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## A Systematic Review of Meditation and Physical Activity based Interventions in Schools

**ORIGINAL ARTICLE**



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### Abstract

*In recent years, meditation-based approaches have been used in health and lifestyle interventions. Different kinds of meditation interventions have become very popular and are being tested in educational settings. Interventions related to physical activity have also been tested in a variety of settings. The focus of reviews related to these studies has been more on the cognition, psychological and behavioural outcomes. This article aims to review studies on meditation & physical activity based interventions for the children of age range 6 to 18 years. Using the preferred reporting items for systematic review, electronic databases, including PsychINFO, ERIC, MEDLINE, and Pub Med were searched using keywords "mindfulness," in addition to "schools," or "students.". Thirty papers were selected for inclusion that met the eligibility criteria. Out of the reviewed studies 75% percent of studies focuses on mindfulness meditation. Further review indicates that meditation-based interventions were*

*more likely to be successful if these were physical activity-specific and targeted psychological factors like improvements in dietary behaviour, sleep quality & inactivity level. Though there are different types of eastern meditation practices that are being practiced for many years (viz. sahaj yoga, mantra meditation) and are reported on blogs, websites, and abstract books but lack in journal publications. The body of research shows a need for more methodologically rigorous studies to establish the effect of meditation on physical activity and to identify potential mechanisms involved in the meditation-physical activity relationship. Finally, it concludes by highlighting the problems that are needed to address to improve quality of research in this area.*

### Key Words

*Meditation-based interventions, Physical activity interventions, Schools, Psychological factors.*

The application of meditation and physical activity (PA) based interventions for students have become increasingly popular in the past few years. It is the cycle by which we approach extending our consideration and mindfulness, refining them, and placing them to more prominent reasonable use in our lives (Zinn, 1994). Contemplation is a demonstrated method for hushing the brain, empowering mindfulness and giving ideal conditions to generative reasoning and reflection (Dave, 2006). Meditation is a proven means for silencing the

mind, encouraging mindfulness and providing optimum conditions for generative thinking and reflection (Awasthi, 2012). Physical activity is defined as any bodily movement produced by skeletal muscles those results in energy expenditure (Caspersen, Powell, & Christenson, 1985).

The physical, mental and social benefits of physical activity for children are generally recognized (Boreham, 2001). Regardless of public health recommendations for children to spend an hour each day in moderate- to vigorous-intensity physical activity (Salmon & Shilton, 2004), numerous children are not meeting the base suggested levels. Of further concern there is proof of significant decreases in physical action levels from youth through to adolescence (Andersen & Mechelen, 2005). Recent research also suggests that physical activity may enhance cognitive functions of children (Tompsonski, Cullick & Pesce, 2015). It is also reported that schools serve the best place for the development of fundamental movement skills (FMS) which lays strong foundation for the development of PA in primary school children (Hardy et. al., 2012). It is therefore important to address physical activity participation during childhood through the development of effective and efficacious intervention strategies which can be fun-filled & enjoyable. The goal of this review is to assess the evidence for the ability of mindfulness/emotional and PA-based methods for children aged 6 to 18 years.

## **Overview of Meditation**

Brains of young people are sensitive to being changed through experience as compared to an adult's brain. There is a need to provide better opportunities to children that may be beneficial in nurturing children to grow up as better human beings. Schools are considered as an ideal place where children spend a large part of their day. There can be multiple opportunities for children in schools that may be utilized in order to train one's mind & body simultaneously. Meditation & physical activity can be the ultimate pathway that can be followed in order to provide a happy & healthy environment in schools. Thus, an intervention designed to increase physical activity and decrease stress and anxiety is probably useful for understudies. Yoga is one such complementary approach which has become popular in the United States in the general adult population as well as in populations with chronic illnesses (Wang, 2019). Recently, mindfulness meditation have received more attention in the meditation of lifestyles due to their ability to remove psychological barriers to facilitate change (Hayes, 2004).

Mindfulness-based interventions (MBIs) typically comprise instructive advice and mindful meditation training (MMT), the latter adjusted for a western mainstream setting from Eastern conventions of reflection rehearses, most remarkably Buddhism. MMT is an essential component of MBI, such as Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Cognitive Therapy (MBCT), and Mindfulness-Based Strength Training (MBSP). Mindfulness training improves self-regulation abilities, including attentional mechanisms, behaviour flexibility, and emotion regulation (Kaunhoven & Dorjee, 2017). In the case of PA, mindful awareness could upgrade acknowledgment of contrary or awkward contemplations and vibes that are probably going to happen during PA, especially in amateur exercisers or people with overweight and heftiness (e.g., torment, weariness, effort) and in this manner urge individuals to continue PA in the short and long haul (Schnieder, Malinowski, Watson & Lattimore, 2018). Mindfulness based methodologies can be utilized as an assistant to weight reduction meditations & can possibly help in improving individuals' readiness who experience issues in beginning and keeping up an activity program by improving their acceptance of PA-related uneasiness. Nonetheless, little is presently thought about the impact of mindfulness on PA conduct change. (Shapiro, 2006).

## **Overview of Physical Activity**

Physical activity (PA) has been related with various physiological and psychosocial medical advantages in school-going children. Consequently, global PA guidelines recommend that children of age group 5-18 years should engage in at least 60 min of moderate-to-vigorous physical activity (MVPA) every day (WHO, 2020). PA behaviors build up in early childhood and track through to adolescence and adulthood. A review finding states that 10 countries had an annual diminishing rate of 4.2% in PA and an expansion in ST (inactive time) after the age of 5 years (Cooper, et. al., 2015). For instance, an ongoing longitudinal study including

around 1000 children revealed a decrease in MVPA (3 min for girls; 7 min boys) and an expansion in ST (83 min for girls; 74 min for boys) between UK School Year 1 (5-6 years) and 4 (8-9 years) (Jago et. al., 2017). Physical inactivity is the fourth driving danger factor for worldwide mortality in students (World Health Organization, 2009). Many who are motivated also fail to enact their intentions for physical activity. Mindfulness, a form of increased awareness and acceptance, is a changeable inner factor that has been shown to impact several health behaviors, counting eating, drinking, sleeping, and drug use. Evolving evidence shows a constructive association between intelligence and overall cardiovascular health (Nardi et al., 2020). The role of mindfulness has also received attention for its potential to promote physical activity. Yet research on mindfulness and physical activity has been ambivalent about the relative contributions of trait and state forms of mindfulness.

A systematic review is needed to summarize the available evidence on associations between the mindfulness and physical activity, to identify critical gaps in the literature, and guide future research. This review summarizes the available literature & recommendations are framed for future research as a roadmap in progress to encourage research in the field of physical activity towards achieving population-level impact globally. In addition, it is important to highlight several physical, psychological, and social health benefits of PA. Many PA interventions have resulted in improvement in academic achievement, cognition, executive functions (Howie & Pate, 2012). These interventions have been developed and implemented in a variety of settings, and have previously been reviewed with a recent review suggesting an overall lack of effectiveness of interventions to increase children's objectively measured physical activity (Salmon et. al., 2007). In the present review the effect of PA interventions, meditation based interventions & effect of integration of these two interventions on psychological & physiological variables has been examined.

## Method

This systematic review was conducted in accordance with the preferred reporting items for systematic reviews:

## Literature Review

In order to conserve the point on MBI, physical activities or studies which utilize mind-based practices or correlated keywords on interventions consists of yoga and meditation a systematic search was conducted for papers published up the year of June 2014 with Multiple electronic databases using keywords "mindfulness," in addition to "schools," or "students." Databases included PsychINFO, ERIC, MEDLINE, and Pub Med. Combinations of the following search terms and their abbreviations were used: mindfulness; dispositional mindfulness; cultivated mindfulness; mindfulness meditation training; Acceptance and Commitment Therapy; Dialectical Behavior Therapy; Mindfulness-Based Stress Reduction; Mindfulness-Based Cognitive Therapy; Mindfulness-Based Strengths Practice; Zen meditation; Vipassana meditation; physical activity; exercise; fitness; and physical health. The reference sections of included articles were scanned to identify any additional studies that met the inclusion criteria.

## Inclusion and Exclusion Criteria

The studies were included, if these were cross-sectional or longitudinal studies providing a quantitative measure of dispositional mindfulness or intervention studies that contained MBIs (with or without a PA component). Measured any frequency, type, duration, or intensity of PA using quantitative outcomes; and where the MBI contained PA, only studies that controlled for the PA component by including a PA-based control group were considered for inclusion. Studies were not based on participant characteristics (eg, age, gender, culture, health status, weight status) or year of publication. The choice to contain or eliminate studies was based on the title, then the abstract, and finally the full text.

These simple search terms resulted in hundreds of papers that were considered for review:

1. School location.
2. The age of the students in the range of younger than 18 years of age.
3. This research is point outs examining effects of interventions (with or without physical activity component).
4. The target of the intervention was students.

## Study Selection

Thirty studies were reviewed. Sample size in these studies varied. The total number of participants in these studies was 3532 students. The range in student sample size was 3 to 522 with an average 121 students per study (SD= 127.0). The range of sample size in five studies was 4 to 12 with an average of 6 students per study (SD=4.4). The five largest studies had an average of 339 students per study (SD=126.0). Studies that used experimental group designs tended to have smaller sample sizes (mean=102.1, SD=57.2) than quasi-experimental group designs (mean=158.9,SD=155.7).

A cross-sectional study was involved since it did not evaluate the relationship between intelligence and PA. One cross-sectional and one longitudinal study were not involved because they did not deliver qualitative analysis. Ten intervention studies were excluded because they did not provide a measure of PA and seven others were excluded because PA was a component of the MBI with no PA-based control group. Bearing in mind the assessment employed in this work, a summary of the characteristics is created from this review which is introduced in Table 1.

**Table 1:** Summary of Studies Examining Effect of MBI

STUDY	N(%) girl	AGE MEAN OR RANGE (GRADE LEVELS)	STUDENT POPULATION	SPECIFIC INTERVENTION NAME (DETAILS)	INTERVENTION LENGTH (FACILITATOR)	STUDY DESIGN TYPE	MEASUREMENT TYPE	SIGNIFICANT GENERAL INTERVENTION OUTCOMES
Britton et al.2014	100	11.8(6)	General education	(Roth 2014) Integrative contemplative pedagogy	3–12min5×/week for (two group) 6 weeks (teacher)	EX(two group)	Student self-report	Student reported reduced suicidal ideation and affective disturbance
Viafora Mathiesen & Unsworth 2015	63(52)	11 to13 (6–8)	School students & homeless youths	nr (components of Planting	8 weeks	QE63(52) (two groups)	Student self-report	Improved mindful awareness & acceptance, greater emotional well-being
Sibinga et al. 2013	41 (0)	12.5 (7–8)	General education	nr (modified MBSR)	50 min 1×/week for 12weeks (facilitator)	EX (two group)	Student self –report and physiological measures	Student reported decreased anxiety and rumination
Bei et al. 2013	9(100)	13 to15(9)	Sleep difficulties	nr (components of MBCT)	90 min 1×/week for 6 weeks	QE(pre-post)	Physiological and student self-report	Improved objective measures of sleep and student reported improved sleep and reduced anxiety(not found through statistical significance)
Flook et al. 2010	64 (54.7)	8.2 (2–3)	General education	Mindful awareness practices(components of classical mindfulness training for adults)	Nr total minutes, 2×/week for 8 weeks (facilitator)	EX (two group)	Teacher and parent report on student Behavior	Teacher and parent reported improved executive functioning
Joyce et al.2010	175(43.8)	11.3 (5–6)	General education	Nr(teacher self-awareness and relaxation components)	45 min 10frequency of sessions or total duration nr (facilitator)	QE(pre-post)	Studentself-report	Student reported decrease in depression
Wright et al.2011	121(59.5)	15.0(9)	High blood pressure	Breathing awareness meditation(components of MBSR)	10 min 5x 1 week for 12weeks (teacher)	EX(three groups)	Physiological and student self-repor	Studentreported24-hsystolic bloodpressure
Norton(2-013)	28(57)	17.3(10-12)	Alternative educational placement	nr(non-specified mindfulness meditation) (Wisner and Norton 2013)	10–30 min 2–4×/week for 8 weeks (facilitator)	QE(pre-post)	Teacher report on student	Teacher reported increased behavioral and emotional strengths
White(2012)	155(100)	9.9(45)	General educator	Mindful Awareness for Girls through Yoga (components of MBSR)	60 min 1×/week for 8 weeks	EX (two groups)	Student self-report	Student reported increased coping
Sibinga et al. 2013	41 (0)	12.5(7-8)	General education	Nr(modified MBSR)	50 min 1x/ week for 12 weeks (facilitator)	EX(two group)	Student self-report and physiological	Student reported decreased anxiety and rumination
Lawlor(2010)	246(48)	11.4(4-7)	General education	Mindful education	40-50 min 1x/week and 9 min 4x/week for 10 weeks(teacher)	QE (prepost)	Student self-report and teacher report	Teacher reported decreased disruptive behavior and increased attention and social-emotional competence
Metz et al., 2013	216 (34.3)	16.5 (10–12)	General education	Learning to BREATHE (Broderick 2013)	12 weeks (facilitator) 15–25 min, 1–2×/week (18 total sessions) for 16 weeks (teacher)	QE (two groups)	Student self-report	emotion regulation Student reported improved emotion regulation and reduced psychosomatic symptoms
Liehr and Diaz (2010)	17(29)	9.5(nr)	General education	Mindful school	15 min, 5x/week for 2 weeks(teacher)	EX(two group)	Student self-report	Student reported reduction in depressive symptoms

Lau and hue(2011)	48(nr)	Nr(nr)intervention 5.73(nr)target ed 14	Low academic achievement	Nr(components of MBSR)	120 min 1x/week for 6 weeks and a 7 h retreat (facilitator)	QE(two groups)	Student self-report	Student reported reductions in anxiety symptoms
Kuyken et al.2013	522(299.9)	14.8(nr,secondary school)	General education	Mindfulness in schools programme (component of MBSR and MBCT)	nrminutes,1x/week for 9 weeks (teacher)	QE(pre-post)	Student self-report	Student reported reductions in depressive symptoms
Klatt(2017)	41(61)	8.5(3)	General education	Move-into – learning(mindfulness and yoga practices)(Klatt et al.2013)	45 min 1x/week for 8 week (facilitator) and 15 min 4 x/week for 8 weeks (teacher)	QE(pre-post)	Teacher report on student	Teacher reported reductions in ADHD – related behavior
Napoli(2005)	194(47.4)	Nr(1-3)	General education	Attention academy program	45 min,1x/2weeks for 24 weeks (facilitator)	EX(two groups)	Teacher report on student ,student self-report, and students behavioral measurement	Teacher reported improved attention and social skills students reported reduced test
Singh (2007)	3(3.33)	13.3(7)	Conduct disorder	Soles of feet	14 min 1x/week for eight weeks(facilitator)	QE(three groups)	Student self –report	Student reported increased mindfulness
Carboni(2013)	4(0)	8.5(3)	Attention-deficit/hyperactivity disorder	Nr(components of mindful based stress reduction (MBSR)	30–45 min 2x/week for 5 weeks(facilitator)	Multiple-baseline single subject	Direct observations of student behavior teacher and parent report on student behavior	Increased student academic engagement
Schonert-Reichl and lawlor (2010)	246(48)	11.4(4-7)	General education	Mindful education	40-50 min 1 x /week and 9 min 4 x/ week for 10 weeks (teacher)	QE (Pre-post)	Student self-report and parent report on student	Student reported increased optimism teacher reported decreased disruptive behavior and increased in the social emotional competence.
Lagor et al (2013)	13(40)	13(3-12)	Chronic medical illness	Mindfulness-based intervention(components of MBCT –C and ACT)	Nr minutes 1x/week for 6 weeks (facilitator)	QE (Pre-post)	Student self –report	Student reported reduction in depressive symptoms

**Table 2 : Description of the Reviewed Studies on Mindfulness and Physical Activity**

Article	Participants and design	Measure of mindfulness	Measure of physical activity or exercise	Dimension of physical activity measure	Main findings in trait or state mindfulness and physical activity (PA)
Roberts and Dan off-Burg (2010)	553 undergraduate students; Cross-sectional	The Five-Factor Mindfulness Questionnaire (FFMQ)	Selected items from Youth Risk Behavior Surveillance System and Weight and Lifestyle Inventory	Frequency	Trait mindfulness was positively associated with: 1. Perceived daily PA level 2. Enjoyment of PA 3. Number of days reported to be physically active in the past week
Gilbert and Waltz (2010)	undergraduate students; Cross-sectional	FFMQ	International Physical Activity Questionnaire (IPAQ)	Volume	1. Trait mindfulness (the Describe subscale) predicted more moderate PA. 2. Trait mindfulness (the Observe subscale) predicted more moderate and vigorous PA in male. 3. Trait mindfulness (the Act with Awareness) subscale predicted vigorous PA in female.
Loucks et al. (2015)	382 adults with mean age of 14; Cross-sectional	Mindful Attention and Awareness Scale (MAAS)	International physical activity questionnaire (IPAQ)	Volume	Trait mindfulness was positively related to PA level.
Tsafou et al. (2017)	Dutch speaking adults age between 12 and 18; Cross-sectional	MAAS (Dutch version) MFPA FFMQ	Satisfaction with International physical activity questionnaire (IPAQ)	Volume	1. Trait mindfulness was positively related to PA 2. Satisfaction with PA mediated the positive association between state mindfulness during PA and PA level. 3. Trait mindfulness was positively associated with PA level through state mindfulness during PA and then satisfaction with PA.
Kangasniemi et al. (2014)	108 Finnish adults; 58 physically less active and 50 physically active; Cross-sectional	Kentucky Inventory of Mindfulness Skills (KIMS)	ActiGraph-GT1M accelerometer	Volume	1. Trait mindfulness was positively associated with moderate to vigorous PA. 2. Compared to less active participants, active individuals had higher trait mindfulness level and less psychological symptoms.
Ruffault et al. (2016)	adults age 18; Cross-sectional	MAAS	IPAQ	Volume	1. No direct association between trait mindfulness and PA. 2. Trait mindfulness level moderated the relation between intrinsic motivation and PA.
Salmorago Blotcher et al. (2013)	Adults with psychological symptom; mean age = 47; Single group pre-post intervention	FFMQ	Health Behaviors Questionnaire: selected items from the Rapid Assessment of Physical Activity questionnaire (RAPA)	Volume	After completing the mindfulness based stress reduction programme, participants showed: 1. Significant improvements in dietary behaviors and sleep quality. 2. Improvements in inactivity level. 3. Non-significant changes in PA level

## Data Management

### Intervention Outcomes

Studies varied in the amount of detail provided about the interventions. Many studies did not provide or cite a formal title for the intervention used (n=11). The studies have given description about the mindfulness-intervention components implemented, but this ranged from citing a specific published manual, to vague descriptions of “mindfulness practices”. Nine studies specifically implemented components of Mindfulness-Based Stress reduction, and three studies incorporated elements of Mindfulness-Based Cognitive Therapy (Segal et al. 2002). Twelve studies included an out-of-school practice component, however most studies did not report this detail (n=16).

Many studies confirmed reduced features of psychopathology following intervention, including reductions in behavioral problems (n=06), anxiety (n=05), depression (n=04), affective disturbances (n=04), problems with executive functioning and attention (n=04), and suicidal ideation (n=01). Studies also frequently verified increases in pro-social psychosocial qualities, although the precise attribute varied greatly and comprised classroom engagement, sentiment regulation, social skills, social-emotional competence, coping, positive affect,

optimism, and classroom conduct. Four studies demonstrated benefits to aspects of physiological functioning, and one study documented improvements in self-reported mindfulness. No study in this review included school-collected academic or behavioral outcome data. To better understand the population of the 21 studies in this review, the total student population (n=2347) characteristics were calculated and are quantitatively summarized below:

**Gender:** The majority of studies reviewed reported the subject's gender (n=26). Of these studies, approximately half of the total students (45.9 %) were female, reflecting a relatively balanced gender distribution. Most of the studies reported some description of student age (n=25), ranging from 5 to 17 years of age. Of those studies that reported exact ages (n=20), the average student's age was 12.3 years (SD=3.5). Three studies did not report any details of student age.

**Grade:** Most studies reported student grade level or range (n=23), with eight of the study's participants coming from a single grade, and fourteen studies coming from a range of grade levels; five studies did not report any details of student grade level. To further analyze the grade distributions, student grade level was categorized using standard US classification, whereby grades were divided into elementary (grades K through 5), middle school (grades 6 through 8), and high school (grades 9 through 12) levels, although 5 studies were necessarily counted twice given overlapping grade distributions (e.g., grades five through six counted as both elementary and middle school).

**Disability Status and Other Student-Level Variables:** If studies did not specify selecting for a particular student characteristic, it was assumed that subjects were selected from a normative general education population (n=17). Of the studies conducted on selected student populations, five studies recruited students with medical ailments (n=03) with high blood pressure, (n=01) with sleep disturbance (n=01), and with chronic medical conditions, three studies recruited students with behavioral problems (n=01) with Conduct Disorder, (n=01) with Attention-Deficit Hyperactivity Disorder, and (n=01) with high rates of disruptive behavior), one study utilized students who attended school in an alternative educational placement (i.e., the students local educational district could not provide services to meet the student's needs). Only two studies focused specifically on students with learning difficulties (n=01 with Learning Disabilities and n=01 with low academic achievement).

**Socio-Economic Status:** Most studies did not report any details on student socio-economic status (SES) (n=20). Only three studies reported specific individual details of student SES; five studies reported SES details about the overall population (e.g., average family income in the school district). Only one study reported the school's free and reduced price lunch status, which is a commonly reported SES demographic marker in educational research.

**Measures:** Measures for physical activity were more heterogeneous but 12 of them used self-report measures. The International Physical Activity Questionnaire was the most common measure used in six studies. Other self-report measures included the Godin Leisure-Time Exercise Questionnaire and the Physical Activity, Exercise, and Sport Questionnaire. Researchers used selected items from Rapid Assessment of Physical Activity questionnaire (to assess weekly, daily physical activity, and daily lifestyle activity). One study used the number of athletic center visits as a proxy for duration of physical activity. Only one study utilized accelerometers to measure physical activity. Overall, most studies conveyed the number of hours of physical activity, except for four studies that reported the number of days of physical activity. In addition to evaluating physical activity levels, Few studies have judged physical activity skill strength, exercise adherence, and physical activity gratification using self-report questionnaires.

## **The Effect of Mindfulness Based Interventions on Physical Activity**

The results of the current review indicate that MBIs are more likely to be successful at implementing PA behavior change if they target psychological factors related to PA. However, evidence for the active components

of MBIs is still scarce. More research is required to establish what makes MBIs successful at increasing PA and what mechanisms are involved in the mindfulness-PA relationship mentioned in Table 3.

**Table 3:** Effect of Mindfulness-Based Interventions on Physical Activity

No. of studies	Effects on MBI on Physical Activity
Five	Cohort studies (no control group)
One	Non-randomised controlled clinical trial
Five	Compared usual care with a mindfulness component to 21 a usual care-only group
Eight	Compared a MBI to another intervention
Two	Compared a MBI to a no-treatment control group
Four	That showed effects for some PA outcomes
Three	Three included PA education and recommendations
Three	Showed significant positive within-subjects effects on PA, but found no differences between the MBI and a control group
One	Improvements in some types of PA (e.g., activities aimed at improving flexibility), but not others (e.g., activities aimed at improving strength)
Three	Rcts that found no effect on PA outcomes in either group

## Discussion

This review investigates the relationship between mindfulness and PA (Table 2). In terms of dispositional mindfulness, nine studies showed weak to moderate correlation with PA, but only one of those studies measured PA objectively. The utilization of MBI in school settings has incredible potential for improving instructive and psychosocial results for the present youth. This review proposes that MBI is a plausible and satisfactory methodology of meditation for use in school settings, yet numerous extra observational inquiries remain that should be investigated.

This systematic review characterized the available evidence linking mindfulness and physical activity (Table 2). The study design was typically cross-sectional with self-report measures of mental and physical activity. Researchers have used a variety of measures to assess mental and physical activity, with the MAAS and IPAQ being the most popular choices for mindfulness and physical activity respectively. Despite the perceived risk, the strength (ie, effect size) of the positive association between mindfulness and physical activity was generally small to moderate. Former study has studied the straight relationship between intelligence and physical activity and the role of meditation in controlling the connection between motivational processes and physical activity.

Most of the empirical studies narrowly focused on trait mindfulness and did not assess mindfulness as a state or time-varying construct. Thirteen studies included in this review assessed trait or dispositional mindfulness, and 10 of them found significant positive associations between trait mindfulness and physical activity. In contrast, only three studies assessed state mindfulness in specific exercise or physical activity contexts, and two of them found that higher state mindfulness could predict physical activity level (Tsafou et al., 2016, 2017). Most of the studies used group-based interventions conducted in a typical classroom environment during normal school hours. This finding is encouraging for the generalization of these practices in school settings, as interventions delivered to students in their normal classroom are more likely to generalize to the classroom environment and skills learned may also be more likely to be used. This also reduces a barrier to implementation, as there is less transition time if classes are conducted in the classroom and students do not need to transition to a different room. The review revealed that nearly one-third of studies included an out-of-school practice, although details regarding whether students used these practices were rarely reported. Many studies in this review used components of MBSR, with the MBI for the most empirical support for its effectiveness. Although component analyses of MBSR have yet to be conducted, and therefore it is an existing

question what are the effective elements of MBSR. However, a caveat is that MBSR is a specific 8-week program carefully crafted with regards to its components, based on dharmic foundations, and a component analysis would really not be a test of the MBSR program itself.

### Limitations

Despite the rigorous search criteria and study reviews conducted, this review is not without limitations. Current literature regarding the relationship between mindfulness and PA cognitions, attitudes, and behavior is relatively scarce; more research is required before conclusions regarding the effect of mindfulness on PA can be drawn. Consequently, there are also limitations to many of the included studies. A general limitation of these studies was the lack of reporting of study details. In addition to the many intervention characteristics that were consistently not reported, such as the amount of time students engaged intervention, many studies failed to report even simple participant characteristics. As an example, 71 % of studies in this review did not report any details about participant or community socio-economic status (SES). Also, considering the students recruited in these studies, very few studies included students receiving special education supports or who were identified as having a disability that significantly impacted their learning, another notable limitation in the field (Viafora; Mathiesen & Unsworth, 2014).

Research review support the benefits of MBI for students in school settings, however, there are significant limitations in terms of the dependent outcomes collected. Similar to the general evidence of MBI in youth, these studies indicate that MBI appear to be effective at reducing psychosocial problems and supporting positive attributes. However, most studies relied on questionnaire measures to assess for effects (particularly student self-report) and did not include follow-up assessments. Although some studies included in our review used multiple methods and multiple informants, the majority relied on a single informant and single method. A major limitation in this review was that no study included objective data on student educational or behavioral outcomes, such as student achievement, grades, or office discipline referrals. Given the current educational legislation and accountability standards, these data are virtually always collected by schools, and could serve as an important “real world” outcome to demonstrate treatment effects.

### Recommendations

Bearing in mind the studies investigated in this review, there are a few specific recommendations for future research to address the notable cons in the review base. A summary of the suggestions created from this review is introduced in Table 5. In this writing survey, most of studies utilized non-trial plans what’s more, few depended on irregular task to test meditation impact.

**Table 5:** Recommendations for Future Research on Physical Activity and Mindfulness-Based Interventions in School Setups

CATEGORY	RECOMMENDATIONS
<b>Research design</b>	<ul style="list-style-type: none"> <li>Utilize experimental randomized control trial designs</li> <li>Utilize active control condition which consists of didactic as well as experimental elements</li> </ul>
<b>Subject characteristics</b>	<ul style="list-style-type: none"> <li>To discover execution with the student to recognize disabilities and/or learning disabilities</li> <li>Consisting report of full information for both individual and school characteristics</li> </ul>
<b>Intervention characteristics</b>	<ul style="list-style-type: none"> <li>It imitates current interventions as oppose to examine innovative methods</li> <li>Need to organize element findings consisting testing for dosage effects scientifically analyse the amount of preparation wants to effectively deliver MBI</li> </ul>



<b>Outcomes</b>	<ul style="list-style-type: none"><li>• To accumulate follow up data</li><li>• To add multi methods multi informant outcomes</li><li>• To include data collected by school district, including academic achievement and behavior results</li></ul>
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## Conclusion

The results of this review suggest that mindfulness may be associated with PA, but evidence is currently inconclusive and more research is required to investigate the relationship between mindfulness and PA experimentally and longitudinally. Mindfulness could potentially provide an inexpensive alternative for individuals not benefitting from existing lifestyle interventions. However, the current structure and design of MBIs seems insufficient for increasing PA. MBIs require a re-formulation in terms of PA-specificity and the identification of the active ingredients, which may be responsible for affecting PA behaviour change. MBIs may be more effective for enhancing PA if they are PA-specific and target psychological factors related to sustained PA.

## Future Directions

This research shows a requirement for increasingly thorough research that thinks about MBIs against coordinated control conditions to build up the potential dynamic environment, so progressively successful PA interventions can be created. Additionally, tests are required to inspect the systems associated with the mindfulness-PA relationship, possibly by analyzing psychological elements identified with continued PA conduct change and whether they lead to expanded PA in the long. At last, future examinations should mean to evaluate PA utilizing target measures (e.g., accelerometers or pedometers) and think about various exercise types, with the goal that the genuine impact of mindfulness on PA can be set up.

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