

Effectiveness of Mindfulness-Based Interventions (MBIs) in Educational Settings (In-Person and Blended): A Protocol for Systematic Review and Meta-Analysis

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ABSTRACT

Background: Mindfulness is a psychological process directing an individual's attention to the experiences in the present moment. Mindfulness-based interventions (MBIs) have been widely studied as a means of improving teaching-learning in educational environments (e.g., schools and universities). The main objective of this study is to determine the effectiveness of MBIs on students' academic achievement in schools or universities. Additionally, the present study aims to examine the effect of MBIs on stress reduction, executive function, and working memory performance in educational environments.

Methods: Several bibliographic databases such as PubMed, Embase, and Web of Sciences will be searched to find relevant studies with interventional designs. A combined approach using a thesaurus (MeSH and Emtree) and free-text-based methods will be applied to find the search terms and construct the search syntax. The intervention of interest is any type of MBI, alone or in combination with other cognitive interventions. The control is considered as "no intervention" or "any similar cognitive intervention(s)" such as different teaching-learning processes. The Cochrane Collaboration tool will be used to assess the bias risk in randomized trials for examining the quality of the studies. Effect size measurements such as d , Cohen's d , and Hedges' g will be performed.

Discussion: This review will provide necessary data for examining the effectiveness of MBIs in educational programs. Additionally, by performing subgroup analyses, a comparison between different types of MBIs will be made to find suitable interventions for particular groups of students. Furthermore, the major sources of heterogeneity between the included studies will be investigated.

Keywords: Mindfulness, Mindfulness-based intervention (MBI), Educational research, Self-efficacy, Student empowerment, Blended learning

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Introduction

Mindfulness is a psychological process that draws people's attention to the experiences in the present moment. In other words, it enables them to foster consciousness and alertness by focusing care and attention on the present moment. Mindfulness can be achieved through various methods such as meditation. There are two central concepts in mindfulness training: presence in the current moment and being non-judgmental about events, actions, and reactions. In other words, mindfulness means being awake and alert to the events occurring around and inside us while having no judgment or prejudice regarding the nature of these events (1).

Mindfulness can be taught by using different techniques. In its classic form, it is taught by meditation (sitting meditation or yoga). Kabat-Zinn (2) first used sitting meditation as a mindfulness-based intervention (MBI) performed to alleviate stress. This intervention has been used in combination with cognitive therapy (CT) to prevent the recurrence of depression (3). MBIs have also been performed to reduce stress in people with chronic health conditions, sleep disorders, and cancer. The use of MBIs has recently become a common practice in educational environments (e.g., schools and universities) aimed at improving teaching-learning processes (4). In educational settings, MBIs can contribute to stress management among teachers (5). As for learners, a recent randomized clinical trial reported that 182 students who completed a two-month mindfulness skills course experienced significantly lower distress levels than those receiving usual supports (6). The distress level in this study was assessed during the university exams. The MBI in this trial consisted of face-to-face training as well as the skills taught in group sessions using a book (6).

To the best of our knowledge, the last systematic review related to MBIs for students was conducted about five years ago (7). Considering the fact that there is growing evidence on the importance of

MBIs in educational environments and that there are different protocols for delivering mindfulness interventions, it appears necessary to conduct another systematic review to better examine the most recent findings. The preliminary aim of this study is to determine the effectiveness of MBIs on students' academic attainment. The second objective is to examine the effect of MBIs on stress reduction, executive function, and working memory performance in educational environments. Additionally, the effectiveness of MBIs on academic performance in educational settings will be assessed in view of the type and nature of the MBI (in-person and blended learning formats), different levels of academic achievement, educational institutions (schools and universities), and essential items in the design of the primary studies (e.g., randomization and blindness).

Methods

The following databases will be consulted for the purposes of this systematic review: PubMed/MEDLINE, Scopus, Web of Science (WoS), PsycINFO (the most specialized database in the fields of psychology, psychiatry, and related disciplines), ProQuest, Embase, CENTRAL (The Cochrane Central Register of Controlled Trials), ERIC (an internet-based digital library of education research and information), PSYINDEX (a database of psychology and related studies in German-speaking countries), and EBSCO (Psychology & Behavioral Sciences Collection). To retrieve abstracts presented in scientific meetings and conferences, "allconferences.com" will be used to find relevant events. Theses and dissertations will be retrieved from ProQuest as well as OpenThesis and DissOnline databases. This will be complemented by a manual search of "Mindfulness Research Monthly Journal" and "Mindfulness Journal". All the above-mentioned databases (bibliographic databases and grey literature) will be searched from January 1, 1990 to November 30, 2020.

A combination of methods using a thesaurus (MeSH and Emtree) and methods

based on free text methods will be used to find search terms to construct the search syntax. The general search syntax will include two items of PICO (participants, intervention group, comparison group, and outcome). These two items will be intervention (i.e., mindfulness) and participants (i.e., students). The search syntax for PubMed, Scopus, Web of Science (WoS), and ERIC databases is shown in the [appendix](#). There will be no language restriction to include the eligible studies. Google Translation service will be used and, if required, an official translator will be employed to translate non-English records to English.

Inclusion Criteria

All primary interventional studies will be eligible to be included. These studies could have different designs, including a single group with before and after design (for comparing at least one outcome after the implementation of an MBI to the pre-intervention state) or including two or more groups where at least one group received an MBI and another group was considered as a control (comparator) group. MBIs delivered with traditional (in-person) design and blended learning format will be considered as eligible. Random assignment of the participants will not mandatory as an inclusion criterion. Additionally, any type of blinding (e.g., blinding the participants, the evaluators of outcome(s), the data analyst, or a combination of these three different subjects) will be eligible for inclusion. Regarding inclusion of several groups, these studies can have a parallel design (i.e., each group with any nature of the intervention remains constant during the study) or crossover design (the type of intervention in at least one of the study groups, will change at least at one of the sections of the study).

Primary studies of non-interventional/observational (i.e., MBI was not performed by the researchers), case studies/reports, and review articles will not be included.

Condition or Domain of Interest

Two previous systematic reviews were

conducted to determine the efficacy of MBIs. Zenner et al. (2) determined the effectiveness of MBIs in educational settings using 12 databases in October 2012 in a systematic review and meta-analysis. They examined a total of 24 interventional studies and found that MBIs could improve cognitive functions and resilience to the stress among students with a moderate to strong effect.

In another systematic review, Emerson et al. (8) reviewed interventional studies exploring the effect of MBIs on teachers of 5- to 18-year-old students from 1996 to September 2015. Twelve published studies (including 13 study populations) met the inclusion criteria and were reviewed systematically. However, due to high heterogeneity of the studies in terms of objectives, intervention components, and study designs, they did not perform a meta-analysis and conducted a meta-synthesis instead. Of the 11 interventional studies reporting effect sizes, ten studies reported effect sizes based on independent groups with pre- and post-test designs (d_{IGPP}). One study reported an effect size based on repeated measures (d_{RM}). Four studies reported that MBIs could have a moderate to significant effect on reducing anxiety. Two of the five studies investigating teachers' self-efficacy as an outcome showed that MBIs had a moderate to strong effect. However, three studies did not report such an effect.

Since the current systematic review is not the first one to investigate the efficacy of MBIs on students' academic attainment in educational settings, the relative advantages of this review over the previous one (2) are addressed. It should be noted that the following items are related to the objectives and methodology of this systematic review and it cannot be guaranteed that the findings would be more definitive than those of the previous studies (2).

1. Synthesis of results with more primary studies: Given the fact that about five years has passed from the search period in the previous systematic review, it is likely that more relevant studies have been published in this period, which can result in the inclusion

of more primary studies with different and more reliable results. In addition, having access to more primary studies can allow performing sub-group analyses.

2. Exploratory nature of the previous systematic review: Given the fact that the previous systematic review was the first systematic review and meta-analysis examining the effect of MBIs on students, the researchers considered exploratory objectives (not confirmatory objectives). In the current systematic review, confirmatory objectives are considered at least for some objectives (primary and secondary objectives) due to the availability of evidence related to the effectiveness of MBIs in educational settings.

3. Possibility to resolve the limitations of statistical analysis: A limitation regarding the statistical analyses of the previous meta-analysis by Zenner et al. (2) is the existence of at least two types of designs in the included studies, i.e., before and after designs as well as two-group with pre and post-intervention designs. Most studies (19 out of 24 studies) had the latter design. The researchers estimated two effect size indices: within-group (intervention group) effect size and controlled between-group effect size (the difference between two mean differences of within-group measurements between intervention and control groups). Unfortunately, the latter effect size is not a valid one in two-group designs with pre- and post-interventions. The experts (9, 10) have advocated the use of Cohen's d effect size (standardized mean difference) in study designs such as two-group design with pre- and post-intervention. This effect size is known as d_{PPC} (effect size d for pre and post comparison). Morris has suggested three methods to estimate this effect size: d_{PPC1} , d_{PPC2} , and d_{PPC3} . The validity of the second and third indices is higher than the first one. Therefore, one of the advantages of the current systematic review over Zenner et al.'s study (2) is the estimation of an effect size which is more valid and recommended by experts considering the methodological design of the primary studies.

4. Inadequate treatment of heterogeneity:

Another limitation of the Zenner et al.'s systematic review (2) is that they only reported I^2 as a heterogeneity index. The authors did not find potential contributors to the observed heterogeneity. However, the potential sources of heterogeneity will be explored using sub-group analysis and meta-regression methods in the current review. From a methodological point of view, if the number of primary studies is higher (which this is expected to occur), the number of factors considered as potential sources of heterogeneity would be significant.

Participants/Population

All primary interventional studies investigating homogeneous or heterogeneous populations of students at schools or universities (or a combination of these them) will be considered. No restriction will be imposed in terms of age and gender. In other words, in primary studies, university or school students will be chosen from both genders and any age group. In addition, the participants of the studies will be from different races/ethnicities and socioeconomic levels. Furthermore, no geographic limitation will be considered in selecting the primary studies.

Intervention(s), Exposure(s)

The intervention of interest will be any type of MBI alone or in combination with other cognitive interventions. No limitation will be imposed regarding the number of MBI sessions or their duration as well as intensities and levels of the desired interventions.

Comparator(s)/Control

The control will be 'no intervention' or 'any similar cognitive intervention(s)' such as different teaching-learning processes.

Context

All eligible studies will be considered for inclusion.

Data Extraction (Selection and Coding)

The related literature will be retrieved by developing search syntax for the primary

bibliographic databases. Then, the developed search syntax will be adapted for other databases. PubMed will be considered as the primary database. When the search period (mentioned in the search strategy section) is applied in the search syntax, there will be no need for dividing articles according to the periods in later steps. The grey literature will be searched using some search terms by considering the capabilities of the relevant system. An expert librarian familiar with search strategies for systematic reviews will be consulted during the process of database search.

After performing the search, a reference management software (EndNote, Reference Manager, or equivalent web-based ones such as Mendeley Web) will be used to transfer search results from the databases. The Reference Manager will be utilized to facilitate the transfer of the search results and find duplications.

The screening phase will be performed after transferring the search output to the reference manager software. A screening checklist will be developed (the checklist is similar to a table) using some of the inclusion/exclusion criteria expected to be reported more frequently (minimum of three and maximum of five criteria). The titles and abstracts of the records will be reviewed using the screening checklist. The primary studies meeting at least one of the screening criteria will be selected for the next step (selection) while other records not fulfilling at least one of the screening criteria will be excluded. The articles with titles or abstracts not containing the required information will not be excluded. Such records will be handled similar to articles remaining for the selection stage. In other words, at the screening stage, only the studies which would definitely not have the inclusion criteria will be excluded.

The next step is the selection phase. This step is performed similarly to the screening phase with a difference that instead of the titles and abstracts, the full texts of the records will be reviewed. All inclusion/exclusion criteria will be used to determine the inclusion or exclusion of a particular record. If only one

of the criteria is not met, the record will be excluded at this step. Given the critical stage of selection and following the Cochrane Collaboration guidelines, two reviewers will perform this step. Any disagreements between the reviewers will be resolved to reach a consensus.

It is necessary to extract the required data of the primary studies to fulfil the objectives of this systematic review, and calculate or estimate the effect sizes for reporting the findings and implementing the meta-analysis phase. Therefore, a form titled as 'data collection form' or 'data summary form' will be used. This form will be designed when the review is designed (designing the protocol of the systematic review) by the research team, and a pilot study (using a single primary study) will be performed if necessary. At this stage, two reviewers will be involved, and any possible disagreements will be resolved by consensus and discussion. In case of deficient data in a study, the corresponding author of that particular study will be contacted. If there is no response after three attempts to contact him/her with a 10-day interval and unclear data regarding the primary objective, that study will be excluded from the review. However, if the deficient or unclear data are related to the secondary objectives of this review, that study will not be excluded.

As stated previously, a form will be used to collect the data related to the primary studies. This form will be designed according to the primary and secondary objectives of the systematic review and meta-analysis. To ensure content validity of this form, some experts such as faculty members and advisors will be consulted. According to the guidelines of the Cochrane Collaboration indicating evaluation and completion of the form by two reviewers and reaching agreement between them, the reliability and validity of the form will be addressed and access to the maximum validity and reliability will be ensured.

Additionally, a lot of the data (information) extracted from primary studies, the main source of validity and reliability is related to measurement of the variable(s) at primary

studies (the participants) and taking into account the presumption that in primary studies, the most appropriate and desirable methods have been used to assure validity and reliability, the current systematic review will not face a limitation regarding these issues.

Risk of Bias (Quality) Assessment

Since primary studies included in this systematic review will be of interventional type, the Cochrane Collaboration tool will be used to assess the risk of bias in randomized trials. This tool has seven domains, and each item includes three options, namely 'low risk of bias', 'high risk of bias', and 'unclear risk of bias'. Two methods will be used for more accurate evaluation and robustness in determining the methodological quality. In the first method, based on a scoring system, one point will be assigned to domains with low risk of bias while zero will be assigned to the other two options (i.e., high risk of bias and unclear risk of bias). Then, the scores will be summed for all seven domains. In the second method, instead of assigning scores, the primary studies will be categorized according to three possibilities (low quality, moderate quality, and high-quality studies). The second method (i.e., analysis based on categorization of the primary studies) has been suggested by the Cochrane Collaboration tool.

Strategies for Data Synthesis

Selecting an effect size indicator and then calculating/estimating it for the primary studies is the main step in meta-analysis studies. This will be performed for all the included primary studies regardless of whether the desired effect size has been reported in a particular primary study or not. The meta-analysis will be performed with suitable statistical software by using the primary information to calculate the effect size or directly access the effect size index. Given the explanations related to the innovations and relative advantages of this systematic review, the appropriate effect size could be divided into two or more categories. The effect size 'd_{ppc2}' will be used for

primary studies in which at least two groups are included "before and after" the design.

Cohen's *d* will be used in primary studies including two groups (or at least two groups) with parallel designs or measuring outcomes at a cross-section (after the intervention or at the end of the follow-up period). Hedges' *g* will be calculated (9) in primary studies where one group is studied with before and after outcome measurement. Although the interpretation of these effect size indices is almost similar, they cannot be combined with each other. Therefore, sensitivity analysis will be used to determine the stability of the final estimated effect size.

Considering the methodological similarities and differences, the combination model/method will be either fixed effect method or random effects model. If the methodological heterogeneity in primary studies is similar or almost similar to the previous systematic review, the combination model will be random effects model (11). A forest plot will be used to combine the studies in a graph based on effect size or subgroup analysis.

The Cochran's *Q* test as well as the inconsistency index (*I*²) will be used to assess between-study heterogeneity. Then, categorization of the heterogeneity will be performed based on Higgins et al. (12) suggesting *I*² of 25% as low, *I*² of 50% as moderate, and *I*² of 75% as severe heterogeneity. Sub-group analysis or meta-regression will be used to investigate the potential contributors to the heterogeneity (13).

Subgroup analysis will be used to analyze the effect of the methodological quality of the primary studies on effect size measurements. If sub-group analysis is not applicable, meta-regression will be used.

Publication bias (small-study effects) will be determined by examining a funnel plot as well as performing statistical tests such as Begg's and Egger's tests (14). Leave-one-out method will be used to perform sensitivity analysis and assess the stability of the results. In addition, sensitivity analysis will be performed considering items such as randomized versus non-randomized studies,

blinded versus non-blinded studies, and different effect size measurements (15).

Discussion

It is estimated that about one-fifth of adolescents may be diagnosed with mental health problems (e.g., isolation and discrimination) during one year (16). MBIs in educational settings such as schools or colleges have gained increasing attention in recent years (17, 18). Different factors, such as delivery method, resources, and shared understanding, can affect the efficacy of MBIs in schools (19). No comprehensive review and meta-analysis studies have examined the true effectiveness of such interventions in schools and universities. It is hoped this review will help provide useful data related to the effectiveness of MBIs in educational programs. In addition, subgroup analyses will enable a comparison between different types of interventions, which can shed light on the kinds of interventions that more suitable for particular groups of students. Furthermore, sources of heterogeneity between the studies will be investigated, which could help future research address variations between studies and propose a standard approach for the best outcome when using MBIs in educational settings.

Ethical Considerations

This article describes the protocol for a systematic review which will be conducted in near future.

Authors' Contributions

ANB participated in making the concept and literature review. KH proposed the methods used for the review. YM prepared the manuscript draft. All authors participated in revision of the final article.

Conflict of Interest

The author declares that there is no conflict of interest.

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