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Assessing Fidelity of Implementation (FOI) for School-Based Mindfulness and Yoga Interventions: A Systematic Review

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Abstract

As school-based mindfulness and yoga programs gain popularity, the systematic study of *fidelity of program implementation* (*FOI*) is critical to provide a more robust understanding of the core components of mindfulness and yoga interventions, their potential to improve specified teacher and student outcomes, and our ability to implement these programs consistently and effectively. This paper reviews the current state of the science with respect to inclusion and reporting of FOI in peer-reviewed studies examining the effects of school-based mindfulness and/or yoga programs targeting students and/or teachers implemented in grades kindergarten through twelve (K-12) in North America. Electronic searches in PsychInfo and Web of Science from their inception through May 2014, in addition to hand searches of relevant review articles, identified 312 publications, 48 of which met inclusion criteria. Findings indicated a relative paucity of rigorous FOI. Fewer than 10% of studies outlined potential core program components or referenced a formal theory of action, and fewer than 20% assessed any aspect of FOI beyond participant dosage. The emerging nature of the evidence base provides a critical window of opportunity to grapple with key issues relevant to FOI of mindfulness-based and yoga programs, including identifying essential elements of these programs that should be faithfully implemented and how we might develop rigorous measures to accurately capture them. Consideration of these questions and suggested next steps are intended to help advance the emerging field of school-based mindfulness and yoga interventions.

Conflict of Interest
The authors declare they have no conflict of interest.

Keywords

mindfulness; yoga; fidelity; implementation; review; school-based intervention

Introduction

In the current climate of enthusiasm for school-based mindfulness and yoga programs, research efforts have aimed primarily to evaluate program impacts on teacher and student outcomes. Indeed, a number of reviews and meta-analyses have now summarized the growing evidence base for effects of school-based mindfulness and yoga (Davidson & Mind and Life Education Research Network 2012; Meiklejohn et al. 2012; Serwacki & Cook-Cottone 2012). Assessing intervention outcomes is critical to testing program efficacy and gaining support and funding for these programs (Greenberg & Harris 2012; Weare 2013). Outcomes assessment alone, however, is not sufficient to build a rigorous evidence base for school-based contemplative practices. The systematic study of *fidelity of program implementation* (*FOI*) is needed to provide a more robust understanding of the core components of mindfulness and yoga interventions for youth, their potential to improve specified teacher and student outcomes, and our ability to implement these programs consistently and effectively across time and in diverse school settings (Davidson & Mind and Life Education Research Network 2012; Greenberg & Harris 2012).

FOI is a multi-dimensional construct that refers to the degree to which intervention delivery adheres to the intervention developers' model (Dane & Schneider 1998). Whereas traditional intervention outcomes research focuses on program effects (the dependent variables), the study of FOI refines our understanding of the core elements that constitute a given program (the independent variable) and their relationship to program outcomes. In order to study FOI, researchers and program developers must first identify the key constituent parts of an intervention and articulate how these components are anticipated to create desired outcomes. They must then develop reliable and valid measures of FOI and establish measurable criteria for implementation integrity. These criteria can be used in subsequent research to examine empirically whether variation in the implementation of core components is systematically related to particular outcomes across replication trials (Feagans Gould et al. 2014).

Why is Fidelity of Implementation Important?

Assessing fidelity of implementation is important to our understanding of whether and how school-based mindfulness programs work for several reasons. First, *what actually gets implemented in real-world settings, like schools, may vary from study to study, even within the same program*. Therefore evidence-based practice needs a means of evaluating whether a program is being implemented as intended (Carroll et al. 2007). Evidence indicates marked variation in implementation fidelity both across and within youth psychosocial prevention and promotion programs focused on mental and physical health (Durlak & Dupre 2008). It is highly likely that similar variability in implementation fidelity exists for mindfulness-based programs. Such variation will become more apparent as an increasing number of mindfulness-based programs are implemented and larger studies are conducted.

Second, the degree to which programs are implemented with fidelity in real-world settings *directly informs the conclusions we can make about the effectiveness of a single program or school-based mindfulness programs more generally* (Carroll et al. 2007). Durlak and Dupre reviewed over 500 studies of promotion and prevention programs for youth and adolescents, including 5 meta-analyses, and concluded that, "Achieving good implementation not only increases the chances of program success in statistical terms, but also can lead to much stronger benefits for participants" (2008, p. 334). Indeed the magnitude of mean effect sizes was at least two to three times higher when programs were carefully implemented and free from serious implementation problems, particularly when fidelity or dosage were assessed. This is consistent with an emerging body of evidence that suggests program fidelity leads to better outcomes and program outcomes are sensitive to variations in implementation fidelity (Kutash, Cross, Madias, Duchonowski, & Green 2012). In addition, assessing fidelity of implementation guards against making what is known as a Type III error - the incorrect conclusion that a program itself is not effective, when in fact poor outcomes are the result of shortcomings in implementation (e.g., the instructor did not have time to cover all the curriculum components) (Domitrovich & Greenberg 2000).

Third, assessing program fidelity can help move us toward an understanding of *how* programs work and the "active ingredients," or drivers, of program effects. Although mindfulness and yoga programs all include contemplative practices that focus on anchoring attention in the present moment, programs vary widely in the specific forms of mindfulness practice they teach, in program duration and dosage, and in the types and characteristics of school-based populations they target (e.g., students and/or teachers, developmental stage or grade level, socioeconomic status) (Greenberg & Harris 2012; Meiklejohn et al. 2012). Programs are likely to produce different levels of impact based on program features and characteristics of the target population. Particular practices (e.g., breath work) or program components (e.g., assigned homework) also may be differentially effective in producing outcomes. Thus, FOI measures are critical for developing our understanding of which mindfulness practices or program components are most effective, for whom, and under which conditions.

Finally, assessing *FOI can help facilitate program improvement and refinement*. FOI findings can identify which aspects of a program are contributing to its efficacy and which aspects are not, potentially informing changes in intervention content. For instance, if practice of guided mindfulness reflections is found to predict particularly robust intervention gains, program developers may wish to increase the frequency with which this skill is practiced throughout the program. FOI findings can also inform decisions about which program aspects may require modification to overcome implementation challenges and facilitate delivery as intended. For instance, if program instructors consistently have difficulty fully covering curriculum material, program developers may decide that the curriculum needs to be pared down or that more intervention sessions are needed.

How do we study FOI?

Approaches for assessing and analyzing FOI vary based on program and research goals, as well as the nature of the program and context of implementation. Conceptualizations of FOI

span many disciplines including mental health, prevention research, education, criminal justice, public health and policy (Burkel et al. 2011; Century, Rudnick, & Freeman 2010; Caroll et al. 2007; Durlak & Dupre 2008; O'Donnell 2008; Fixsen, Blase, Naoom, & Wallace 2009). Although differences across these frameworks merit attention, their core aspects are fairly similar. This review references a general framework based on the Plan Do Study Act (PDSA) cycle (Deming 1986) and consistent with leading FOI conceptualizations (Century et al. 2010), which our team has discussed elsewhere in the context of our school-based mindfulness research (Feagans Gould et al. 2014). We have termed this framework the CORE cycle, as it involves the following steps: (C) Conceptualize core components; (O) Operationalize and measure; (R) Run analyses and review; and (E) Enhance and refine. Thus, we conceptualize the study of FOI as a four-step, iterative process that leads, over time, to a more refined theory of change, greater knowledge about the effective or core components of a program, and more rigorous measures of implementation integrity (see Figure 1). Below we briefly outline the four steps and their relevance to the study of FOI in school-based mindfulness and yoga programs.

Step 1: Define program core components and their relation to hypothesized outcomes—The aim of this step is to answer the question: *What should be implemented?* To judge whether a program is implemented faithfully, we must first identify the core components, also referred to as critical components (see Ruiz-Primo 2005; Century et al. 2012) that comprise the program. Core components are -- "the most essential and indispensable components of an intervention practice or program" (Fixen et al. 2005 p.24)—and the backbone of program fidelity. Core components have been conceptualized as being of two types: *structural* components (the content or activities to be delivered, say, as part of a manual) and *process* components (the manner in which content should be implemented, for instance, the modeling of compassionate responses by program instructors) (Century et al. 2012). Identification of core components transforms an intervention from a "black box" to a set of elements that can be measured and assessed.

Development of a programmatic logic model--sometimes called a theory of change—is also critical and goes hand in hand with specification of core program components. A logic model guides measurement and analysis by specifying how each program core component, or combinations of components, should lead to hypothesized outcomes. For instance, program developers may predict that focused attention training through awareness of the breath will enhance capacities for self-regulation, leading to downstream improvements in students' behavior and performance in class. A logic model generally draws on relevant theoretical perspectives and empirical findings from the literature, e.g., an evidence base supporting links between self-regulation and classroom behavior. Ideally, there is logic not only behind specification of the hypothesized core components but also to support other aspects of a program like the sequencing of intervention activities and program dosing.

Step 2: Operationalize and measure the FOI of core program components—The aim of this step is to answer the question*: How will we know if a program is implemented with fidelity?* Once a program's core components have been articulated, an objective assessment system is needed to monitor fidelity of implementation to these core

components (Durlak 1998; Domitrovich & Greenberg 2000). There are four commonly agreed-upon dimensions of fidelity (Dane & Schneider 1998; Dusenbury, Brannigan, Falco, & Hansen 2003): 1) *Adherence* - the extent to which the core components were implemented as designed; 2) *Dosage* - the amount of the intervention received by participants; 3) *Quality* - the extent to which an instructor delivered program content as intended; and 4) *Responsiveness* - the extent to which participants were engaged in the program. Assessing multiple dimensions of fidelity is preferable, not only because it offers a more well-rounded assessment of these various aspects of FOI, but also because evidence shows that each has the potential to be a critical dimension fostering participant outcomes (Durlak & Dupre 2008).

Measures of each dimension of FOI should be reliable and valid, using the same standards applied to intervention outcome measures (Domitrovich & Greenberg 2000; O'Donnell 2008). Collecting FOI data from multiple reporters is desirable, particularly using "objective" measures, such as observational coding of intervention sessions by coders because these are typically more highly correlated with program outcomes than instructor-reported data, which are prone to bias (Dane & Schneider 1998). Along with developing reliable and valid measures, *a priori* criteria for what constitutes implementation "as intended" or "not as intended" must be defined and operationalized in terms of the measures being used. For example, it is helpful to create a cut-off for the number of sessions a participant must attend or the extent of training a teacher must receive in order to qualify as a sufficient "dose." Another way to operationalize as intended is to create categories of "low," "medium," and 'high" dosage. The important point is that these criteria are defined *a priori* within a single study, so that they are theoretically informed. Across replication trials, however, specific cut-offs can be empirically informed by results.

Two final aspects of rigorously assessing FOI are the monitoring of control/comparison conditions and reporting adaptations made to the program during implementation (Durlak & Dupre 2008). Monitoring control/comparison conditions involves describing the nature and amount of services received by members of comparison conditions because it is often incorrectly assumed that controls do not receive any services, but this is almost never the case in school-based studies (Durlak 1985). In order to fully understand control-comparison condition differences, FOI data can be collected to inform differential uptake of the IV and therefore a more accurate picture of the unique value of an intervention. In addition, collecting data on what meaningful adaptations were made to program delivery is important as sometimes such adaptations have been found to have adverse effects on outcomes, and other times adaptations based on context or the specific characteristics of recipients have been found to improve impacts (Durlak & Dupre 2008).

Developing and refining valid and reliable measures for each of the four dimensions of FOI is a challenging process that takes time and may also require additional resources, such as recording of intervention sessions and training independent coders. Given the iterative nature of the process, FOI measures for a given intervention have potential to improve following initial formative work, as the program components are increasingly refined and as implementation issues are better understood.

Step 3: Analyze FOI data and report findings—This step may address a variety of questions, including: *Was the program implemented as intended? If variation in implementation exists, to what extent are outcomes affected*? It is important for researchers to report the level of FOI in studies on school-based mindfulness and yoga programs to document the implementation quality associated with particular outcomes and to identify potential variation in program implementation across intervention instructors and/or sites. If variation exists, researchers should gauge whether FOI was so low that participants did not in fact receive what would be considered a minimally effective dose of the program. If there is sufficient variation in FOI, evaluators can also categorize intervention groups, classrooms, or schools by levels of FOI to test whether variation is related to outcomes. When such analyses are performed they help us answer important questions like "what is the dosage or frequency needed to produce certain level of outcomes?"

Step 4: Enhance and refine the logic model and FOI measures based on findings from FOI data—This step aims to address the question, *What did we learn about a program and FOI measures?* Researchers should ideally use FOI data to reflect on their hypothesized core components and logic model. Rigorous measurement and analysis of FOI can facilitate the iterative learning cycle of program development. FOI analyses within a given study can refine understanding of why and under what conditions a program works. Across programs, such analyses can move the field towards identification of best practices or common active ingredients, a key next step in the growing new field of school-based mindfulness and yoga interventions research.

Aims of the current review

Given the importance of FOI for building a robust and informative evidence-base, we reviewed the current state of the science with respect to inclusion and reporting of FOI in studies on school-based mindfulness and yoga interventions. We focused on the extent to which: 1) hypothesized program core components and logic models are specified in the literature; 2) FOI is being rigorously assessed and reported; and 3) the relationship between FOI and program outcomes is being reported. We hope this paper will offer useful suggestions for school-based mindfulness researchers beginning to tackle the challenges of FOI measurement and analysis. Synthesizing FOI data across studies also provides an opportunity to reflect on the commonalities across specified core components and logic models and the utility of particular FOI measures. Consideration of these questions is intended to help advance the emerging field of school-based mindfulness and yoga interventions.

Method

Information sources and searches

To identify potentially relevant articles, we searched two databases, PsycInfo and Web of Science, from their inception to May 2014 using combinations of the terms *mindfulness, mindful*, *yoga*, *meditation*, *school*, *education*, *program, students*, and *teachers*. We also searched reference lists in relevant review articles.

Study selection

To be selected for inclusion, a study was required to meet the following criteria: 1) assessment of a program for students and/or teachers whose primary content was mindfulness-based practices or yoga-based movement, 2) program delivery in a school setting--either during or after the school day—in grades kindergarten through twelfth grade (K-12), 3) program delivery in the United States or Canada, 4) Experimental, Quasi-experimental, or single group study designs with a sample size of greater than five participants (consistent with Meiklejohn et al. 2012), 5) publication in a peer-reviewed journal or book chapter, and 6) publication in English. We chose to focus on mindfulness and yoga-based programs because these are the most widely-used forms of contemplative practices secularly implemented and studied in school settings (Greenberg & Harris 2012). Our focus on grades K-12 was motivated by the focus of this special issue on school-based mindfulness programs for youth. We chose to limit our review to programs delivered in North America as we anticipated that these programs and school settings would be most comparable and thus most amenable to this initial attempt at synthesis of FOI measurement. Questions regarding whether or not a study met eligibility criteria were discussed among two or more co-authors until consensus was reached. In three instances when it was unclear if a study met inclusion criteria based on the full text of an article, the lead author contacted the corresponding author to provide additional details.

Data abstraction

The lead author abstracted the following data from each study included in the review within the following broad domains:

Program and study characteristics included primary program focus, program approach, program session length, frequency, duration, and format, grade-level of school setting, when and where a program was implemented within the school setting, study design, sample size, and number of schools and classrooms in which a program was implemented. These variables capture the potential variation in program focus and implementation methods as well as the kinds of studies conducted to date. *Primary program focus* refers to whether the intervention content consisted mostly of “Meditation,” “Yoga;” or “Combined Meditation and Yoga.” In order for a program to be categorized as “primarily meditation,” the primary program practices and components, as described in the article, included forms of meditation such as open-monitoring, focused attention, and/or loving kindness/compassion practices (see Ricard, Lutz, & Davidson 2014; Roeser & Pinela 2014 for further discussion of forms of meditation). For a program to be “primarily yoga,” the predominate program practices and components, as described in the article, included yoga –based physical movements (e.g. asanas) and embodied practices. For programs categorized as “combined meditation and yoga,” the program focus was relatively equally distributed across meditation and yoga practices and components. *Program approach* is based on the major approaches outlined by Meiklejohn and colleagues (2012) to characterize school-based mindfulness programs as directly targeting students, indirectly delivering to teachers or delivering program components to both students and teachers.

Theoretical rationale underpinning core program components included whether a study articulated the core or potentially essential program components and theoretical underpinnings for the program being evaluated. For this domain, we extracted the language used to describe the main program components and any rationale for these components, coded whether key or core program components were articulated (as opposed to simply describing components of the program without any reference to their centrality to program theory), as well as whether or not a logic model was included.

FOI rigor and reporting categorized whether a study assessed each of the four dimensions of FOI (i.e. adherence, quality, dosage, and responsiveness), what measures were used to assess each dimension, if multiple measures were used to assess a single dimension, if reliability or validity of measures were assessed, if any *a priori* criteria for "high" or "low" levels of FOI were set, if FOI was monitored in the control/comparison condition, and if and what adaptions made during implementation were reported. We also recorded whether and how levels of FOI were reported and whether there was any variation in FOI across different instances of program delivery in the study.

FOI associations with outcomes categorized whether a study assessed the association of FOI aspects with outcomes and, if yes, briefly summarized the findings.

Results

Our literature search identified 312 citations, from which 60 articles were retrieved and 48 judged to meet study criteria and retained (see Figure 2). Additional details about the programs and studies included as well as select categories of data extracted are included in Appendix A.

Program and study characteristics

The 48 studies included here evaluated the impact of 35 different mindfulness and yoga programs implemented in school settings. Of these 35 programs, 22 (63%) were primarily meditation-based; many of these were adapted from the standard MBSR program (Kabat-Zinn 1990). Eight programs (23%) were primarily yoga-based, focusing on physical postures (asanas), deep breathing, relaxation, and some meditation. The remaining 5 programs (14%) focused equally on meditation and yoga practices. Twenty-four programs (69%) targeted students, 8 programs (23%) targeted teachers, and 3 programs (8%) targeted both students and teachers.

The manner in which these programs were structured and delivered varied across the 48 studies. Specifically, the total number of sessions delivered ranged from 5 to 180 and the length of sessions ranged from "a few minutes" to weekend-long retreats. The most common session length was between 30 to 60 minutes (approximately one class-period). The intensity of program delivery varied from program components being delivered every school day to every couple of weeks. The shortest program duration (from start to end of program delivery) was 2 weeks while the longest duration was 12-months. Finally, programs utilized various session formats including individual sessions, group meetings and/or lessons, individual coaching calls, full-day long sessions, and weekend residential retreats.

Nineteen studies (40%) evaluated programs implemented in elementary schools, 8% in middle schools, 31% in high schools, and 10% across multiple K-12 school settings. Five studies (10%) did not report the grade levels in which programs were implemented. Thirty-five studies (73%) implemented programs during school hours, either integrated into classroom activities, during health class, physical education, a resource period, or briefly at the start or end of the school day. Eleven studies (23%), most of which targeted teachers, implemented programs outside school hours, either directly after school, in the evenings, or on weekends. Two studies (4%)--both programs targeting students and teachers--implemented the student component during school hours and the teacher component outside school hours. Four of the studies (8%) implemented programs either during summer camp within a school setting or during summer teacher professional development.

In addition to program and implementation differences, there was variation in study designs and sample sizes. Of the 48 studies included, 26 (54%) were experimental designs or randomized control trials (RCTS), 13 (27%) were quasi-experimental (QEDS) and 10 (21%) were single-group designs (the total number of study designs equals 49 because one article (Jennings et al. 2011) included a larger study comprised of two sub-studies). Sample sizes ranged from 8 to 409. Three-fourths (or 75%) of studies had a total sample size of less than 100. Most studies were implemented in 1 or 2 schools or a few classrooms, although several studies implemented a program in more than 15 classrooms (Black & Fernando 2013; Lantieri et al. 2011), suggesting variation in scope of program implementation.

Specification of program core components and their association with relevant outcomes

Most often, potential program core components were not clearly articulated in studies. Almost all of the studies provided a general description of program content by summarizing the major lesson themes or content in the order taught, the instructional or pedagogical techniques used to engage participants in learning, the key practices taught (e.g. awareness of breathing or physical postures), and/or the overall program goals. Many programs were described as being “adapted” from more established interventions such as MBSR (Kabat-Zinn 1990), Semple’s work (Semple et al. 2005), or Mind-Body Awareness which combines aspects of MBSR and Social Emotional Learning (SEL). For these adapted programs, many studies described the program in terms of how they differed or were adapted from the original program. Only a handful of studies identified program components in terms of being “key,” “core,” or “essential.” There were no studies that formally distinguished potential structural core components from process core components.

While the majority of studies outlined a general theory of anticipated programmatic impacts based on the effects of mindfulness or yoga programs more broadly, only 3 (6%) published or referenced a logic model or theory of change (Jennings et al. 2013; Mendelson et al. 2010; Roeser et al. 2013). In addition, only a handful of studies included more specified programmatic theory – that is, theory specifying the rationale for inclusion of specific program components and how those components were intended to produce specific outcomes or contribute to participant engagement. Not surprisingly, these were also the studies that distinguished program components in terms of being “key” or “core.” These programs and studies included: Learning to BREATHE ((Metz et al, 2013), Mindfulness

Education (ME) Program (Schonert-Reichl & Lawlor 2010), Cultivating Awareness and Resilience in Education (CARE) (Jennings et. al. 2013), Moving into Learning (MIL) (Klatt et al. 2013), SMART-in-Education Program (Roeser et al. 2013), and a Kripalu-based Yoga Program (Noggle et al. 2012).

The Cultivating Awareness and Resilience in Education (CARE) program (Jennings et al. 2010; Jennings et al. 2013) and the SMART-in-Education Program (Roeser et al. 2013) are noteworthy with respect to articulating program components and theoretical underpinnings. Jennings and her colleagues (2013) outlined a CARE intervention logic model that specifies the main program components and the proximal and long-term outcomes hypothesized to result from program implementation. Each of the three main components - Emotion Skills Instruction, Mindfulness Practices, and Compassion Practices – was described in terms of the rationale and empirical evidence behind its inclusion, the approximate percentage of the program devoted to it, as well as the specific kinds of activities delivered as part of each. Roeser and his colleagues outline very specific programmatic theory in terms of how mindful self-regulation skills and self-compassionate mind-sets for coping are hypothesized to impact specific mechanisms underlying regulation. They also outline the main program components in terms of teaching/pedagogical techniques and specific practices to facilitate experiential learning. In addition, their programmatic logic model includes program fidelity as an important facilitator of producing hypothesized program effects.

FOI rigor and reporting

Based on our criteria and coding, the majority of studies - 30 out of 48 or 63% of the studies reviewed -assessed at least one dimension of FOI. Nine studies (just under 20%) assessed 2 or 3 dimension of FOI. No study we reviewed assessed all 4 dimensions of FOI. Eighteen studies (37%) did not assess any aspect of FOI. Table 1 provides a summary of the number and percent of studies that assessed and reported FOI data in a rigorous manner.

The most commonly assessed dimension of FOI was participant dosage. Dosage was evaluated in two ways: participant *attendance* at program sessions and participant *outside practice* (i.e., the frequency of mindfulness practice at home or outside of formal program time). Almost half the studies (23 of 48) assessed one or both of these aspects of participant dosage. Fewer than 20% of studies assessed program adherence, program quality, or participant responsiveness (see Table 1 for greater detail).

Rigorous FOI assessment is also characterized by at least two rating sources for a single dimension, observational measures, testing of reliability and validity, *a priori* cut-offs for program delivery “as intended,” monitoring of control/comparison conditions, and reporting any adaptations made during program delivery. Nine studies (19%) used some kind of observational measure to assess an aspect of FOI, although only two studies (Koenig et al. 2012 & Peck et al. 2005) reported the number of items comprising an observational measure and/or how often observations were conducted. Five studies (10%) used more than one source of data to assess a single dimension of FOI, using both a self-report checklist for the intervention facilitator and an observational assessment, generally of program adherence. None evaluated the convergent validity of these measures. One study assessed the reliability of an observational measure across two independent coders (Koenig et al. 2012).

Four studies (8%) established cut-offs for some aspect of FOI. Three of the four studies defined “program completers” based on the number of sessions attended, specifying that participants must attend at least 66%, 73%, or 100% of sessions in order to qualify as a “program completer.” The other study (Koenig et al. 2012) established an *a priori* cut off for what “good” implementation would entail. This study used 5 categories to construct a 16-point scale on which a score of 12–16 indicates “good” implementation. Five studies (13% of studies including a control/comparison condition) assessed an aspect of FOI in both experimental and control conditions (Barnes et al. 2001; Barnes et al. 2004; Gregogski et al. 2011; Hagins et al. 2013; & Napoli et al. 2005). All five experimental studies assessed dosage, namely attendance, in both experimental and active control conditions. Two of the studies assessed participant responsiveness and one study instructor quality in both experimental and control conditions. Three studies (6%) reported adaptations made to program delivery (Jennings et al. 2011; Khalsa et al. 2012, Lagor et al. 2013). Program adaptations included modifying curriculum delivery to fit a 50-minute format rather than the originally designed 60-minute format, cancelling a number of sessions due to school events, and cancelling a training session due to a heavy snow storm and condensing that material into one of the final sessions.

The most common way to report participant dosage data was the average percent of lessons attended by participants or the percent of participants attending a certain proportion of lessons (e.g. over 75% or all lessons offered). Across studies these average attendance rates varied and variation was typically reported as a range or standard deviation around the mean. For outside practice most studies reported the average number of days per week or average number of minutes per day participants engaged in practice outside of class or at home. Several studies reported “compliance” meaning the percent of participants reporting that they complied with suggested guidelines for outside practice.

Adherence was generally reported quantitatively as an average and/or range of lessons or percent of lesson components implemented by instructors. The vast majority of studies that assessed adherence in this manner reported “moderate” to “high” fidelity – with “moderate” the label for 70–80% of lessons/content and “high” as being over 80% adherence. Numerous studies reported instructors implemented a program with “high fidelity” without any numerical quantification or qualification, including several studies that stated a program was implemented with “high” or 100% fidelity because the program was implemented by the program developers.

For responsiveness, most studies reported the average participant engagement or percent of participants “maximally,” “moderately,” or “minimally” engaged or the percent of poses in which participants were at least moderately engaged. Several studies reported the average class enthusiasm and attentiveness. Most studies have reported fairly good participant engagement – although one study looked at engagement over the course of a program, and engagement decreased slightly over time (Hagins et al. 2013). One study used qualitative data to describe the process of engagement occurring over course of program (Linden 1973). Program Quality was typically reported as average competency ratings for all instructors or average participant-reported quality, content, and structure of lessons.

FOI associations with program outcomes

Six studies (13%) examined the association between some aspect of FOI and at least one participant outcome. All six assessed an aspect(s) of participant dosage in relation to participant outcomes. In one study, for students practicing four or more days per week outside of class compared to those who only practiced in class, overall somatic complaints were reduced and specific somatic complaints of dizziness and feeling over-tired increased (Broderick & Metz 2009). In another study, teachers' amount of meditation practice (operationalized as the number of days teachers reported practicing meditation 20 min or more) was associated with lower blood pressure reactivity and greater reductions in physiological arousal in response to threat, lower trait anxiety, and higher mindfulness, although not with social behavior in a marital task or compassionate responding (Kemeny et al. 2012).

Khalsa and colleagues examined correlations between session attendance at a yoga program and several outcome measures and found that, as hypothesized, better attendance was associated with greater well-being and life satisfaction (Khalsa et al. 2012). They also found a significant inverse correlation of attendance with anxiety and negative attitudes toward school. In another study, the effects of Breathing Awareness Meditation on sodium handling, an indicator of behavioral stress and a precursor to high blood pressure, in African American youth at risk for high blood pressure were only evident when they excluded participants attending less than 70% of sessions (Barnes et al. 2008). White (2012) examined the association between participant dosage variables (attendance and amount of home practice) and four outcome variables (stress, coping, self-esteem, and self-regulation). Findings indicated a positive correlation between home yoga practice and perceived stress. Not all studies assessing the relationship between dosage and outcomes, however, have reported significant associations (e.g., Noggle et al. 2012).

Discussion

The aim of this review was to assess the current state of science with respect to inclusion and reporting of FOI in studies of school-based mindfulness and yoga interventions in North America. The review was framed around the CORE process model, which emphasizes the iterative nature of developing and testing program theory using increasingly rigorous FOI assessment as research moves from the formative stage to large scale effectiveness trials (Feagans Gould et al. 2014; IES 2013). Consequently, it is important to consider the rigor of study designs as a whole, when evaluating the "rigor" of FOI to this point. The 48 studies reviewed here were predominantly small-scale efficacy studies to test the preliminary feasibility and potential outcomes of school-based mindfulness and/or yoga programs with sample sizes of less than 100 participants in a few classrooms or schools. To that end, the state of the field overall can be considered relatively preliminary or "emerging" (Greenberg & Harris 2012; Meiklejohn et al. 2012; Weare 2013).

Given the preliminary stage of research in this field as a whole, we were encouraged by several pockets of "rigor" within each of the criteria outlined. These included: 1) several programs outlined potential "core" program components and articulated the theoretical rationale behind their inclusion and their relation to hypothesized outcomes, 2) over half of

the studies (63%) assessed at least one dimension of FOI, which most often entailed assessing an aspect of participant dosage – either attendance or outside practice, 3) just under 20% of studies utilized some kind of observational assessment to measure an aspect of FOI, 4) 10% of studies monitored an aspect of dosage within control/comparison conditions, and 5) 13% of studies examined the relationship between an aspect of FOI – in all cases participant dosage – and relevant outcomes and reported on both significant and non-significant findings. These elements of rigor indicate that there is some important groundwork being laid for the assessment and reporting of FOI for school-based mindfulness and yoga studies in North America.

More rarely occurring aspects of rigor (appearing in 6% or less of studies unless otherwise noted) included: 1) referencing a programmatic logic model, 2) distinguishing between structural and process program elements, 3) assessing other potentially meaningful dimensions of FOI - including program adherence, quality, and participant responsiveness - which were reported in less than 20% of published studies, 4) using multiple data sources for a single FOI construct, 5) examining reliability and validity of FOI measures, 6) establishing a priori cut-offs for “adequate” or “low” FOI, and 7) reporting any significant adaptations made to program delivery. These less frequently occurring areas of rigor represent important areas for continued focus, discussion and development.

In our view, the emerging state of the field presents a *critical window of opportunity* to increase the intentionality, theoretical reflection, and rigor of FOI for school-based mindfulness and yoga programming. Rigorous FOI is *critical* because evidence suggests that program fidelity leads to better outcomes (approximately 2 to 3 times the magnitude) and program outcomes are sensitive to variation in implementation fidelity (Durlak & DuPre 2008; Kutash et al. 2012). School contexts pose multiple challenges for consistent and high quality implementation of yoga and mindfulness programs (Mendelson et al. 2013). Therefore, without rigorous assessment of FOI, the evidence base upon which our conclusions rest will fall prey to many threats to internal validity including the potential to falsely conclude a program failed to find effects because its central components are ineffective, rather than poorly implemented (Domitrovich & Greenberg 2000).

Increased attention to FOI is *timely* because of the growing popularity and preliminary promising effects of school-based mindfulness and yoga programs. The field is now moving toward larger scale studies in which the number of classrooms and variation in implementation contexts will increase, making issues of implementation paramount both to the conclusions we can draw and our ability to understand how and under what conditions these programs may impact outcomes. The need for more rigorous FOI work is supported by the current review in which we found a relative paucity of rigorous FOI assessment and reporting as well as substantial variation in program characteristics, foci, and levels of FOI (when reported). In service of optimizing this window of opportunity, we offer below a series of recommendations for increasing both the intentionality and rigor of FOI for mindfulness and yoga programs implemented in school settings.

Recommendation 1: Clearly define core program components

Clearly articulating potential core program components and their underlying theoretical rationale, both within and across studies, is potentially the most important next step for the field. Only a handful of studies (10% of those reviewed) articulated potential core components and even fewer (6%) referenced or included a logic model or theory of action. Articulating potential core program components can, and should, be initiated even in formative studies because it defines the essential features of the program being delivered and provides a road-map for both FOI measures as well as training of facilitators to effectively deliver program curricula (Fixsen et al. 2005). Without clearly defining essential program components, researchers cannot develop and refine appropriate FOI measures. As studies move from small-scale efficacy to effectiveness and scale-up, potential core components provide guidance for what "should" be implemented across instructor, setting, and context and how variation in FOI of those components might relate to relevant participant outcomes. Consequently, researchers and program developers should reflect on a program's essential features, articulate the theoretical and empirical rationale for their inclusion, and formally articulate how those components individually or in combination should relate to hypothesized proximal and distal outcomes, ideally in a formal logic model. The Cultivating Awareness and Resilience in Education (CARE) (Jennings et. al. 2013) and the SMART-in-Education Program (Roeser et al. 2013) may provide helpful examples of school-based mindfulness programs for which potential core components and logic models have been well articulated.

In addition, clearly articulating the core components of mindfulness and yoga programs can help improve the replicability of programs and move us from effective *programs* to effective *practices* (Jones & Bouffard 2012). That is, clearly specifying core components helps clarify what practices and approaches various programs have in common and what distinguishes them from one another and from traditional SEL programs. This process facilitates comparisons across program, which are key for identifying and testing the relative effectiveness of common program elements. For example, leading scholars categorize mindfulness practices into various forms of meditation which include: focused attention practices (focusing on the in and out cycle of breathing or another chosen anchor), open monitoring practices (observing sights, sounds and other sensations or whatever arises in one's present moment experience), and compassion or directive practices (cultivating a feeling of benevolence and kindness toward oneself and/or others) (Ricard et al. 2014; Roeser & Pinela 2014). Mindful movement which includes yoga and tai-chi, is another category of practice in which attention and awareness is focused on the breath, whole body, and movement (Roeser & Pinela 2014). By conceptually grouping practices into these core categories – research can test the unique contribution of each kind of practice to individual outcomes as well as how these practices might have common impact (see Ricard et al. 2014).

As part of the current review, we attempted to evaluate whether certain kinds of components were common across studies, but found that a lack of specificity and shared language made it difficult to determine the extent to which components were the same or different. Generally speaking, program components articulated across studies appeared to fall into

several categories: a) themes or lesson content (e.g. slowing down, self-awareness and knowledge, integrating mindfulness into everyday life), b) actual practices taught (e.g. awareness of breath practices, asanas (or postures), compassion practices), and c) pedagogical methods used (e.g. facilitating group discussion, guided practice, experiential learning techniques). Classifying core program components into these broad categories might help facilitate a common way of conceptualizing potential core program components within the field. The program elements that fall into the first two categories (themes or lesson content and the practices taught) are consistent with potential core *content components* in that they address "what" should be implemented. These content components may inform and provide the backbone of a program manual (Century et al. 2010). The kinds of program elements that fall into the third category, pedagogical methods, are more consistent with potential core *process components* in that they address the "how" or the manner in which the content is delivered – say through skillfully guiding a group discussion and inquiry. Such core *process components* are more likely to inform the training of program facilitators to effectively deliver material.

Recommendation 2: Clearly articulate core process components

Within the peer-reviewed literature on school-based mindfulness and yoga, there has been a relative *over-focus on defining core content components* (and assessing adherence to them) and an *under-focus on the importance of process components*. For example, most studies clearly articulated the rationale for teaching mindfulness or awareness practices such as breathing techniques, concentration practices, physical postures, directive practices, and meditation and provided empirical support for their inclusion. Less often fully articulated and supported by rationale and empirical support are the potential core process components – like facilitating appreciative inquiry or modeling human compassion. Yet, the manner and skill with which instructors are able to deliver the material are likely just, if not more, essential program components to implement with fidelity. *Thoughtfully articulating core process components, the rationale for their inclusion, and incorporating them into logic models that specify how such processes might play a role in enhancing participant responsiveness and relevant outcomes is a much-needed next step in the field*.

Two studies reviewed here may serve as useful examples of outlining a core process component of a program, including Klatt and colleagues (2013) who described *appreciative inquiry* as part of the Moving into Learning (MIL) Program and Roeser and colleagues (2013) who describe *experiential learning* as a key aspect of the SMART-in-Education Program. Both of these possible core process components are not necessarily unique to mindfulness-based interventions and may reflect "active forms of learning," which has been identified as one of the four key elements of effective SEL programs (Jones & Bouffard 2012). We encourage researchers and program developers to look to more established literatures like SEL and prevention and promotion programs to help inform potential core process components of mindfulness and yoga programs.

Process components *specific* to mindfulness or yoga programs will also need to be elucidated and tested. For example, ideally, instructors of mindfulness-based programs embody qualities of mindfulness as a vehicle for teaching it and engaging students in

participatory learning in their own lives (Crane et al. 2012a; Kabat-Zinn 2011). It is consistent with the nature of mindfulness to be “in the moment” and to respond flexibly to students at a given point in time, rather than adhering rigidly to a manualized curriculum (Kabat-Zinn 2011). Indeed, flexibility and the ability of an instructor to respond in the present moment to what is unfolding should be an essential component of FOI of mindfulness and yoga programs. Yet defining and operationalizing such process components pose some interesting and complex challenges for assessing what instructors “should” adhere to faithfully.

Several lines of work might help inform this important inquiry. First, Rebecca Crane and her colleagues have developed assessment criteria for levels of competence in teaching mindfulness-based interventions (MBIs) (Crane et al. 2010; 2012a; 2012b). The criteria cover six domains of competence that include: coverage, pacing and organization of session curriculum, relational skills, embodiment of mindfulness, guiding mindfulness practices, conveying course themes throughout interactive inquiry and didactic teaching, and holding the group learning environment. These kinds of competencies are excellent potential core process elements to be considered and assessed for mindfulness-based programs more generally because they cover how programs should be delivered, while incorporating flexibility to adapt to the situation as essential aspects of competence itself. Although not formally articulated as essential program features, one study reviewed here adapted Crane and colleagues’ work as part of their adherence checklists completed at each session (Metz et al. 2013). Second, Patricia Dobkin and her colleagues have recently outlined a framework for balancing “fidelity” to the four chambers of MBSR, which include: form, content, instructor, and intention with the “imagination” of making appropriate adaptations to populations, occupation, and institutional regulations (Dobkin et al., 2013). This approach offers another way to conceptualize the essential features or core program components of mindfulness-based programs, allowing room for both fidelity and adaptation. We invite discussion regarding how these different teaching competencies—which balance faithfulness to a core set of standards with the ability to flexibly adapt to the current situation and participants--might serve as the backbone of potential core program process components, FOI assessment, and instructor training

Recommendation 3: Assess and report multiple dimensional of FOI

To date, there has been a heavy focus on dosage as a potentially meaningful aspect of FOI and less focus on adherence, quality, and responsiveness. Dosage was by far the most commonly assessed and reported dimension of FOI in the current review. Dosage is important to assess and report because the number of sessions attended by participants is consistently associated with stronger program impacts in other kinds of prevention programs (Berkel et al. 2011), and there is some evidence in yoga research in adults that dosage, particularly home practice, may be a strong indicator of health outcomes (Ross et al. 2012). In addition, neuro-scientific evidence provides a “scientific warrant” for educational interventions that aim, through sustained regular practice to cultivate attention, emotional regulation and empathy (Davidson et al. 2012; Diamond & Lee 2011). Consequently, dosage is and will continue to be an important aspect of FOI for school-based contemplative programs to examine. In the future, researchers may want to consider the multi-dimensional

nature of dosage itself, which can include duration, number of classes per week or month, number of minutes per class, duration, and home practice (see Cook-Cottone 2013).

Dosage alone, however, is not an adequate measure of FOI. Other key aspects of FOI include program adherence, quality, and participant responsiveness. Fewer than 20% of the studies reviewed here assessed one of these potentially influential dimensions of FOI. In other areas of prevention research, these aspects of FOI have shown positive relations with program outcomes (Berkel et al. 2011). For example, program quality--which in other social programming entails the facilitators' use of interactive teaching methods, clinical process skills, and facilitating cohesion among participants--has been an important predictor of program outcomes (Coatsworth et al. 2006; Dane & Schneider 1998; Durlak & Dupre 2008; Forgatch et al. 2005). These kind of skills are theoretically consistent with some of the potential core process components described in the studies reviewed here – which included interactive learning, establishing trust in group as a safe place for disclosure, and activating student interest as important elements of program content. Assessing multiple dimensions of FOI for mindfulness and yoga programs implemented in school settings can help identify additionally important aspects of FOI, outside of dosage. Useful examples of studies that have assessed and reported at least three dimensions of FOI include Roeser et al. 2013, Benn et al. 2012, Gregoski et al. 2011, Steiner et al. 2013, and Feagans Gould et al. 2014.

Recommendation 4: Develop observational assessment systems and common FOI measures

It is also important to increase the precision and validity with which we measure specific dimensions of FOI. Very few studies have started to address these aspects of FOI rigor which likely reflects both the preliminary nature of many of the studies and limited resources to develop such resource-intense assessment systems. Yet, the validity of the conclusions we draw depends on accurate measurement of relevant FOI constructs. The development of sound observational measures is particularly important as they are more highly correlated with program outcomes than instructor-reported measures, which are prone to bias (Dane & Schneider 1998). In addition, observational measures are particularly important for assessing core process components. Consequently, *developing observational assessments systems to assess meaningful FOI dimensions is an important next undertaking to advance the field*.

Given both the importance and resource-intensive nature of developing reliable and valid FOI measures, particularly observational assessments, it might be useful to *develop common FOI assessments* that can be shared across research teams and programs. For example, researcher teams with more resources to devote to FOI could adapt rubrics like the ones developed by Crane and her colleagues--which are available at no cost online (Crane et al. 2012)--for school-based programs. Other programs might then incorporate such observational measures of core program processes into their own FOI assessment system and continue to test and provide feedback on their reliability and validity. In this way, sharing measures helps conserve resources, encourages dialogue across teams, and increases the potential to produce reliable and valid instruments that have been evaluated across a diverse range of programs and participants.

Recommendation 5: Build common FOI language and frameworks

There was considerable variability in the studies reviewed regarding the definition of FOI and related constructs. For example, in some studies "dosage" referred to the number of sessions delivered, while in others it signified the number of sessions attended by participants. In some studies, the term "fidelity" was synonymous with "adherence," in others it referred to a combination of FOI dimensions, and other studies did not clearly define the term. These inconsistencies make it difficult to build a coherent knowledge base on FOI. For example, we had to decide whether to categorize outside practice as an aspect of participant dosage or of participant responsiveness. Our choice, based mostly on what has been done in yoga and mindfulness research to date, has ramifications for the conclusions we draw about dosage as an important aspect of FOI for school-based mindfulness and yoga programs. *Establishing commonality in FOI terms and definitions as well as generating discussion around FOI frameworks may facilitate a more coherent knowledge base to work from*. Frameworks can help build a common understanding of the essential FOI elements to be considered, the interconnectedness of those elements and how they are related to each other and to participant outcomes. It would be beneficial to draw from other related literatures that have more longstanding histories of studying FOI.

Berkel and colleagues (2011) have proposed a framework that may serve as a useful starting point, in which they distinguished between FOI dimensions related to facilitator and participant behaviors. Specifically, dimensions of adherence, quality, and adaptations are all considered aspects of *facilitator behaviors*, which occur within the delivery of program sessions and represent potential sources of disconnect between the program as designed and as intended. These *facilitator behaviors* are related to *participant responsiveness* (including attendance, active participation, home practice, and satisfaction), which, in turn, relate to program outcomes. There are several strengths of this FOI framework. First, it highlights the interconnectedness of FOI dimensions and their joint influence on outcomes, consistent with literature in prevention science (Rohrback et al. 2010). Second, this framework delineates what is within the control of program implementers (and hence what can be improved through training, monitoring or facilitator selection) and what is related to how participants respond (which depends on both the quality of facilitator behaviors and the characteristics of the participants being targeted). Within this framework, participant behaviors (e.g. attendance, home practice, and active participation) would be considered more proximal predictors of program outcomes that are influenced by facilitator behaviors (e.g. program quality and adherence).

Limitations

Despite the systematic nature of this review, it is important to highlight potential limitations of the findings reported and conclusions drawn here. First, findings reported in the current review are limited by what is reported in a particular peer-review publication or book chapter. Evaluation teams must decide what to include within the limited journal space allotted (particularly in health and medical fields) to describe a particular intervention and its implementation. Fully describing program components, FOI measures, and reporting FOI findings must be weighed against reporting other meaningful aspects of study designs and findings. Consequently, our assessment of the rigor of FOI is based only on what is being

published in peer-reviewed article, which may not reflect the full amount of FOI work being conducted. Although we did not review additional sources of information on program components, several studies referenced other publications or provided hyperlinks to online supplemental materials (Hagins et al. 2013; Sibinga et al. 2013). These are useful strategies to balance space limitations with providing more comprehensive explanations of program theory or FOI measures.

Second, the current review was limited to programs implemented in school settings in North America. We made this decision in order to limit potential heterogeneity related, for example, to diverse educational cultures and/or historical lineage of mindfulness and yoga programs. We recognize however, that there are many rigorous and informative studies being conducted in countries outside North America that deserve careful attention. For example, Kuyken and colleagues evaluating the Mindfulness in Schools Programme (MiSP), have articulated some key "principles" of effective school-based programs teaching social emotional competence – one of which is program implementation that pays close attention to fidelity (Kuyken et al. 2013). They also conducted analyses to test the relationship between outside practice and several outcomes and found that more frequent use of mindfulness practices outside of class was associated with higher well-being scores at post-intervention and follow-up, lower depression scores at post-intervention and lower stress scores at follow-up. Because we did not include such studies in the current review, we do not know the extent to which programs implemented outside North America are rigorously assessing FOI. These studies merit attention, and the core program components and methods used to assess FOI they report should undoubtedly be included in the ongoing conversation in the field.

Final reflections

Rigorously assessing FOI is an essential component of building a rigorous evidence base. As Joseph Durlak and Emily DuPre eloquently stated in their seminal 2008 paper, "science cannot study what it cannot measure accurately and cannot measure what it does not define" (p. 342). Therefore, if we fail to systematically identify and measure the FOI of core program components of school-based mindfulness and yoga programs harnessing the power of the scientific method, we will not understand the potential importance of these aspects to producing the very outcomes we aim to foster. At the same time, we, as scientists and practitioners, must remain open to the full ramifications of mindfulness as a way of being and knowing, and acknowledge the limitations of the scientific method to know *everything*. Indeed science offers one meaningful voice, in a larger conversation of what works, why, and under what conditions.

The current review highlights the current state of the science as well as some potential next steps in service of that larger conversation. Pressing next steps for the field include clearly articulating core program components and how they relate to hypothesized outcomes in a formal theory of change, focusing more explicitly on core process components, as well as assessing and reporting multiple dimensions of FOI (using observational measures when possible). It is critical that we work together to construct and share common FOI measures, language, and frameworks, utilizing the extensive literature in SEL as well as elaborating

aspects unique to mindfulness and yoga interventions. Our intention is that this review will serve as an invitation for dialogue and a call to action, prompting more rigorous assessment of FOI for school-based mindfulness and yoga programs and encouraging researchers and program developers to engage in an iterative learning cycle together.

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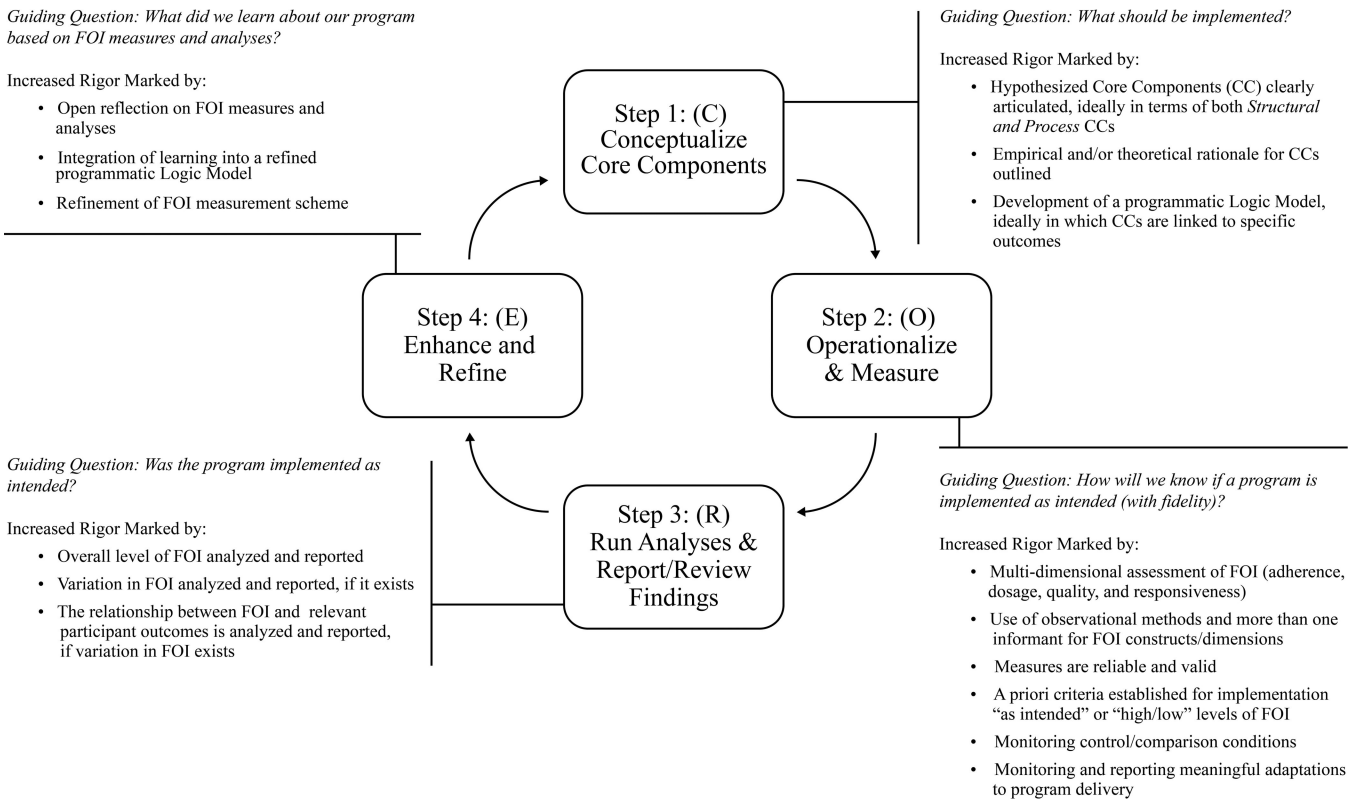

Fig. 1.
The CORE Process Model for Assessing Fidelity of Implementation (FOI)

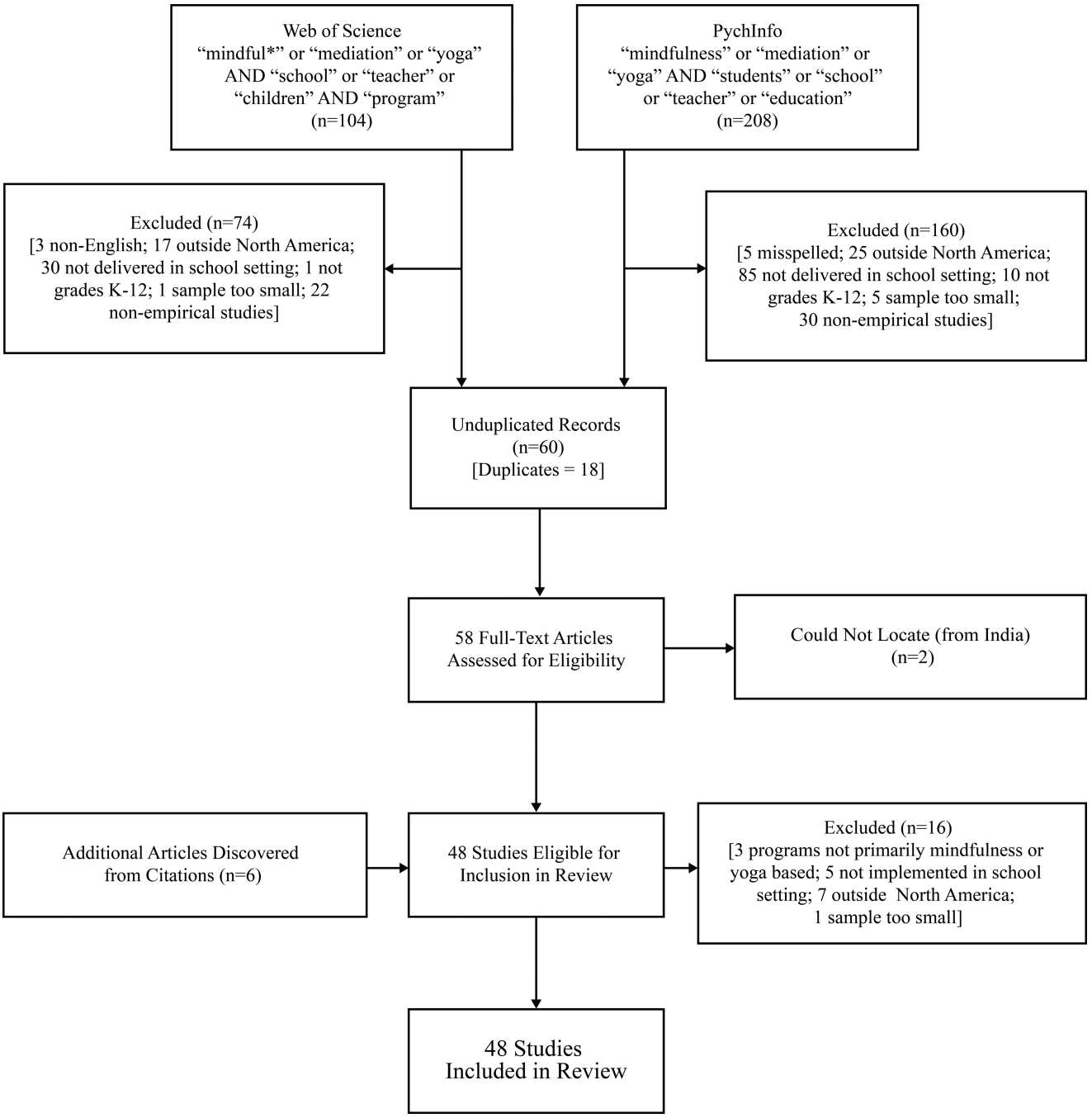

Fig. 2.
Flow Diagram of Relevant Article Identification and Selection

Table 1

Number and Percent of Reviewed Studies Collecting and Reporting FOI Data in Rigorous Manner for FOI Dimensions

FOI Dimension ***Sub-Dimension***	**Studies Measuring**	**Studies Using Observational Measures**	**Studies Where >1 Source Used**	**Studies Assessing Reliability or Validity**	**Studies Establishing A-Priori Cut-offs**	**Studies Monitoring Comparison Condition**	**Studies Reporting Adaptations**	**Studies Reporting Level of FOI**	**Studies Linking Aspect(s) of FOI to Outcomes**
Program Adherence	9 (19%)	7 (15%)	3 (6%)	1 (2%)	1 (2%)	0 (0%)	3 (6%)	8 (17%)	0 (0%)
Program Quality	5 (10%)	2 (4%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)	4 (8%)	0 (0%)
Participant Dosage	23 (48%)	1 (2%)	0 (0%)	0 (0%)	3 (6%)	5 (10%)	0 (0%)	22 (46%)	6 (13%)
Session Attendance	*16 (33%)*	*1 (2%)*	*0 (0%)*	*0 (0%)*	*3 (6%)*	*5 (10%)*	0 (0%)	*15 (31%)*	*3 (6%)*
Outside Practice	*16 (33%)*	*0 (0%)*	*0 (0%)*	*0 (0%)*	*0 (0%)*	1 (2%)	0 (0%)	*15 (31%)*	*3 (6%)*
Participant Responsiveness	7 (15%)	3 (6%)	1 (2%)	0 (0%)	0 (0%)	2 (4%)	0 (0%)	5 (10%)	0 (0%)

Mindfulness (N Y). Author manuscript; available in PMC 2017 February 01.

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Appendix A

List of Programs and Studies Reviewed and Select Categories of Data Extracted

Program		Study	Delivery Approach	Study Design	Session Delivery	FOI Dimensions Assessed and Measures Used				FOI Cut-Offs Established	FOI Reported	Linked to Outcomes
Program Name	***Core Components (CC) Articulated & Logic Model (LM) Included***	***Citation***	***Program targets Students, Teachers, or Both***	***Design (RCT; QED, Single Group); Level of Assign (School or Class); & # IUs (intervention units)***	***Total # Sessions Delivered, Weeks, and Length***	***Program Adherence***	***Program Quality***	***Participant Dosage***	***Participant Responsiveness***	***Were a priori cut-offs established?***	***Was any aspect of FOI reported? If so, what?***	***Was relationship between FOI and participant outcomes assessed?***
Learning to BREATHE	CC - Yes LM -No	Metz et. al. (2013)	Teachers	**Design:** QED pre-post, with instruction-as-usual comparison **Level:** School **IU:** 1 school	**Total #:** 6 thematic lessons broken up and delivered over 18 sessions **Weeks** 16 **Session Length** 15–25 minutes at beginning of class	**Measures.** teacher logs *(unclear # of items; at each lesson, however very few completed)* & observations by program staff *(unclear number of items - checklist; 5% of all sessions)*	**Measures.** teacher logs *(unclear number of items)* & observations by program staff (teacher enthusiasm and preparedness)	Unclear if Assessed	**Measures.** Observations (qualitative)	Not Reported	Adherence/Quality/Responsiveness: Descriptive statement: "Observations indicated lesson adherence, teacher, enthusiasm and preparedness and high student engagement" No teacher logs reported	No
		Broderick & Metz (2009)	Students	**Design:** QED pre-post, with portion of junior class as comparison **Level:** Classroom **IU:** 1 school - 7 sections of health class	**Total #:** 6 lessons per group (7 groups) **Weeks: @** 5 (could be as few as 3) **Session Length:** 32–43 minutes	Not Reported	Not Reported	**Measures.** How oftern practiced mindfulness outside of class (qualitative and then catgorized as 4 or more days/week, once a month to 3 days a week, and none)	Not Reported	Not Reported	Dosage. 65% of students reported practicing some mindfulness techniques otuside of class For those practicing 4 or more days per week outside of class, compared to those who only practiced in class, overall somatic complaints were reduced & specific somatic complaints of dizziness and feeling over-tired increased.	Yes
Inner Kids Program	CC- No LM - No	Flook et al. (2010)	Students	**Design:** RCT with active reading period control **Level:** Student with block randomization stratified by classroom, gender, and age **IU:** 32 students	**Total #:** 16 sessions **Weeks:** 8 **Session Length:** 30 minutes	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Adherence. Number of sessions delivered	No
Mindfulness Education (ME) Program	CC-Yes LM - No	Schonert-Reichl and Lawlor (2010)	Teachers	**Design:** QED, pre-post **Level** Classroom **IU:** 6 Classrooms	**Total #** 9–10 lessons + (daily mindfulness exercises 3 times a day for up to 3 minutes) **Weeks:** 9–10 (final week optional) **Session Length:** 40–50 minutes	**Measures.** Teacher Daily Diary track daily implementation of core exercises; extent to which implemented program lessons each week, and # of ways integrated into classroom curriculum and practices	Not Reported	Not Reported *(although classify the adherence measures to the left as "dosage")*	Not Reported	Not Reported	Adherence. Mean and range across lessons: teachers reported implementing components of lessons 75% of time, indicating a moderate to high level of average implementation Average proportion of program core mindful exercises (breathing practices) completed by week. Included a table for this. Range of implementation of core exercises was 73%–100% with an average of 87% across 9 weeks. 100% of teachers reported that they implemented extension activities within classrooms *(not clear what this means)*	No
Holistic Life Foundation	CC- No LM - Yes	Mendelson et al. (2010)	Students	**Design:** RCT w/ wait-list control (not active) **Level:** School **IU:** 2 elementary schools	**Total #:** 48 sessions **Weeks:** 12 **Session Length:** 45 minutes	Not Reported	Not Reported	**Measures.** Student Attendance (*but don't outline how assessed*)	Not Reported	Not Reported	Dosage. Percent of students at each school who attended at least 75% of sessions. 73.5% at one school and 40% of students at another. Teacher focus group data indicated that some teachers prevented students from attending as form of punishment for poor in-class behavior	No
		Feagans Gould et al. (2012)	Students	**Design:** RCT w/ wait-list control (not active) **Level:** School **IU:** 2 elementary schools	**Total #:** 48 sessions **Weeks:** 12 **Session Length:** 45 minutes	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	No
CARE: Cultivating Awareness & Resilience in Education	CC- Yes LM - Yes	Jennings et al. (2013)	Teachers	**Design:** RCT **Level:** Teacher **IU** 27 teachers	**Total #:** 5 full-day sessions, plus 2 coaching calls, plus local group support activities **Weeks:** approx. 12 weeks **Session Length:**	**Measures.** Facilitators Record sheet completed at end of each session by facilitator and trained observer. *Don't say anything*	Not Reported	Not Reported	Not Reported	Not Reported	Adherence. Desriptive statement: "Because the facilitators were working directly from the materials they created, the program was delivered with a high degree of fidelity (100%)" *However, do not report what measures were comprised of or how compiled and cross-validated to get at 100% fidelity*	No

Program		Study	Delivery Approach	Study Design	Session Delivery	FOI Dimensions Assessed and Measures Used				FOI Cut-Offs Established	FOI Reported	Linked to Outcomes
Program Name	***Core Components (CC) Articulated & Logic Model (LM) Included***	***Citation***	***Program targets Students, Teachers, or Both***	***Design (RCT; QED, Single Group); Level of Assign (School or Class); & # IUs (intervention units)***	***Total # Sessions Delivered, Weeks, and Length***	***Program Adherence***	***Program Quality***	***Participant Dosage***	***Participant Responsiveness***	***Were a priori cut-offs established?***	***Was any aspect of FOI reported? If so, what?***	***Was relationship between FOI and participant outcomes assessed?***
					Varied: Full-day sessions (6 hours); Coaching calls (20–30 minutes)	*specific about number of items whether quant or qual or how assessed at all.*						
		Jennings et al. (2011)	Teachers	*Study 1* **Design:** Single group pre-post **Level:** Teacher **IU:** 31 *Study 2* **Design:** RCT **Level:** Classroom (student teacher/ mentor teacher pairs) **IU:** 21	**Total #:** 4 or 5 full-day sessions, plus 2 coaching calls **Weeks:** approx. 5 weeks **Session Length:** Varied: Full-day sessions; Coaching calls (20–30 minutes)	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	No
mMBSR (modified mindfulness-based stress reduction)	CC- No LM - No	Flook et al. (2013)	Teachers	**Design:** RCT with wait-list control - 4 schools total **Level:** Classroom/teacher **IU:** 10 teachers/classrooms	**Total #:** 9 sessions (26 hours total) **Weeks:** 8 **Session Length:** 2.5 hours per week for 8 weeks plus a day-long immersion for 6 hours	Not Reported	Not Reported	**Measures.** Weekly practice logs in which participants recorded Mindfulness practice compliance (or number of minutes per day spent engaging in formal (e.g. sitting meditation) and informal (e.g. brief moments of mindfulness) mindfulness practice.	Not Reported	Not Reported	Dosage. Reported the average minutes per day in formal and informal practice as well as frequency of mindfulness practice. Specifically, participants reported spending on average 21.7 min (SD=13.8) per day in formal practice and 7.5 min (SD=4.7) per day in informal practice. During 8-week course, participats reported engaging in formal practice 83.7% of days (M=46.9; SD=7.1) and informal practice 88.7% of days (M=49.7; SD=4.4).	No
MM (Mindfulness Meditation)	CC- No LM - No	Beauchemin et al. 2008	Both Students & Teachers	**Design:** Single group, pre-post **Level:** Classroom **IU** 4 classes (2 teachers & 34 students)	**Total #** approx. 27 **Weeks:** 5 **Session Length** 5–10 minutes at beginning of class period (# of class periods per day not specified) plus two 20 minute instructional sessions.	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	No
Cultivating Emotional Balance	CC- No LM - No	Kemeny et al. (2012)	Teachers	**Design:** RCT, pre-post, 5-month follow-up **Level:** Teacher **IU:** 41 teachers	**Total #:** 4 sessions **Weeks** 8 **Session Length:** 4 All-Day & 4 Evening sessions (total of 42 hours of training); recommended 25 min/day home practice	Not Reported	Not Reported	**Measures.** Weekly online self-reported logs to assess # of minutes of meditation practiced each day. Created varaible: total days mediated 20 min or more across 8-week period.	Not Reported	No	Dosage. The greater the number of days individuals reported practing meditation (20 min/day or more), the lower their trait anxiety and the higher their mindfulness at posttraining, but these did not occur with other self-report measures. Greater meditation practice associated with diminished blood pressure reactivity during lab task, compared with those who practiced less, & decreased Diastolic Blood Pressure during speech and math portions of Trier Social Stress Test at follow-up as well as decreased Respiratory Sinus Arrhythmia in response to the math task at follow-up Greater mediation practice was not associated with compassionate responding or social behavior on marital task.	Yes
MIL: Moving into Learning	CC- Yes LM - No	Klatt et al. (2013)	Students	**Design:** Single group, pre-post & follow-up **Level:** Classroom **IU:** 2 classrooms (41 students)	**Total #:** 8 weekly sessions; 32 daily sessions **Weeks:** 8 **Session Length:** 45 minutes for weekly sessions; 15 minutes for daily sessions	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Inner Resilience Program (IRP)	CC- No LM - No	Lantieri et al. (2011)	Both Students & Teachers	**Design:** RCT **Level:** Classroom across many schools (unsure #) **IU:** 29 teachers &	**Total #:** 27 weekly yoga sessions; 9 monthly NTIL sessions; 1 weekend-long retreat **Weeks** 27–36 weeks	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No

Program		Study	Delivery Approach	Study Design	Session Delivery	FOI Dimensions Assessed and Measures Used				FOI Cut-Offs Established	FOI Reported	Linked to Outcomes
Program Name	***Core Components (CC) Articulated & Logic Model (LM) Included***	***Citation***	***Program targets Students, Teachers, or Both***	***Design (RCT; QED, Single Group); Level of Assign (School or Class); & # IUs (intervention units)***	***Total # Sessions Delivered, Weeks, and Length***	***Program Adherence***	***Program Quality***	***Participant Dosage***	***Participant Responsiveness***	***Were a priori cut-offs established?***	***Was any aspect of FOI reported? If so, what?***	***Was relationship between FOI and participant outcomes assessed?***
				471 students in their classrooms	across components **Session Length:** Weekly yoga (75 minutes); Monthly NTIL meetings (2.5 hours each); 2-day weekend residential retreat							
SMART-in-Education (Stress Management & Relaxation Techniques) Program	CC- Yes LM - Yes	Roeser et al. 2013	Teachers	**Design:** RCT, with 3-month follow-up **Level:** Teacher **IU:** 54 Teachers	**Total #:** 11 **Weeks:** 8 **Session Length:** Doesn't say, but total of 36 contact hours across 11 sessions	Not Reported *(although assert adherence was controlled for because program developer implemented at all sites)*	**Measures**. Evaluation survey participants filled out at end of program. Instructor domain-specific expertise, genuineness, effectiveness at presenting material, and trustworthiness on 5-pt. Likert scale.	**Measures.** Facilitator-reported attendance at weekly sessions as well as teacher completion of program. Daily mindfulness practice journal. Teachers self-reported minutes of daily practice	Not Reported	Yes. Program completer had to attend at least 8 of the 11 sessions. Suggested 15/min a day of home practice.	Dosage. Those who didn't drop out attended 92% of sessions. Absences ranged from 0–4 with 87% of participants completed the program by attending 8 or more of the 11 sessions. Amount of home practice examined for the 60% of participants who returned daily practice journals. Teachers reported avg. of 16 min. of practice/day (Canadian sample) and 15 min. of practice/day (U.S. sample). This showed compliance w/ 15-min a day home practice Quality. On average, participants "strongly agreed" that instructor demonstrated good knowledge of the subject matter (expert knowledge, M=4.98, SD=.14); was a "good role model for what was being taught" (genuineness, M= 4.94, SD=.24), was "effective in presentation of material" (effectiveness, M=4.83; SD=.38), and participants "developed a faith in their ability to trust & learn from the instructor" (trustworthiness, M=4.88, SD=.48). Instructions for home practice very clear and useful.	No
	CC- No LM - No	Benn et. al. (2012)	Teachers	**Design:** RCT with 2-month follow-up **Level:** Teacher/Parent **IU:** 31 participants (12 parents and 19 educators)	**Total #:** 11 sessions (2 times per week for a total of 36 hours) **Weeks:** 5 **Session Length:** 2.5 hours (9 sessions) & 6 hours (2 sessions)	**Measures**. Research assistant observed sessions and provided qualitative feedback on program fidelity (instructor adherence to format, content, and process of delivery) during weekly research meetings.	**Measures.** Participant responses to open-ended questions on individual session evaluations and ratings of overall instructor quality at the conclusion of the program.	**Measures**. Program completion and attendance. Unclear what determines program completion. Participant-reported estimates of frequency of home practice.	Not Reported	No	Dosage. Results showed that all but 1 participant competed the MT program and all attended most of the sessions (M=9.9 sessions, range 7–11 sessions). Quality. Participants indicated high levels of satisfaction with the program in terms of quality of instruction, content, and structure. They rated the level of instruction as either a 4 or 5 on a 5-point scale. Adherence. Qualitative reports by RAs suggest high-quality instructor adherence to the format, content, and process of curriculum delivery. Participants reported an average of 10 minutes of formal mindfulness home practice per day.	No
MBSR adapted for urban youth	CC- No LM - No	Sibinga et al. (2013)	Students	**Design:** RCT, with 3-month follow-up, active control - health education program **Level:** Student **IU:** 1 school (22 students)	**Total #:** 12 sessions **Weeks:** 12 **Session Length:** 50 minutes	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Adapted MBSR Program	CC- No LM - No	Frank et al. (2013)	Teachers	**Design** QED, pre-post **Level:** School **IU** 1 School - 18 instructors, specialists, and administrators	**Total #** 8 **Weeks:** 8 **Session Length:** 2 hours (weekly sessions) plus 25–30 min of daily practice (at home) 6 days/wk.	Not Reported	Not Reported	**Measures.** Daily logs - *no other details on what those are.*	Not Reported	No	Dosage. MBSR participants practiced mindfulness meditation outside class on average 4 times per week (M=3.9; SD=1.5) for a mean of 22.6 minutes (SD=4.6) per practice period over the 8 week course.	No
Transformative Life Skills (TLS)	CC- No LM - No	Frank et al. (2014)	Teachers	**Design** Single group, pre-post **Level:** Student **IU:** 49 students	**Total #** 48 lessons **Weeks:** Approximately 12 **Session Length:** 30 minutes (3–4 days a week)	**Measures.** Instructor-reported lesson component completion checklist at the end of each lesson. Say supervision of instructors by program developers, observation, and review of these checklists were used to monitor fidelity	**Measures**. Instructor-reported reflection on quality of lesson implementation.	Not Reported	**Measures**. Instructor-reported overall level of student engagement (as a whole not per student) at the end of each lesson.	No	Overall fidelity: All lessons were implemented with greater than 80% fidelity (*not sure how calculated - if refers to adherence or adherence & quality*)	No

Program		Study	Delivery Approach	Study Design	Session Delivery	FOI Dimensions Assessed and Measures Used				FOI Cut-Offs Established	FOI Reported	Linked to Outcomes
Program Name	***Core Components (CC) Articulated & Logic Model (LM) Included***	***Citation***	***Program targets Students, Teachers, or Both***	***Design (RCT; QED, Single Group); Level of Assign (School or Class); & # IUs (intervention units)***	***Total # Sessions Delivered, Weeks, and Length***	***Program Adherence***	***Program Quality***	***Participant Dosage***	***Participant Responsiveness***	***Were a priori cut-offs established?***	***Was any aspect of FOI reported? If so, what?***	***Was relationship between FOI and participant outcomes assessed?***
						throughout implementation.						
Mindfulness Meditation (MM) Program	CC- No LM - No	Wisner (2013)	Students	**Design** Single group **Level:** Student **IU:** 35 Students in a single alternative high school (total enrollment of school was 36 students)	**Total #:** 29 sessions **Weeks** 8 **Session Length:** Varied (1 30-min intro session, plus 30-min sessions 2 times per week; plus 10 minute sits 2 times per week in weeks 3–8)	Not Reported	Not Reported	**Measures.** Participant reported use of practice CD and home practice.	Not Reported	No	Dosage. Ten out of 35 (approx. 30%) students reported using practice CD at home, with most of these students using the CD once, twice, or three times. One student used CD on regular basis. Five out 35 students (approx. 15%) reported that they practicd meditation at home without the CD and 2 students reported using meditation on a regular basis while 3 students reported trying meditation on two or three occassions.	No
		Wisner et al. (2013)	Students	**Design:** Single group, pre-post **Level:** student **IU:** 28 students from 1 alternative high school (78% of student body)	**Total #:** 29 sessions **Weeks:** 8 **Session Length:** Varied (1 30-min intro session, plus 30-min sessions 2 times per week; plus 10 minute sits 2 times per week in weeks 3–8)	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
RISE Program	CC- No LM - No	Winzelberg & Luskin (1999)	Teachers	**Design:** RCT, with 8-week follow-up **Level:** Teacher **IU:** Unclear - but probably 8 teachers in training (6 couldn't attend training so assigned to wait-list control; remaining 15 randomized to exp. Or control)	**Total #:** 4 **Weeks:** 4 **Session Length** 45-minutes	Not Reported	Not Reported	**Measures**. Self-report questionnaire administered at follow-up (8 weeks after). Asked frequency with which practiced techniques in an average week during the program and at the time of follow-up (both for mediation and the 3 corollary techniques)	Not Reported	No	Dosage. During program, participants reported practicing meditation an average of 3 times/week. At follow-up, 1/2 of the participants reported they were no longer practicing the meditation, but most were still practicing the corollary techniiques. They reported remimbering to "slow down" and "do one thing at a time" several times a week. Overall, use of all techniques decreased from an average of 13.4 at post-test to 9.1 at follow-up. Includes a Table of treatment group practice frequency per week over the course of the program.	No
Mindful Schools (K-5 Curriculum)	CC- No LM - No	Black & Fernando (2013)	Students (with small Teachers component)	**Design:** RCT (no control) either MS or MS + 7 additional sessions **Level** Classroom **IU:** 17 classrooms total (409 students)	**Total #:** 15 (MS) or 22 (MS +); brief (2 min) practices on non-session school days **Weeks:** 5 (MS) or 12 (MS +) **Session Length:** 15 min., 3 times/week (once weekly for additional 7 weeks MS +). 2-min short practices on all other school days	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
		Liehr and Diaz (2010)	Students	**Design:** RCT w/ Health Education control **Level:** Student **IU:** 9 students	**Total #:** 10 **Weeks** 2 **Session Length:** 15 minutes of MS curriculum plus 20 minutes of time to "shift from previous activities and document presence."	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Attention Academy Program (AAP)	CC- No LM - No	Napoli et al. (2005)	Students	**Design:** RCT **Level:** Student **IU:** 114 students (across 9 classrooms)	**Total #** 12 **Weeks:** 24 **Session Length:** 45 minutes	Not Reported	Not Reported	**Measures**. Student attendance in both experimental and control conditions.	Not Reported	Yes. Program completer had to attend 12 sessions. Control participants had to attend 12 control sessions.	Dosage/Completers. Thirty-four students (approx. 15%) missed more than one training/control group session and were excluded from analysis. A total of 194 students completed the program (94 experimental and 97 control).	No
Standardized Meditation Program	CC- No LM - No	Anderson et al. (1999)	Teachers	**Design:** RCT, with follow-up (4-weeks post) **Level:** Teacher **IU** 45 teachers	**Total #:** 6 (5 weekly and 1 follow-up) plus 40-minutes a day of mediation practice. **Weeks:** 5 weeks	Not Reported	Not Reported	**Measures.** Participant teachers completed a questionnaire during each of the 6 sessions that asked them to estimate how	Not Reported	No	Dosage. 60% of participating teachers reported meditating at least 6 times/wk and 40% reported 2–5 times/week	No

Program		Study	Delivery Approach	Study Design	Session Delivery	FOI Dimensions Assessed and Measures Used				FOI Cut-Offs Established	FOI Reported	Linked to Outcomes
Program Name	***Core Components (CC) Articulated & Logic Model (LM) Included***	***Citation***	***Program targets Students, Teachers, or Both***	***Design (RCT; QED, Single Group); Level of Assign (School or Class); & # IUs (intervention units)***	***Total # Sessions Delivered, Weeks, and Length***	***Program Adherence***	***Program Quality***	***Participant Dosage***	***Participant Responsiveness***	***Were a priori cut-offs established?***	***Was any aspect of FOI reported? If so, what?***	***Was relationship between FOI and participant outcomes assessed?***
					Session Length: 1.5 hours for weekly sessions, 2, 20-minute daily mediations, and 1 hour for follow-up session			many times they had meditated during the week.				
Mindfulness Workbook (Seymour N.B. M*ack's Top Secret Detective Manual*)	CC- No LM - No	Reid & Miller (2009)	Students (with teacher delivering workbook - called "inspector connectors")	**Design:** Single group, pre-post **Level:** Academic Summer program **IU** 24 students and 4 teachers (leading 2 groups of 12 kids each)	**Total #:**Varies (24–30 sessions recommended) **Weeks** 6 **Session Length:** Not reported (and may vary based on teacher leeway to use workbook as deem appropriate)	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Transcendental Meditation (TM)	CC- No LM - No	Nidich et. al. (1986)	Unclear	**Design:** Single group, pre-post **Level:** Student **IU:** 75 students (37 incoming students and 38 continuing students)	**Total #:** Unclear **Weeks:** Unclear **Session Length:** a few minutes in morning and few minutes in afternoon	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
		Gelderloos et al. (1987)	Unclear	**Design:** QED, single time point design with Montessori school as comparison **Level:** School **IU** 1 School (48 students)	**Total #** Unclear **Weeks** Unclear **Session Length:** a few minutes in morning and few minutes in afternoon	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
	CC- No LM - No	Rosaen & Benn (2006)	Students	**Design:** Single group, qualitative assessment **Level** Student **IU:** 10 students	**Total #:** Unclear - every school day for 12 months **Weeks:** approx. 52 **Session Length:** 10 minutes (twice a day each school day)	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Transcendental Meditation (TM)	CC- No LM - No	Barnes et al. (2001)	Students	**Design:** RCT, with active, HE control condition **Level:** student **IU:** 15 students	**Total #:** approx. 40 in-school sessions plus approx. 72 at-home sessions **Weeks** approx. 8 **Session Length:** 15 minutes	Not Reported	Not Reported	**Measures**. Attendance at school sessions for both experimental and control group. Self-reported compliance with TM home practice. Unclear number of items or how asked.	Not Reported	No	Dosage. Average attendance of the TM group was 67.8% while average attendance for control group was 68.2%. Percentage of students attending at least 60% of sessions was 80% for TM group and 58% for control group. Average self-reported compliance with TM practice at home was 76.6%	No
		Elder et al. (2011)	Students	**Design:** QED, pre-post **Level:** Student **IU:** 68 students	**Total #** Not specified **Weeks:** approximately 16 **Session Length:** Varies - An hour for the initial set of sessions and then personal practice 10–15 minutes morning and afternoon every school day	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Breathing Awareness Mediation (BAM)	CC- No LM - No	Gregoski et al. (2011)	Students	**Design:** RCT, with active LST (Life Skills Training) and HE (Health Education) Control conditions **Level:** School (to treatment group & Classroom (one	**Total #:** 108 **(**Weekly health class plus home practice each weekday and twice daily on weekends). **Weeks:** approx. 12 **Session Length:** 10 minutes each	Not Reported	**Measures**. Instructor thoroughness and enthusiasm assessed weekly by single rater using Likert scale ratings (0–4 scale). 1 item for	**Measures.** Attendance & Self-reported compliance of home practice. Also measured Control and LST conditions on attendance	**Measures.** Class attentiveness assessed weekly by single rater using Likert scale ratings (0–4 scale). 1 item for attentiveness. Also rated Control and LST instructors on this.	No	Dosage. For BAM group - Average in-school attendance was 79% of total sessions. For all conditions - statistical differences observed for attendance between two schools (77% vs. 90%, p=.01). These differences were primarily due to bomb threats and fire alarm activations. Attendance was not statistically different by treatment group (p=.52) and the group by school interaction was non-significant (p=.46) Self-reported home compliance for home practice was 86.6% +/− 7.4%	No

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				teacher per semester randomly assigned to teach intervention. **IU:** 53 students			thoroughness and 1 item for enthusiasm. Also rated Control and LST instructors on these. *(fairly certain enthusiasm is for instructor - small possibility it could be about students - not fully clear from write -up)*				Quality & Responsiveness. All instructors were rated as competent in implementing the various components throughout the intervention: average of ratings (on scale of 0–4) were 3.34 +/− 0.26 for thoroughness; 3.28 +/− 0.32 for class attentiveness; & 3.31 +/− 0.27 for enthusiasm. No sign. differences between treatment groups, schools, teachers, or interactions of these factors observed for any components (all p's > .05)	
		Barnes et al. (2008)	Students	**Design:** RCT **Level:** School **IU:** 20 students in 1 high school	Total #: Unclear Weeks: approx. 12 Session Length: 10 minutes	Not Reported	Not Reported	**Measures.** Attendance	Not Reported	No	Dosage. Self-reported home compliance for home practice was 86.6% +/− 7.4% Examined sodium handling excluding subjects with less than 70% attendance and adjusting for baseline values of attendance (BAM, n=11; Control, n=28), overnight urinary sodium excretion rate decreased from pre-to post-intervention in the BAM group but increased in the control group (−1.6+/−1.1 vs 1.5+/− 0.7 mEq/hr, p < .03) as did overnight urine sodium content (−1.1+/− 0.7 vs 8+/− 0.4g, p < .03).	Yes
		Barnes et al. (2004)	Students	**Design:** RCT with active, HE control **Level:** Classroom **IU:** 34 students in 2 classrooms in same school	**Total #** approx. 60 in-school sessions and 84 at-home practice sessions; 12 instructor sessions **Weeks** approx. 12 **Session Length:** 10-minutes for practice time in-school and home; 20-minutes/week with instructor discussing	Not Reported	Not Reported	**Measures.** Teacher/instructor recorded daily attendance of students at sessions and individual meditation practice at home. Attendance and home practice (which was 20-minute daily walks) also collected for control group.	Not Reported	No	Dosage. The average attendance of the meditation group was 88.5% and the control group 86%. The average self-reported compliance with meditation practice at home was 86%.	No
Meditation Practice (*no formal name*)	CC- No LM - No	Linden (1973)	Students	**Design:** RCT with two control conditions (guidance group and no interv) **Level:** student **IU** 30 students in 1 elementary school	**Total #:** 36 (twice a week) **Weeks:** 18 **Session Length** 20–25 minutes	Not Reported	Not Reported	Not Reported	**Measures.** Clinical observations as qualitative evidence that the independent variable "took."	No	Responsiveness. Descriptive Statement: "Many of the Subjects were unaccepting of the instructions at first or seemed to fear being judged "silly" if they accepted them…gradually the groups' nomr shifted from curiosity and hesitancy to approval and anticipation of the instructions. As the sessions continued, the subjects seemed to do the exercises more readily. It is likely that in addition to the experimenter's demand, the subjects sensed that their neighbors really were engaged in something they wished to continue doing undisturbed. Had the new group norm not become operative, the effectiveness of the mediation practice would have been nil or severely limited."	No
Youth Empowerment Seminar (YES!)	CC- No LM - No	Ghahremani et al (2013)	Students	**Design:** QED, pre-post **Level:** Classroom **IU:** 327 students in 3 schools (# classrooms not reported)	**Total #** 20 lessons **Weeks:** 4 **Session Length:** 60 minutes	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Tai Chi curriculum, augmented by MBSR	CC- No LM - No	Wall (2005)	Students	**Design** Single group, qualitative **Level** Student **IU** 14 students	**Total #:** 5 (once per week) **Weeks:** 5 **Session Length:** 60 minutes	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Mindfulness-Based Youth Suicide	CC- No LM - No	Le & Gobert (2013)	Students	**Design** Single group, pre-post **Level:** Student	**Total #:** 36 sessions **Weeks:** 9 **Session Length:** 55	Not Reported	Not Reported	Not Reported	**Measures**. Facilitators reported weekly (via open-ended personal reflection) on	No	No	No

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Prevention Intervention in a Native American Community				**IU:** 8 students	minutes				what group dynamic was and what contributed to the dynamics, what activities worked and why, what experiences, events or participants stood out, what helped me to be effective and to connect with youth.			
Mindfulness-based Intervention for Chronically Ill Youth	CC- No LM - No	Lagor et al. (2013)	Students	**Design:** Single group, pre-post **Level:** 1 school **IU:** 15 students (entire student population)	**Total #** 6 **Weeks** 6 **Session Length:** 50 minutes	**Measures**. Clinical notes and records kept	Not Reported	**Measures**. Attendance records kept at sessions. Outside practice assessed via semi-structured interviews with participants after intervention.	Qualitatively mentioned in discussion section. Unclear source of data.	Yes. Treatment completers were defined as those who attended at least 4 of 6 (66%) of clinical sessions. Analyses were only conducted on treatment completers.	Dosage/Completers. 13 out of 15 participants were "Treatment completers" - those defined as attending at least 4 of 6 sessions. Average attendance rate was 85%. Adherence/Adaptation. First clinical session delayed by 1 week. Slight adjustments made to session content based on 50- minute sessions (as opposed to curriculum which outlined 60 min sessions), Adaptations: To maximize continuity between sessions and catch up students who missed, each session began with a review of the previous sessions material.	No
Yoga Ed (modified version)	CC- No LM - No	Khalsa et al. (2012)	Students	**Design:** RCT **Level:** Class **IU:** 4 classes (74 students total)	**Total #:** ranged from 23–32 sessions **Weeks:** 11 **Session Length:** 30–40 minutes long,	Not Reported	Not Reported	**Measures.** Participant attendance at sessions.	Not Reported	No	Dosage. Reported the number of participants attending at least 1 yoga session (73 out of 74 participants); average number of sessions attended for all participants (M=20.5 ;SD=7.7) as well as for those with approx. 2 sessions per week (M=18.0; SD=5.1) and those with approx. 3 sessions per week (M=23.7 (SD=9.2); & percentage of available sessions attended (80% at the beginning of the yoga program and declined to just under 70% by the end). Adaptation. Reported the number of sessions cancelled due to school events - 6 different days.	Yes
Yoga Ed	CC- No LM - No	Steiner et al. (2013)	Students	**Design** Single group, pre-post **Level** Student **IU:** 37 Students	**Total #:** approx. 28 **Weeks:** approx. 14 **Session Length:** 60 minutes	**Measures**. Instructor-report of time spent on each of the 4 main components of curriculum at each session.	Not Reported	**Measures.** Session attendance forms in which instructors tracked participant attendance (including excuses for absences)	**Measures.** Instructor-reported "group dynamics" and individual participant engagement for each of the 4 curricular components using categories:"engagement," "medium engagement," or "need for redirection."	No	Dosage. On average, students attendended 90% of sessions. Responsiveness. Students were engaged for the majority (78%) of poses. Adherence. "Fidelity was ensured because of experienced yoga instructors following Yoga Ed curriculum, as well as instructor-rated adherence." *No supporting data or methods to back up statement.*	No
Kripalu-based Yoga Program	CC- Yes LM - No	Noggle et al. (2012)	Students	**Design:** RCT, active control (PE as usual) **Level:** Student **IU:** 36 students within 3 PE classes	**Total #:** 28 sessions **Weeks** 10 weeks **Session Length:** 30–40 minutes	Not Reported (*assert assessed adherence, but does not fit this definition*)	Not Reported	**Measures**. Participant attendance at sessions. Yoga Evaluation Questionnaire (YEQ) asked if students used yoga skills at school or home on a 10-cm. visual analgue scale on which mark degree of agreement from "not at all" to "very much so". Not sure how many items.	Not Reported	No	Dosage. Central tendencies of attendance rates for experimental condition (Mean =58%; =/- 26% SD; Median = 64%, and Mode = 75%). Range of attendance (0% - 93%). Attendance less than 25% of sessions for 7 of 36 students. Qualitatively report range of answers for outside use. Specifically, when asked whether yoga was helpful or whether they used any yoga skills at school and home, responses were scattered more evenly across scale (data not shown) indicating perhaps not all students who liked yoga were applying it outside of class. Examined correlation between attendance rates and all outcome measures and NONE were correlated	Yes
		Conboy et al. (2013)	Students	**Design:** RCT, active control (PE as usual) **Level:** Student **IU:** approx. 56 - because say selected half to include in this study	**Total #:** 32 sessions **Weeks** 12 weeks **Session Length:** 30 minutes	Not Reported	Not Reported	Not Reported	Not Reported	No	No	No
Get Ready to Learn (GRTL)	CC- No LM - No	Koenig et al. (2012)	Students	**Design** QED, pre-post **Level:** Classroom **IU:** 4 classrooms (24 students)	**Total #** 80 sessions **Weeks:** 16 **Session Length:** 15–20 minutes	**Measures.** FOI assessed using checklist and videotaped sessions. Checklist included 16- pt. scale in five categories: 1)	Unclear. *The categories outlined as part of overall FOI could be*	Not Reported	Not Reported	Yes. A score of 12–16 points on FOI checklist indicated "good program implementation."	Overall Fidelity/Adherence. Classroom observations were rated for fidelity, and all classes scored within the "good" implementation range. *Unclear which dimensions used to construct Overall Fidelity.* Reliability. Raters achieved 100% agreement on two independent samples.	No

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						classroom-environment, 2) classroom organization and setup, 3) program implementation by the teacher, 4) DVD routine and student support, and 5) GRTL program conclusion. A score of 12–16 points indicates good program implementation. Researchers used checklists and video tapes to reach 80% agreement on categories. Once reliable, observed classrooms directly in 4 intervention classrooms (unclear how many times).	*conceptualized as "quality" but don't talk about it as such.*					
Yoga Fitness for Kids (Gaiam, 2003)	CC- No LM - No	Peck et al. (2005)	Students	**Design:** QED, multiple baseline, intervention, and follow-up periods with convenience comparison group **Level:** Grade-level **IU:** 10 students (3 in Grade 1, 3 in Grade 2, and 3 in Grade 3)	**Total #:** 6 (2 X per week) **Weeks** 3 **Session Length:** 30 minutes	**Measures.** Treatment Integrity Checklist completed by data collector. Intervention components checked off if completed as intended. These included 2 adherence items: 1) all participants dressed appropriately, and 2) researcher played yoga videotape and participants followed along with deep breaths, physical postures, and relaxation exercises.	Not Reported	**Measures.** Attendance for group recorded via Treatment Integrity Checklist completed by data collector. Single Item: all participants in grade level group were present at session.	Not Reported	No	Dosage/Adherence. It was determined that all elements of the intervention were implemented with 100% accuracy. *This is what is termed "Treatment Integrity" which is composed of the 3 items (2 adherence and 1 dosage) but, don't say how determined or calculated this.*	No
Yoga Program	CC- No LM - No	Hagins, Haden, Daly (2013)	Students	**Design:** RCT, with PE control **Level** Student **IU:** 15 students	**Total #:** approx. 30-45 (says 3 X per week in one place and 2 X per week in another) **Weeks:** 15 **Session Length** 50 minutes	Not Reported	Not Reported	**Measures.** Student attendance at each session. Assessed in both Yoga and PE Control groups.	**Measures**. "Child Engagement Index" created in which Yoga & PE instructors completed index on each child twice within the trial period (approx. 5 weeks and 10 weeks). 3-point scale anchored by the terms "minimal", "moderate", and "maximum" engagement - narrative text describing each. Put form online via hyperlink as supplemental material for readers.	No	Dosage. Mean attendance for yoga group was 26.87 classes (SD=4.85); Mean attendance for PE group was 22.8 classes (SD=7.36). Responsiveness. *Yoga Group:* At Time 1 (5 weeks in) 10 students were maximally engaged, 4 were moderately engaged, and 0 were minimally engaged. At Time 2 (10 weeks in), 8 students maximally engaged, 5 students moderately engaged, and 0 minimally engaged. PE *Group* At Time 1 (5 weeks in) 6 students were maximally engaged, 8 were moderately engaged, and 0 were minimally engaged. At Time 2 (10 weeks in), 8 students maximally engaged, 5 students moderately engaged, and 0 minimally engaged. No sig differences in engagement between groups.	No
Bent on Learning	CC- No LM - No	Berger et al. (2009)	Students	**Design:** QED, pre-post **Level:** After-school program **IU:** 39 students in 1 after-school program.	**Total #:** 12 (1 per week) **Weeks:** 12 **Session Length** 1 hour	Not Reported	Not Reported	**Measures**. Attendance for each student (yoga group only). Recorded by after-school program teachers. Also recorded if child unable to participate due to injury or if the yoga teacher was absent. Collected for 10 of the 12 classes.	Not Reported	No	Dosage. Children attended 68.5% (SD=21.6) of yoga classes. This is an estimate as data were obtained for only 10 of 12 classes.	No
Mindful Awareness for Girls through Yoga	CC- No LM - No	White (2012)	Students	**Design:** RCT **Level** School **IU:** 1 School (190 students)	**Total #** 8 sessions (plus 60 minutes of homework practice/week)	Unclear if Assessed **Measures**. Study fidelity maintained through Intervention	Not Reported	**Measures.** 1) Participant attendance at sessions and 2) Self-reported home practice of yoga.	Not Reported	No	Dosage. 1) Session attendance reported as a range (ranged between 3–8 sessions) and percent of participants completing all eight sessions (61.4%) & 2) Amount of home practice (which is defined as part of "dosage": Average frequency	Yes

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						Weeks: 8 **Session Length:** 60 minutes weekly session + 10 min of HW 6 days/week	manual 2) journal kept by interventionist c) an intervention checklist monitored by research assistants, d) written instructions, and e) homework with pictures and audio instructions, and f) feedback during sessions		*However measures not described so don't know number of items or quant/qual.*			(10.8 times; SD=+/− 9.6). Ranged from 0–42 times Amount of home practice (which is defined as part of "dosage": Average frequency (10.8 times; SD=+/− 9.6). Ranged from 0–42 times Examined correlation between both participant dosage variables and all outcome variables. 1 was significant. That is, there was a positive correlation between home yoga practice and perceived stress ($r=.29$, $p<.05$)	