improvements in student-reported internalizing ($d = .51$)* and externalizing symptoms ($d = .56$),** attention problems ($d = .39$),* perceived stress ($d = .88$),** cognitive reappraisal ($d = .31$),* expressive suppression ($d = .68$),** emotional processing ($d = .58$),** emotional expression ($d = .61$),** avoidance fusion ($d = .90$),** and rumination ($d = .61$)* in the mindfulness group
Klatt et al. (2013)	Grade 3	<i>N</i> = 40	No control	Move-Into-Learning (MIL)	8 sessions (45-min weekly)	General classroom	CTRS-R:S	Improvement in teacher-reported ADHD index ($d = .56$)*, hyperactivity ($d = .42$)* and inattention ($d = .53$)* subscales
Mendelson et al. (2015)	Grades 7–8	<i>N</i> = 49 <i>m</i> = 29	Standard “resource period” class	RAP Club	12 sessions (45-min sessions twice weekly over 6 weeks)	General classroom	Teacher: SDQ, ACES, SCS, SIS, Students: SMFQ, ASRI, CCSC, EAQ	Improvement in teacher-reported dysregulation ($d = 0.85$)*, social competence ($d = 0.87$)*, academic competence ($d = 0.76$)*, and authority acceptance ($d = 0.69$)* compared to controls Student-reported measures did not differ by group
Quach et al. (2016)	Grades 7–9	<i>N</i> = 186 <i>m</i> = 61	1) Hatha yoga (HY) 2) Waitlist (WL)	Mindfulness meditation groups; based on MBSR	8 sessions (45-min sessions twice weekly for 4 weeks)	General classroom with limited enrollment	AOSPAN, PSS, SCARED, CAMM	Within-group improvements in working memory ($d = -.55$)* in mindfulness group only Within-group improvements in student-reported stress (m: $d = .52$; HY: $d = .18$; WL: $d = .06$)* and anxiety (m: $d = .20$ HY: $d = .19$; WL: $d = .22$)* in all groups
Quach et al. (2017)							Intervention expectations, AOSPAN, PSS-10, SCARED, CAMM, Daily homework log	Less perceived stress in hatha yoga high practice group ($\eta^2 = .26$)* and increased perceived stress in the hatha yoga low practice group ($\eta^2 = .15$)*

*Secondary analysis of Quach 2016 study. Refer to above row for study details

Table 1 (continued)

Authors	School grade	Sample size	Control group	Intervention	Length and duration of training	Target student population	Measures	Significant findings
Sibinga et al. (2013)	Grades 7–8	N = 41 m = 22	Health education program	MBSR with developmental adaptations	12 sessions (50-min weekly)	General classroom	SCL-90-R, STAXI, MASC, CDI, Brief COPE, CAMM, CRSQ	Less perceived stress ($\eta^2 = .11$)* in the mindfulness group, and less anxiety in the mindfulness ($\eta^2 = .08$)* and hatha yoga ($\eta^2 = .16$)* groups, regardless of practice Improvement in student-reported anxiety ($d = .79$)* and rumination ($d = .64$)* compared to the control group
Sibinga et al. (2016)	Grades 5–8	N = 300 m = 159	Health education program	MBSR with developmental adaptations	12 sessions (50-min weekly)	General classroom	CAMM, PSS, CDI-S, SCL-90-R, MASC, PANAS, DES, STAXI-2, CRSQ, CSE, Brief COPE, CPSS	Improvement in student-reported depressive symptoms*, somatization*, negative affect*, negative coping*, rumination*, and post-traumatic stress symptoms* compared to the control group.

N total sample size, m mindfulness condition, * $p < .05$, ** $p < .001$

Devereaux Student Strengths Assessment—Teacher Scale (DESSA; LeBuffe, Shapiro, & Naglieri, 2009), Conners-3 short form (CRS-3, Conners, 2008) Child Behavior; Checklist (CBCL; Achenbach and Rescorla 2001), Youth Self-Report (YSR; Achenbach & Edelbrock, 1987), Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA; Gullone and Taffe 2012), Perceived Stress Scale (PSS; Cohen et al. 1994), Emotional Approach Coping Scale (EACS; Stanton et al. 2000), Avoidance and Fusion Questionnaire for Youth (AFQ-Y8; Greco et al. 2008), Children’s Response Styles Questionnaire (CRSQ; Abela et al. 2004), Connor’s Teacher Rating Scale-Revised [Short form] (CTRS-R:S; Conners, Sitarenios, Parker, & Epstein, 1998), Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), Academic Competence Evaluation Scales (ACES; DiPerna & Elliott, 1999), Social Competence Scale (SCS; Werthamer-Larsson, Kellam, & Wheeler, 1991), Student Internalizing Symptoms (SIS; Achenbach, 1991; Achenbach & Edelbrock, 1986), Short Mood and Feelings Questionnaire Child Version (SMFQ; Angold et al., 1995), Adolescent Self-Regulatory Inventory (ASRI; Moilanen, 2007), Children’s Coping Strategies Checklist (CCSC; Ayers, Sandler, West, & Roosa, 1996), Emotional Awareness Questionnaire (EAQ; Rieffe et al., 2007), Automated Operation Span Task (AOSPAN; Unsworth et al., 2005), Screen for Child Anxiety and Related Emotional Disorders (SCARED; Birmaher et al., 1997), Child Acceptance and Mindfulness Measure (CAMP; Greco et al. 2011), Symptom Checklist-Revised (SCL-90-R; Derogatis, 1994), State-Trait Anger Expression Inventory (STAXI; Forgas et al., 1997), Multidimensional Anxiety Scale for Children (MASC; March et al., 1999), Children’s Depression Inventory (CDI; Kovacs, 2004), Brief COPE (Carver et al., 1997), Positive and Negative Affect Schedule (PANAS; Crawford & Henry, 2004), Differential Emotions Scale (DES; Izard et al., 1993), Coping Self-Efficacy Scale (CSE; Chesney et al., 2006), Children’s Post-Traumatic Symptom Severity Checklist (CPSS; Foa et al., 2001), Intervention Expectations Questionnaire (Jastrowski Mano et al., 2013)

non-impulsive manner. Techniques such as observing the breath are practiced to cultivate present-focused awareness (Brown and Ryan 2003). RAP Club also incorporates psychoeducation (e.g., effects of stress) and cognitive-behavioral strategies (e.g., problem solving).

With the exception of RAP Club, which was adapted from an intervention developed for adolescents facing chronic stress (DeRosa and Pelcovitz 2009), one important feature that was noted across all interventions was the absence of any specific content modifications for delivering these programs to low-income populations (e.g., additional modules or core themes designed to address the unique challenges faced by low-income youth).

Intervention Fidelity

Adherence to the program during the intervention (i.e., intervention fidelity) was only formally assessed in one study (Fung et al. 2019), in which the authors reported an average adherence score of 89.6% across all coded sessions (48 sessions; 16.67% of sessions). Quach et al. (2016) noted that a researcher occasionally attended mindfulness sessions to assess fidelity to the curriculum; however, no formal measures of fidelity were reported in this study.

Implementation and Feasibility

An important variable to consider with respect to implementation is the level at which each intervention was administered (e.g., general classroom/universal compared to invitation-based for students with an at-risk factor or identified need). Across studies, the participating schools were identified as serving at-risk student populations (e.g., low-income households, disadvantaged neighborhoods, poor academic standing), but most interventions were administered as preventive interventions at the general classroom level. Among interventions that were administered at the general classroom level, enrollment ranged between 75 and 98% (Klatt et al. 2013; Mendelson et al. 2015; Sibinga et al. 2013, 2016 did not provide enrollment data). Despite delivering the intervention during regular class time, Quach et al. (2016) reported an enrollment rate of 47%, as they were only able to enroll the first 30–35 students in each class who returned their signed consent forms due to limited study personnel. Enrollment was more variable in the Fung et al. (2016, 2019) studies, in which the intervention was only delivered to students identified as at-risk for depression, and the intervention was not administered during regular class time. Fung et al. (2016) reported an enrollment rate of 35% between those who were eligible and those who enrolled, and Fung et al. (2019) reported enrollment rates of 32% and 95.1% across their two cohorts, depending on whether they used a passive or active consent process.

Feasibility measurement varied across studies. In line with Bowen et al.'s (2009) feasibility guidelines, feasibility was most commonly defined in terms of the satisfaction/acceptability of the program ($n = 3$ studies), or in terms of program demand, which refers to information regarding the actual use of the intervention (i.e., adherence to the program outside of the intervention, $n = 3$; retention, $n = 7$; and attendance, $n = 4$).

Regarding satisfaction/acceptability of the program, Fung et al. (2016, 2019) measured student satisfaction of the intervention using a post-intervention questionnaire that consisted of questions rated on a 10-point Likert scale as well as open-ended questions. Across both samples, students reported moderate levels of satisfaction with the intervention overall (7.21/10 and 7.35/10, respectively) and a high likelihood of recommending the program to a friend (92% and 93%, respectively). Klatt et al. (2013) examined intervention feasibility by conducting a semi-structured interview with two teachers involved in the 8-week program. Teachers were asked open-ended questions about the intervention, including whether the program appeared to be acceptable for the students, whether it improved the classroom experience, what percentage of students seemed to benefit, what they viewed as the primary benefits, and whether the program impacted classroom attendance. A qualitative assessment of teachers' responses showed that teachers found the intervention to be acceptable for teaching stress reduction techniques in a classroom setting; they found it to be beneficial for most students and that they were able to fit the mindfulness practice into their daily schedule without difficulty.

Only three studies (Fung et al. 2016, 2019; Quach et al. 2017) reported on adherence to the program outside of the intervention. Fung et al. (2016) found that 75% of the participants reported practicing mindfulness at least 4–6 times per week outside of the intervention, and approximately 67% reported using the audio files from the intervention session at least once a week. Additionally, Fung et al. (2019) found that 46% of their sample practiced mindfulness 2–3 times per week and only 32% of students used the audio files at least once a week, suggesting that students in this sample were less inclined to utilize mindfulness strategies outside of the sessions. Quach et al. (2017) closely examined adherence to mindfulness practice outside of the intervention sessions. Students recorded daily practice logs, which captured the time spent practicing mindfulness or hatha yoga at home. Participants were asked to engage in 15 to 30 min of daily practice, using a recording provided by the instructors, for a maximum of 21 days. The study reported poor adherence regarding at-home practice, with an average of 5.66 days of practice (of the maximum 21 days) and an average of 77.16 min of practice in the mindfulness meditation group. Conversely, the authors found relatively higher practice

compliance in the hatha yoga (control) group, with an average 7.22 practice days and 140.05 min of engagement at home. Importantly, not all participants completed practice adherence logs for the duration of the intervention, and these data were coded as “0 min” of home practice in the above analyses.

Retention was evaluated in terms of the number of students who participated in the intervention from enrollment to study completion. Retention rates were observed to be fairly high whether the intervention was administered at the general classroom level ($n = 5$; range: 72.8–100%; Klatt et al. 2013; Mendelson et al. 2015; Quach et al. 2016; Sibinga et al. 2013, 2016), or whether it was administered to students based on identified need and outside of regular class times ($n = 2$, 84.43–89.4%; Fung et al. 2016, 2019). Among studies that reported on attendance, attendance rates ranged between 75 and 92% of program sessions attended (Fung et al. 2016, 2019; Quach et al. 2016; Sibinga et al. 2016). Klatt et al. (2013) reported that general student attendance was higher on days of the intervention. However, they did not provide quantitative data for the number of students attending class, and consequently attending the intervention.

Regarding other measures of feasibility, organizational-level factors (e.g., fit of the intervention with the school climate, plan for sustainment) have been highlighted as an important area of focus in evaluating the feasibility of implementing school-based interventions (Emerson et al. 2020). For example, Sibinga et al. (2016), described how their partnership with a community organization was critical for the implementation of their intervention (e.g., the organization’s familiarity with the specific student population, their pre-existing relationships with the school staff), as well as other organizational determinants within the school (e.g., the “reasonably accepting” administration, pg. 5). Fung et al. (2016) noted a few implementation challenges at the organizational level, including poor communication about the intervention between school administration and teachers, leading to teachers’ reluctance to excuse children from class. Klatt et al. (2013) noted that their intervention has potential to be implemented by teachers, but there was no explicit mention of a plan for sustainment of the intervention beyond the study. Data regarding organizational-level factors were limited to these studies.

Psychological Outcomes

The included studies reported on a variety of outcome measures to evaluate intervention effects. As per the inclusion criteria, all of the studies included at least one measure of psychological functioning (i.e., internalizing/externalizing symptoms). Other outcomes included emotion regulation, coping, mindfulness, and perceived stress. Below, results of the individual studies have been grouped by common outcomes.

Externalizing Symptoms and Attention Problems

Fung et al. (2016) reported a significantly greater decrease in parent-reported externalizing symptoms in the intervention group compared to waitlist controls; however, neither Fung et al. (2016) nor Fung et al. (2019) found significant differences in student-reported externalizing behaviors between groups. When examining the within-group treatment effects in a pooled sample, Fung et al. (2016, 2019) both found a significant reduction in externalizing behaviors, which was maintained at the 3-month follow-up (parent-reported in Fung et al. 2016, student-reported in Fung et al. 2019).

Klatt et al. (2013) found significant teacher-reported reductions in overall ADHD symptoms, hyperactivity, and inattention, with small to medium effects from pre-intervention to post-intervention. Improvements on the ADHD index and hyperactivity subscale were maintained at the 2-month follow-up, while inattention continued to improve. Fung et al. (2019) also found significant improvements in student-reported attention problems, which were maintained at 3-month follow-up; however, this effect was only found in the pooled sample analysis, and there were no differences in attention problems between groups. Mendelson et al. (2015) also measured teacher-reported improvements in attention, but they did not find significant between-groups differences.

Internalizing Symptoms Sibinga et al. (2013, 2016) found significantly greater reductions in student-reported anxiety and depression (respectively) in the MBSR group exhibited compared to active controls. Quach et al. (2016) found significant pre-to post-intervention reductions in student-reported anxiety symptoms across all three conditions (mindfulness intervention, hatha yoga, and waitlist). Fung et al. (2016, 2019) found a significant within-group reduction in student-reported internalizing symptoms in the mindfulness group, which was maintained at the 3-month follow-up, whereas only Fung et al. (2019) found significantly greater improvement in student-reported internalizing symptoms between the intervention and waitlist. Fung et al. (2016) did not find significant group differences in internalizing symptoms (parent- or student-reported), and Sibinga et al. (2013) and Mendelson et al. (2015) failed to find significant group differences in student-reported depressive symptoms.

Perceived Stress Fung et al. (2019) and Quach et al. (2016) both found a significant decrease in student-reported perceived stress, but Fung et al. (2019) reported significantly greater improvements in the mindfulness group compared to waitlist, whereas Quach et al. (2016) reported similar improvements across all three groups. Sibinga et al. (2013, 2016) failed to find significant group differences in student-reported perceived stress in the mindfulness group compared to active controls.

Emotion Regulation A number of the studies also reported on outcomes related to emotion regulation. Specifically, Sibinga et al. (2016) reported that the MBSR group had significantly greater student-reported reductions in rumination, self-hostility, negative affect, and negative coping compared to active controls. Mendelson et al. (2015) included a measure of teacher-reported dysregulation and found significantly greater improvements in the intervention compared to active controls, with a large effect size. Fung et al. (2019) found significantly greater student-reported improvement in cognitive reappraisal, emotion processing, emotion expression, and rumination between the intervention and control groups, as well as significant pre-post improvements on all emotion regulation outcomes (including expressive suppression and avoidance fusion) in the pooled sample analysis. The latter changes were maintained at the 3-month follow-up. In contrast, Fung et al. (2016) only reported significant within-group improvements in student-reported expressive suppression in the mindfulness intervention, and they did not report any between-group differences in emotion regulation outcomes.

Mindfulness Three studies measured mindfulness as an outcome variable; however, only two studies completely analyzed changes in mindfulness due to the intervention. Quach et al. (2016) measured mindfulness using the Child Acceptance and Mindfulness Measure (Greco et al. 2011), but they found unacceptable internal consistency using this scale ($\alpha = .41$), so they did not conduct any further analyses. Neither of the two studies that measured mindfulness as an outcome variable reported significant improvements in student-reported mindfulness after the intervention (Sibinga et al. 2013, 2016).

Risk of Bias Within Studies

Studies were assessed for risk of bias using the Cochrane Risk of Bias Tool (Higgins and Green 2008), which assess bias across six domains: selection, performance, detection, reporting, attrition, and other. Table 2 presents the ratings for all studies across each domain.

Discussion

Social and emotional interventions are particularly important in serving low-income settings, due to numerous and extreme stressors, coupled with low access to mental health care. This systematic review aimed to understand factors related to the implementation and feasibility of mindfulness-based interventions in low-income settings and the extent to which they are effective in improving psychological symptoms and functioning.

In interpreting the pattern of results, a consistent factor noted across studies was the lack of fidelity data. Understanding the degree of adherence to the intervention during delivery is critical in assessing the validity of intervention outcomes, which was generally unavailable across studies (aside from Fung et al. 2019).

Implementation and Feasibility

Feasibility is a multifaceted construct that was operationalized according to different standards across studies. In this review, the most common definitions of feasibility were related to program satisfaction/acceptability (i.e., whether participants found the program to be suitable) and demand (i.e., how likely the program was to be used; Bowen et al. 2009). Feasibility data were only available from a limited number of studies, with findings of moderate student satisfaction, poor adherence to mindfulness practice outside of the intervention, and high retention and attendance rates among studies who reported on these outcomes.

Only two studies measured student-rated satisfaction and found that students' responses towards the program were fairly positive (Fung et al. 2016, 2019). Students reported finding the intervention to help with stress management, emotion awareness, understanding, and acceptance, and they reported that they would be highly likely to recommend the intervention to a friend. Students further reported finding the intervention to be beneficial even for events occurring outside of the intervention (e.g., conflict with parents; Fung et al. 2016), which may be a particularly important outcome among children and adolescents living in low-income neighborhoods or high-risk households. Klatt et al. (2013) reported on teacher satisfaction regarding the MIL intervention, for which teachers' high ratings of satisfaction were driven by observed student benefits, appropriate fit of the program within the school day, and increased student attendance on days of the intervention. Although limited, these findings suggest a high and consistent degree of acceptability at least regarding the L2B and MIL programs. Given the lack of data regarding the implementation of mindfulness-based interventions within low-income schools, these data provide preliminary support regarding the acceptability of these interventions.

Although Fung et al.'s (2016, 2019) positive findings regarding acceptability may suggest that students would be likely to engage in at-home practice, studies measuring practice compliance found that students were unlikely to use the provided resources to engage in mindfulness practice at home (Fung et al. 2016, 2019; Quach et al. 2017). Low rates of homework compliance are a fairly typical obstacle for psychological interventions with youth. For example, studies of cognitive behavioral therapy with adolescents have reported that homework completion rates tend to be around 50% and compliance tends to decline over the duration of treatment

Table 2 Risk of bias of individual studies

	Selection bias		Performance bias		Detection bias		Reporting bias		Attrition bias		Other bias	
	Random sequence generation	Allocation concealment	Blinding participants and personnel	Blinding outcome assessment	Selective reporting	Incomplete outcome data	Other sources of bias					
Fung et al. (2016)	High risk (randomization via coin toss)	Unclear risk (not described in sufficient detail)	N/A	Unclear risk (not described in sufficient detail)	Low risk	Low risk (intent-to-treat analysis for all participants with baseline data; attrition rate described)	N/A					
Fung et al. (2019)	Unclear risk (not described in sufficient detail)	Low risk (use of sealed envelopes)	N/A	Unclear risk (not described in sufficient detail)	Low risk	Low risk (intent-to-treat analysis for all participants with baseline data; attrition rate described)	N/A					
Klatt et al. (2013)	N/A	N/A	N/A	High risk (outcome assessment not blinded)	Low risk	Low risk (attrition rate described)	N/A					
Mendelson et al. (2015)	High risk (condition assignment not completely random; over selected for intervention group, and teachers requested certain students not be placed together)	Unclear risk (not described in sufficient detail)	High risk (teachers not blinded)	Unclear risk (not described in sufficient detail)	High risk (data not presented for student-rated outcomes)	Low risk (attrition rate described)	N/A					
Quach et al. (2016)	Unclear risk (not described in sufficient detail)	Unclear risk (not described in sufficient detail)	Unclear risk (insufficient details provided)	Unclear risk (not described in sufficient detail)	Low risk	Low risk (described handling of incomplete outcome data and attrition rate)	Study enrollment determined by speed of returning consent form					
Quach et al. 2017	*Secondary analysis of Quach 2016 study. Refer to above row for study details											
Sibinga et al. (2013)	Low risk (randomization by “computer-generated scheme”)	Unclear risk (not described in sufficient detail)	Low risk (students, study, and school staff blinded to allocation)	Unclear risk (not described in sufficient detail)	Low risk	Low risk (attrition rate described)	N/A					
Sibinga et al. (2016)	Unclear risk (not described in sufficient detail)	Unclear risk (not described in sufficient detail)	High risk (participants and school personnel not blinded to conditions)	Low risk (blinding to condition occurred throughout data analysis and interpretation)	Low risk	Low risk (described handling of incomplete outcome data and attrition rate)	N/A					

(Gaynor et al. 2006; Wilansky et al. 2016). To address this challenge, previous interventions for youth have incorporated token-reward systems (van der Oord et al. 2012), and mobile apps (Wilansky et al. 2016) to boost practice compliance. The current interventions may benefit from such adaptations to enhance homework completion (e.g., a mobile app that provides reminders and a tracking system for at-home practice). Furthermore, the Social and Emotional Learning (SEL) literature has highlighted family engagement as an important strategy for boosting SEL intervention success (McClelland et al. 2017), noting that program effects tend to be more pervasive and sustainable when there is collaboration between schools and families (Elias 2006). Considering the role of caregiver engagement in the reviewed interventions may further reveal areas of improvement for promoting the transfer of skills between school and home and regarding at-home practice. None of the interventions in this review included a separate caregiver component; however, greater caregiver involvement may be a possible means for facilitating children's engagement in mindfulness strategies outside of the intervention sessions. Fung et al. (2016) highlighted the importance of caregiver buy-in in the successful implementation of school-based interventions, especially for conveying the importance of these programs and the benefits of mindfulness to parents (e.g., information sessions designed for parents). Ensuring consistent messaging between schools and families surrounding these programs may additionally help with increasing students' at-home engagement.

Despite poor rates of student engagement outside of the intervention, high rates of retention across all studies (72.8–100%) and high rates of session attendance among studies who reported on attendance (75–92%) suggest a more positive picture regarding the actual use of the interventions within the school day.

Evaluating the level at which each program was delivered and subsequent enrollment rates is also an important factor in understanding best practices for implementing school-based interventions, including the reach of each intervention (i.e., the proportion of eligible students who participated in each intervention; Merrell and Buchanan 2006). When interventions were administered at the general classroom level, during regular class hours, enrollment rates tended to be fairly high across studies, and these studies were more successful in reaching eligible students within the target population. Lower enrollment rates were observed in studies where passive consent processes were used, and when students were pulled from class to participate in the intervention. Specifically, Fung et al. (2019) reported a ~60% increase in enrollment when they used an active process of consent (i.e., only screening students who expressed interest in the study), compared to screening all Grade 9 students and then providing study information and the option of participating to eligible students. In addition to using this passive enrollment process,

Fung et al. (2016) reported that parent concerns regarding children missing classroom instruction also contributed to their low enrollment rate. This may have impacted enrollment in the Quach et al. (2016) study as well, as students in that study had the risk of missing their regular physical education curriculum depending on which study condition they were assigned to. These concerns may be particularly relevant for delivering interventions in low-income schools, as it may be more difficult for low-income families to supplement children's learning outside of the classroom if they were to fall behind (e.g., financial resources to hire tutors).

Psychological Outcomes

Assessment of psychological outcomes varied across the studies, and it also differed depending on the comparison group. Aside from one study that lacked a control condition, all studies examined differences between the active intervention condition and a control condition. Based on comparisons between groups, the impact of the intervention on psychological outcomes is inconsistent, in that improvements between groups exist, but for different behavioral and emotional outcomes across studies. Externalizing symptoms and attention problems improved over the course of mindfulness interventions (Fung et al. 2016, 2019; Klatt et al. 2013) with limited support of greater improvement compared to waitlist (Fung et al. 2016). There was some support for greater improvement in anxiety, depression, and internalizing symptoms more generally in the mindfulness intervention compared to waitlist and active controls (Fung et al. 2019; Sibinga et al. 2013, 2016), yet Quach et al. (2016) found within-group improvements in anxiety across all three of their conditions (mindfulness, hatha yoga, and active control), suggesting non-specific effects, and other studies failed to find differences in student-reported depression between the intervention and active controls. Similarly, for perceived stress, only one study found greater improvements in the mindfulness group compared to waitlist (Fung et al. 2019), whereas Quach et al. (2016) found non-specific improvements across all three groups. Emotion regulation outcomes were positive, with three studies reporting greater improvements in emotion regulation (e.g., rumination) in the mindfulness intervention compared to waitlist and active controls (Fung et al. 2019; Mendelson et al. 2015; Sibinga et al. 2016).

The outcomes observed across studies were similar to those reported in previous meta-analyses and systematic reviews on mindfulness-based interventions for children in school and other settings. For example, Carsley et al. (2018) found that school-based mindful interventions led to small improvements in mental health outcomes, both across time and compared to controls. They additionally observed the largest effects when interventions were delivered to adolescents between the ages of 15 to 18 years, which is a slightly older developmental period than the participants in the current review and may account for

differences in effect sizes. Furthermore, adaptations of MBSR have been previously found to be moderately effective in improving depressive symptoms in adolescents and young adults compared to controls (Chi et al. 2018), which is in line with our findings of improvements in depressive and internalizing symptoms more generally in a number of studies, compared to waitlist and active controls. Previous studies have further noted that the high degree of heterogeneity across studies has led to difficulty drawing conclusions regarding the generalized effectiveness of mindfulness-based interventions (Burke 2010; Zenner et al. 2014), which was also reflected in the current review.

Interestingly, neither of the two studies that analyzed changes in mindfulness found that it improved after the intervention compared to active controls (Sibinga et al. 2013, 2016), suggesting that there was no improvement in mindfulness following the interventions. However, this lack of association may also suggest that the construct of mindfulness is difficult to capture and assess via self-report rating scales, which has been previously critiqued in the literature. Specifically, Grossman (2011) has raised issues of inadequate evidence for links between mindfulness scales and the behaviors they purport to measure, as well as a lack of content validity, as many scales oversample questions regarding inattention and brand this as a comprehensive depiction of mindfulness. Relevant to the specific population examined in this review, Quach et al. (2016)—who were unable to report on mindfulness outcomes due to problems with the reliability of their scale—additionally noted that much of the validation research on their scale has been conducted with White children and adolescents (CAMM; Greco et al. 2011), which raises concerns about the appropriateness of using these measures with predominantly non-White samples.

Strengths of the Literature and Review

In appraising the current literature, there are a number of strengths to highlight. First, the current literature is at a stage where most studies are conducting randomized controlled trials to evaluate intervention effects. Evaluating studies at this stage allows for more nuanced conclusions about the effectiveness of the intervention, as controlled research designs allow for closer approximations of cause-and-effect relationships.

Although also a limitation of this review, the diversity in intervention implementation across different schools greatly contributes to the generalizability of the results. The interventions were administered and facilitated by a host of different personnel, including graduate students, trained mindfulness instructors, and school teachers, thus highlighting the versatility of these interventions. For example, the practice sessions in MIL were delivered via CD facilitated by teachers, whereas Quach et al.'s (2016) MBSR was taught by trained instructors. Furthermore, the students included in this review spanned

Grades 3–9, suggesting that the results of this review generalize to children and adolescents of a diverse age range.

Additionally, all of the interventions were implemented into the typical school day, which is a notable strength of this literature and highlights the accessibility of these interventions. Providing interventions within regular school hours reduces barriers associated with parents serving as a “gatekeeper” to treatment (Reardon et al. 2017, p. 623), which may limit many children and adolescents’ ability to access mental health services. In terms of generalizability, interventions delivered in the classroom are thought to be more easily applied to the broader school setting (Felver et al. 2016), which may encourage the use of skills learned during the interventions to other contexts at school. Finally, one of the strengths of this review is the target population of low-income youth, as this has been a fairly understudied population with respect to the implementation of mindfulness-based interventions, especially within the school setting. None of the reviewed interventions were specifically tailored for use with low-income populations (i.e., no added modules to specifically address the associated unique challenges), suggesting that low-income youth may benefit from interventions developed for youth more generally. This finding is positive, as it may encourage the implementation of other pre-existing interventions into school systems in low-income neighborhoods.

Limitations and Future Research

There is a wealth of data supporting the notion that questionnaire outcomes differ depending on the informant, which is even more critical when conducting research with children and adolescents (Sourander et al. 1999). Ultimately, the most reliable and valid conclusions can be drawn when data are collected from multiple informants, which is considered to be the gold standard when measuring symptoms of childhood disorders (Dirks et al. 2012; Hunsley and Mash 2007). In the current review, only two studies included data from multiple sources (Fung et al. 2016; Mendelson et al. 2015), while most studies relied solely on self- or teacher-report. The inconsistency in reporters across studies further impacted our ability to generalize effectiveness findings across studies with different reporters.

Additionally, only three studies included a follow-up period of the collected outcome measures in their study design. Follow-up periods play an important role in evaluating interventions, as they evaluate whether effects are transient and tied to the immediate intervention period, or whether they are maintained over time. The studies that included follow-up periods found that effects were maintained over time (Fung et al. 2016, 2019; Klatt et al. 2013), but follow-up periods only ranged from 2 to 3 months. An important step for future studies would be to evaluate these outcomes over longer periods of time so that the stability of effects can be evaluated.

The wide variety of interventions reviewed and summarized in this review (L2B, MIL, RAP Club, MBSR-adaptations) is both a strength and limitation of the current review. Although the inclusion of multiple, diverse interventions enables a broad survey and comparison of the many different faces of mindfulness-based interventions in schools, this heterogeneity also limits the ability to draw uniform conclusions across studies, especially given the small number of studies included in this review. For example, the duration of programs varied across studies from 4 to 12 weeks, and the number of sessions varied from 8 to 12 sessions. Thus, when comparing effects across studies, one must consider these differences. In addition, our ability to thoroughly review feasibility was limited by the small number of studies that reported on these outcomes (e.g., satisfaction ratings, adherence to at-home practice). This literature would benefit from an increased reporting of feasibility measures, including attention to organizational factors (Emerson et al. 2020), which were particularly lacking.

Furthermore, in our intention to prioritize the inclusion of low-income samples at the cost of more stringent inclusion criteria regarding the specific mindfulness-based intervention (e.g., Crane et al. 2017), some of the interventions included in this review also had additional intervention components outside of the specific instruction in mindfulness skills. Thus, although the goal of this review was not to conduct a mechanistic review of the specific intervention components, our conclusions regarding the mindfulness elements are limited by other potentially potent treatment elements. For example, Mendelson et al. (2015) reported a large effect for teacher-reported decreases in dysregulation; however, the RAP Club intervention incorporates elements of other evidence-supported interventions, such as dialectical behavior therapy for adolescents (Miller et al. 2007), trauma adaptive recovery group education and therapy (Ford and Russo 2006), and school-based trauma/grief group psychotherapy (Saltzman et al. 2001). Thus, while the intervention as a whole produced positive results, the ability of this review to assess the mindfulness components in particular is somewhat clouded. The same challenge applies to the other interventions that incorporated other elements into their program (e.g., MIL also included art-based activities).

The small number of studies that resulted from our exclusive focus on low-income samples further highlights the need for future studies to measure and report on detailed demographic variables, including socioeconomic status. The inclusion of more detailed information in this domain would be helpful in future pursuits of identifying studies that have evaluated these programs within low-income populations.

As schools are increasingly striving to include programming and curricula that promote social-emotional competency and mental health resilience, mindfulness-based interventions have also been evaluated in terms of their fit within existing Social and Emotional Learning (SEL) frameworks (Feuerborn

and Gueldner 2019; Lawlor 2016). For example, the areas of self-awareness, self-management, social awareness, relationship skills, and responsible decision-making have been highlighted as five important SEL domains (Collaborative for Academic, Social, and Emotional Learning 2013), and self-management has been found to be the SEL construct most frequently represented in school-based mindfulness interventions (e.g., attention, executive functioning, externalizing/internalizing symptom; Feuerborn and Gueldner 2019). Bridging between these literatures to examine how mindfulness programs in schools address these broader competency areas may strengthen our understanding of their impact on social-emotional learning more generally (i.e., as opposed to evaluating the effects of mindfulness programs on individual skills) and is an important direction for future reviews.

Along with the merits of mindfulness-based interventions in schools, there has also been a call for mindfulness educators to critically consider the sociocultural contexts in which these interventions are being administered. For example, some have raised concerns that the widespread adoption of mindfulness in schools may promote neoliberalist values of individualistic responsibility (Forbes 2017; Reveley 2015), which may translate into children believing that stressful experiences arise out of their own personal success or failure in responding to them (i.e., through the quality of their regulation skills), and may divert attention away from the role of sociocultural factors in determining well-being. These concerns are particularly important to consider in the context of low-income youth, whereby the scrutiny of poor learning or living conditions may be overshadowed by the emphasis on turning inwards to identify and address sources of stress, which may foster compliance towards current conditions. In response to these criticisms, social and civic mindfulness initiatives have been developed, which weave critical reflection and social justice activism into contemplative practice and promote a more communal form of mindfulness, compared to focussing on the training of individual capacities. For example, Forbes (2017) suggests that a critical, integral mindfulness program can help students critically examine how notions of the self are shaped by problematic social systems, challenge the siloing of personal stress from community issues, and incite social justice activism (for examples of developed programs, see Berila 2015; Magee 2016). School leadership teams tasked with picking between different social-emotional interventions may benefit from considering these additional perspectives in the context of program development, specifically in the context of low-income schools.

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editing of the original draft. CMM: guidance and feedback on original draft of manuscript.

Compliance with Ethical Standards

Ethics Statement The authors declare that they have no conflict of interest. No informed consent procedures were required given the nature of this study.

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All studies included in this review are indicated by (*).

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