Discover Psychology

Review

Relationship between mental health and students' academic performance through a literature review

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Abstract
Mindfulness has become increasingly popular to improve physical and mental health. Its implementation transcends boundaries of disciplines that study its impact. The aim of this study is to identify and analyze the benefits of mindfulness on mental health, academic performance, well-being, mindfulness and prosocial behavior of university students, as well as to identify the most effective way to achieve habituation to the practice. An analysis and systematic review of papers published in the Scopus database was conducted. It was found that publications on the implementation of mindfulness in higher education began in 2004. Their study has been developed in 22 countries, 15 are European, 3 Asians, 2 North American, one Latin American and one from Oceania. Spain is the only Spanish-speaking country. Academically, mindfulness stimulates creativity, exploratory thinking, critical thinking, attention regulation, increases concentration and improves the learning experience. In addition, immersive virtual reality experiences were found to positively influence habituation towards mindfulness practice among university students.

Keywords Academic performance · Meditation · Mindfulness · University students · Virtual reality

1 Introduction

In recent decades, mindfulness has gained popularity as a technique for reducing stress, anxiety, and depression. As well as increasing the well-being and quality of life of people who practice it [1]. Its origin is found in the Buddhist tradition, as a way to achieve clarity of thought [2]. Although this technique has been practiced in the East for more than 25 centuries, in the West its popularity is recent [3]. However, its application is expanding more and more in different disciplines [4].

Social-emotional learning has been introduced in education. It refers to the training of attention, through meditation techniques, such as mindfulness, the most recent update of the programs that seek emotional intelligence [5]. This type of education is also known as contemplative education, which seeks to enhance the learning experience through reflection and personal perception [6].

Dr. Jon Kabat-Zinn defines mindfulness as "awareness that develops by paying concrete, sustained, deliberate, and non-judgmental attention to the present moment" [7, p. 13]. It facilitates maintaining mental calm and training attention [8]; in addition to increasing mental clarity and awareness [9].

In terms of operability, three qualities that people develop while practicing mindfulness and three qualities related to how the practice is carried out are recognized. The first are observation, description, and participation. While in the mode of practice, acceptance is required, in the present moment and in an effective manner [10].

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Mindfulness can be practiced formally and informally. In formal practice, a specific time is set aside daily for guided meditations. Informal practice brings awareness to daily activities. That is, paying attention to sensations and perceptions while walking, driving, eating, cleaning, among other activities [7].

Mindfulness has been shown to improve physical and mental health. In terms of physical health, it favors the increase of Brain Derived Neurotrophic Factor (BNDF) [11]. While in mental health it reduces symptoms of anxiety [12], stress [13–16] and depression [12]. It also facilitates coping with change and uncertainty [14] and increases well-being [17].

1.1 How might the efficacy of mindfulness be evaluated?

Blood tests can be used to measure the effectiveness of mindfulness. A reduction in the levels of cortisol, the stress hormone [13]; and of increased BNDF can be observed after two weeks of practice [11]. Increased blood BNDF levels are a potential mediator between meditation practice and brain health [13]. BNDF measured in the blood by plasma or saliva is called peripheral BNDF [18].

BNDF is a modulator that regulates neuron growth. It allows the creation of new dendrites which improves communication between neurons; in other words, it promotes greater neuronal plasticity in the central and peripheral nervous system [11, 13, 18–20]. Its main function is at the level of the hippocampus and cerebral cortex, structures linked to learning and memory functions [13].

BNDF is produced in the central nervous system and peripheral tissues. Over time, its production tends to decrease. Its absence is related to psychiatric and neurological disorders such as emotional burnout, anxiety, depression and Alzheimer's disease [13] However, some activities stimulate its production. Exercising, practicing yoga, undergoing controlled stress, traveling, acquiring new experiences, learning and mindfulness stimulate its production [13, 20].

1.2 What are the reasons for integrating mindfulness into higher education?

The increase in mental health illnesses in college students has become a recognized concern [16, 21]; which requires innovative interventions to address this reality [22, 23]. In this sense, mindfulness emerges as a proposed solution [12], to prevent and reduce professional burnout [24]. Thus, there is growing interest in its applications in higher education [25, 26].

In addition to the physical and mental health benefits, mindfulness practice promotes better academic performance [8, 27, 28]. Such as increased attention, learning and thinking [29]; and reduced pre-test anxiety [29, 30].

Mindfulness practice also stimulates exploratory thinking [4], creative thinking [4, 31], and critical thinking [2]. It increases spatial and sensory awareness [4], academic self-efficacy [32, 33], productivity and task quality [8]; in addition to increasing the feeling of personal accomplishment [34].

On the other hand, it facilitates information retention [35], improves concentration [22, 26, 36, 37], attention self-regulation skills [32, 37, 38] and allows for a perceived improvement in the overall learning experience [31, 37, 39–41]. This is because it is essentially training the brain that facilitates focusing attention. A faculty that, for William James, father of American psychology, constituted the root of judgment, character and will [42].

1.3 Technological immersion in mindfulness

Studies show that technology is increasingly present in the field of mindfulness practice. Evidence of that is the introduction of video games such as the one developed at the University of Wisconsin called tenacity. This is to improve mindfulness through breathing exercises [5]. Mobile applications such as Headspace and Calm have also been developed to promote meditation techniques [43, 44].

In addition to the above, immersive environments incorporating Virtual Reality (VR) have been developed to stimulate mindfulness practice. Home meditation studio, tripp and maloka are some of the applications that virtual reality allows mindfulness practice in totally immersive environments.

1.4 Virtual reality and mindfulness in education

VR makes it possible to experience alternative realities perceived atmospherically [45]. It is applied in disciplines and sciences such as medicine, engineering, mathematics, dentistry and education [46]. In education it is used to improve academic performance [29], and increase attention, creativity, flow state, and habituation to practice [47].

Pascual et al. [48] state that, despite there being few studies related to the evaluation of mindfulness interventions using VR, it is considered a more effective platform than standalone mobile meditation apps for encouraging daily practice. Along those lines, results from Miller et al. [49] study indicates that VR-guided meditation practice is associated with increased positive affect compared to non-VR meditation.

In the case study by Malighetti et al. [50] it was found that techniques for the development of emotional intelligence such as increased awareness, identification of emotional states, increased resilience and self-control implemented through VR allowed greater mental regulation in terms of eating habits in patients with binge eating disorders. In that order, students with greater emotional regulation have greater self-efficacy [51].

VR mindfulness promotes mental health [52]. Studies show that it can reduce insomnia and stress [53] and improve learning [46]. Coupled with the above, Kwon et al. [30] found that incorporating virtual environments through VR is feasible for managing anxiety stemming from academic exams.

Kaplan-Rakowski et al. [29] study showed that students who meditated with VR performed better academically than those who meditated using videos. While Yang et al.'s [47] research, immersive virtual reality experiences were found to affect traits associated with students' creativity such as flow state and attention. When students were assigned creative challenges or challenges, those who participated in immersive VR produced better quality products. They also maintained a more stable attention level than the control group.

VR can impact long-term learning. According to Mohring and Brendel [45] it use in the educational context needs to be reflected upon, because it triggers human perception with far-reaching consequences and people using it hardly question the alternative reality experience it offers. Nevertheless, it can contribute significantly to students' training through the development of enhanced digital skills and increased mindfulness.

According to Mohring and Brendel [45] VR can trace the path towards mindfulness in different educational contexts: in teaching and in transforming the relationship between society and the environment. A view that coincides with Whewell et al. [54] who argue that these immersive experiences contribute to the development of enhanced digital skills, increased student engagement, cultural competence and global mindfulness in university students. VR can foster the conditions for students to become global change agents "within the spheres of entrepreneurship and education" [54, p.1].

However, mindfulness benefits require continuous practice. According to the study by Pascual et al. [48], meditation sessions are associated with a decrease in anxiety. Therefore, identifying how to introduce and implement an effective program is of the utmost relevance for updating the current educational system.

In that sense, this research aims to identify programs that have been implemented to incorporate mindfulness into higher education. From its beginnings to the present, it analyzes the scientific literature to understand the evolution of its implementation. It identifies the countries where these programs are carried out, the universities that participate, the years they have been carried out and the types of documents published.

Mindfulness's documented benefits for mental health, academic performance, well-being, and students' awareness and prosocial behavior are discussed. Finally, technology, specifically virtual reality, is addressed as a medium that facilitates mindfulness practice stimulation and habituation.

Therefore, the following research questions were defined: 1. How many publications are published per year? 2. In what language are they published? 3. What kind of documents are published? 4. Which universities are involved in the research? 5. In which countries are mindfulness and higher education being studied? 6. What is the impact of mindfulness on higher education students' mental health? 7. What is the impact of mindfulness on higher education students' academic performance? 8. What is the impact of mindfulness on higher education students' well-being? 9. What is the impact of mindfulness on higher education students' conscientiousness and prosocial behaviour? 10. Is virtual reality the most effective medium for fostering mindfulness among higher education students?

2 Methods

An analysis of scientific publications in the scopus database, which could be accessed through an institutional account of the University of Burgos in Spain as part of a research stay, was carried out. The information search was conducted using English keywords. The keywords used to elaborate the search string were mindfulness, meditation, university students and higher education students. This search string yielded 70 publications as of July 19, 2024.

All Scopus database publication types were considered inclusion criteria: articles, book chapters, papers, reviews, books and short surveys. In English and Spanish. All articles whose information was not available, were not aimed at higher education students, or did not address any meditation technique were excluded.

An Excel document with the articles' information was extracted for analysis. One article was not available so 69 documents were considered. It was found that 11 publications did not actually mention meditation techniques and were excluded. Also, 5 publications not directed at higher education students were not considered. This resulted in 53 selected research papers. Figure 1 illustrates the situation.

To answer questions 6, 7 and 8, a subsequent analysis was carried out to identify the measurement variables used by the authors. Measurement variables were identified in the selected documents. The variables were divided into four categories. Mental health, academic achievement, well-being, and prosocial awareness and attitude.

The mental health category includes 9 variables: reduction of stress, anxiety, depression, emotional exhaustion, depersonalization burnout and negative mood. Also increased mental health, calmness and positive mood. Of the 53 items, 4 address some mental health elements and 23 also include elements from other categories.

Academic achievement is made up of 16 variables: academic performance, clinical performance, exploratory thinking, critical thinking, creative thinking, productivity, task quality, academic speed, persistence, observation skills, attention regulation skills, information retention, academic self-efficacy and concentration. Additionally, the learning experience and divergent and convergent creative writing will be improved. Of the 53 items, 5 address elements relating to academic achievement and 19 also include elements from other categories.

The well-being category consists of 13 variables: increased life satisfaction, well-being, sense of belonging, emotional self-regulation, quality of life, self-compassion, physical activity, resilience, non-judgmental acceptance,

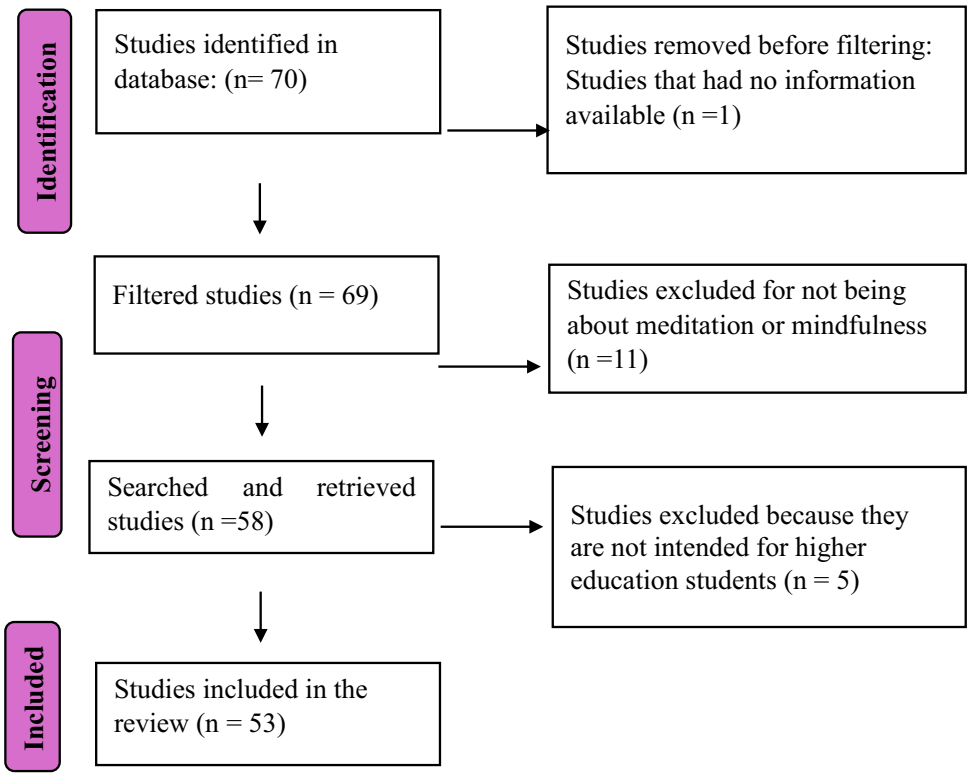

Fig. 1 Flow diagram

perceived social support, and sense of accomplishment. Also included are better dietary decision making and improved sleep quality. Of the 53 items, 1 addresses well-being items and 20 include items from other categories.

In the category awareness and prosocial behavior, 14 variables were integrated: increased mindfulness skills, spatial awareness, sensory awareness, self-awareness, dispositional mindfulness, empathy, benevolence, prosocial behavior, collectivism, a sense of transcendence, universalalism, mental clarity, responsibility and improved interpersonal relationships. Of the 53 items, one addresses element unique to prosocial awareness and behavior and 21 also include elements from other categories.

To answer question 8, an additional search integrating technology and virtual reality was included. Although the object of this study is directed primarily at higher education students, research that analyses mindfulness incorporation at other educational levels was considered in this question.

3 Results

The results of the research are presented in this section. We start with the general findings and then answer the research questions.

3.1 General findings

Although all the investigations analysed are directed at higher education students, 27 do not specify the discipline or the educational program in which the students are enrolled. However, it was found that the educational programs where mindfulness effectiveness is most frequently studied is in medicine and nursing with six investigations, engineering with four, and then anaesthesiology, arts and design, sciences, modern dance, law midwifery, writing, pharmacy, literature, music, social work and design pedagogy with one respectively.

Regarding the duration of the programs, of the 53 studies analysed, 31 do not specify the duration of the practice in weeks, days or sessions. However, in six investigations the programs lasted 8 weeks and in five investigations, 6 weeks. The longest program consisted of 12 weeks and the shortest 1 day. About the analysis of keywords, Fig. 2 shows the identified word networks.

In this analysis, it was found that of the 418 keywords used, 30 have at least a frequency of occurrence of 5. It is highlighted that the words with a higher frequency of occurrence and greater connectivity are mindfulness and meditation. Next, the research questions are answered.

1. How many papers are published each year about mindfulness and higher education students?

According to Table 1, publications on mindfulness in higher education began in 2004. In 2014, these rates began to remain constant. In the United States, the first publication was produced by the doctor Daniel Holland, associated with universities in Pennsylvania, Arkansas, Illinois, and Washington. At the University of Pennsylvania, the first program for developing resilience in children was developed. Furthermore, in the late 1990s, doctors Martin Seligman and Mihaly Csikszentmihalyi, both affiliated with the same university, pioneered positive psychology [55].

As part of positive education, positive psychology was introduced to institutions. The concept of positive education succeeds the concept of emotional education. In addition to emotions, this approach incorporates other elements such as meditation in order to increase well-being [56].

2. What is the language in which mindfulness research is published? There are 53 documents in the collection, 50 of which are in English and three of which are in Spanish
3. Are there any published documents that discuss mindfulness and students in higher education? Publications were classified into five categories: articles, reviews, book chapters, presentations and books. As shown in Table 2, each type of document has a different quantity.

There are several different types of documents published. Articles are the most frequently published. Review articles, presentations, book chapters, and books follow.

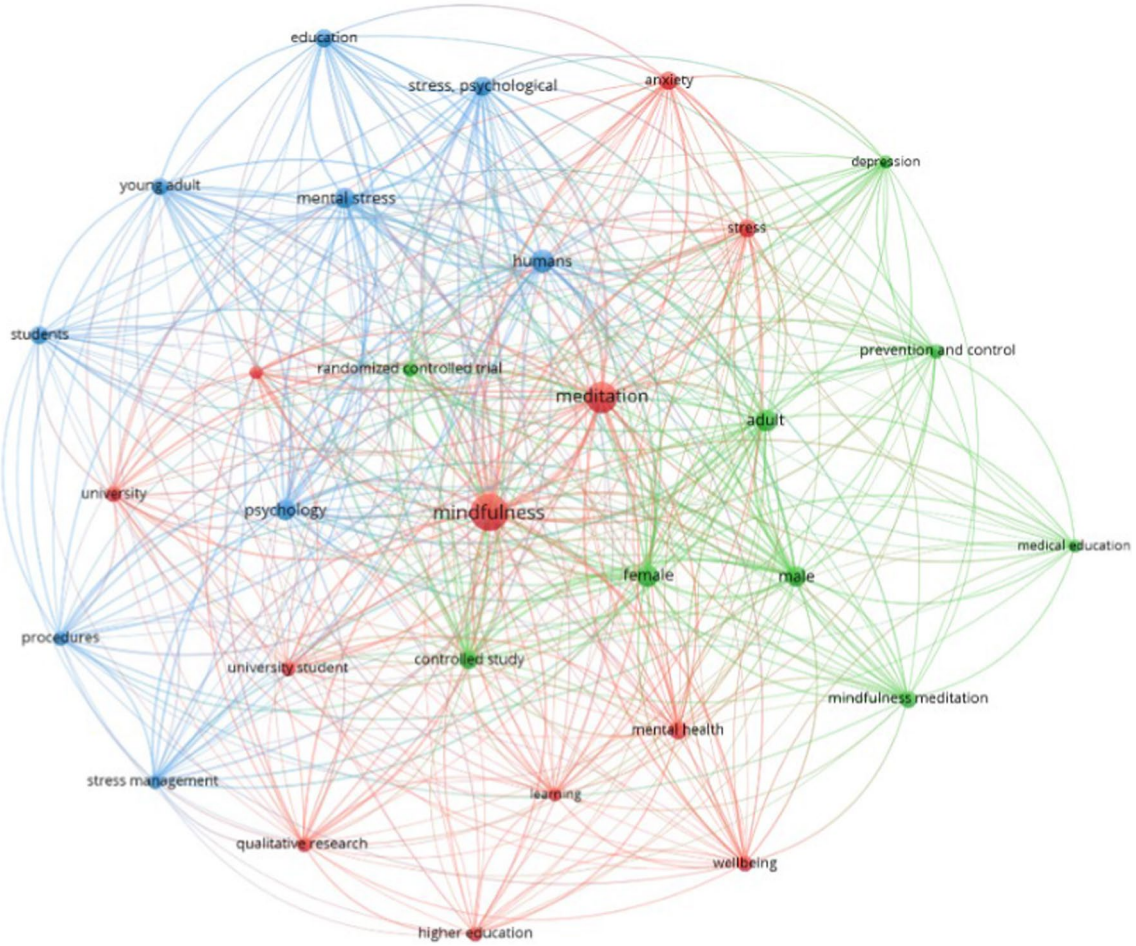

Fig. 2 Visualization of keyword networks based on a VOSviewer version 1.6.20 elaboration

Table 1 Publications on mindfulness and higher education students by year

Year	Papers
2024	5
2023	7
2022	9
2021	6
2020	5
2019	4
2018	3
2017	5
2016	2
2015	2
2014	2
2009	1
2006	1
2004	1
Total	53

Table 2 Type of publications on mindfulness and higher education students

Type	Publications
Papers	41
Reviews	6
Chapter of books	2
Conferences	3
Books	1
Total	53

4. What are the publications of universities on mindfulness and higher education students?

A summary of the publications produced, the universities that participate in collaborations, and the most important findings are presented in this section according to the type of document, the language, and the year.

3.2 Spanish-language articles

There have been only three articles published in Spanish. These include one by the University of Almería in Spain in 2009, another by the University of Lisbon in Portugal in 2022 and another by the University of Granada in Spain in 2024. A study by Justo and Luque [57] demonstrated that mindfulness leads to a deepening of reflection and self-awareness, which in turn stimulates prosocial values like benevolence, collectivism, and the sense of universalism and transcendence. Sobral and Caetano [58] conducted a study in which individual and collective activities were incorporated into two courses, including mindfulness, using students' portfolios and teachers' notes. On the other hand, in the study by García-Pérez et al. [23] mindfulness is considered as a starting point to guarantee mental health and improve the well-being of university students.

3.3 Articles in English

In 2014, two English-language publications were published. One by Nottingham Trent University in the United Kingdom and one by Duke University Medical Center in the United States. Greeson et al. [59] found that the Koru mindfulness training program improved sleep, improved mindfulness skills, increased self-compassion, and decreased stress among college students.

According to Van Gordon et al. [3], the Meditation, Awareness Training (MAT) program has been evaluated by college students. During the eighth weeks of training, the students demonstrated improved well-being and self-regulation skills in terms of thoughts, feelings, and behavior. A significant increase was also observed in dispositional mindfulness.

In 2015 only one paper was published by Newcastle University in Australia. In this study, after 7 weeks of practicing mindfulness, students showed an improvement in their well-being, sleep quality, increased concentration, mental clarity and a reduction in negative mood was observed [22].

In 2016, two articles were published, one by Chatham University in the United States, and another where two universities from two different countries participated, the National University of Ireland and Coleraine University in the United Kingdom. In the study by Noone et al. [2] it was found that dispositional mindfulness facilitates critical thinking. While in the research of Spadaro and Hunker [38] it was found that after 8 weeks of practicing mindfulness online, nursing students in the United States reduced anxiety and stress. They also increased mindfulness self-regulation skills.

There were three articles published in 2017. The first study was conducted by Ohio State University in the United States, the second by Ryerson University in Canada, and the third by the Department of Psychiatry at MoleMann Hospital for Mental Health in the Netherlands.

Using reflective writing and guided mindfulness meditations, Klatt [60] conducted research at Ohio University to increase awareness of students' life goals. According to Schwind et al. [37], mindfulness and loving-kindness meditation practice after eight weeks reduced anxiety, improved learning experience, increased sense of calm, concentration, and attention self-regulation skills among Canadian university students.

While in the research of Van D'Ijk et al. [61] it was found that after 8 weekly sessions of two hours daily using the mindfulness-based stress reduction (MBSR) program, students from the Netherlands reduced anxiety and negative

emotional states. Improved mental health, life satisfaction and increased mindfulness skills were also observed. However, empathy was not increased.

In 2018, three articles were published. One by the University of Seville in Spain, one by the National University of Ireland and one where an international collaboration between 5 universities took place. The University of Southampton in the UK, the Helvetiapraxis Medical Centre in Switzerland, Kings College London in the UK, the Coburg University of Applied Sciences and Arts in Germany and the Poznan University of Medical Sciences in Poland.

Research conducted by Bernárdez et al. [9] revealed that software engineering students at the University of Seville in Spain improved their academic self-efficacy after 6 weeks of practicing mindfulness.

Lynch et al. [25] evaluated mindfulness-based coping with university life (MBCUL), an adaptation of the MBSR program. College students increased their mindfulness skills, decreased stress, anxiety, and depression after eight weeks. The study by Noone and Hogan [62] found that practicing mindfulness using the headspace mobile app for 6 weeks or 30 sessions increased dispositional mindfulness, but not critical thinking. Students at the National University of Ireland participated in this study.

There were three articles published in 2019. In the United Kingdom, Birmingham City University submitted the first study, in the United States, Lousville University submitted the second, and in Iceland, the University of Rhode Island submitted the third.

A study conducted by Dutt et al. [84] from the University of Birmingham has demonstrated that mindfulness reduces stress and helps to make better dietary decisions. The University of Rhode Island conducted a study in which Lemay et al. [63] found that after 6 weeks of practicing viyansa yoga, pharmacy students were able to increase their mindfulness skills and reduce their levels of stress and anxiety. Weingartner et al. [39] found that mindfulness and compassion training increased mindfulness skills, dispositional mindfulness, and empathy in medical students at Lousville University. As a result, interpersonal relationships, resilience, nonjudgmental acceptance, observational skills, and learning experiences were also improved.

In 2020, four papers were published. In the United States, there are four, one from the University of North Carolina, one from the University of Florida, one from Juiz de Fora in Brazil, and one from the Department of Psychological and Behavioral Sciences at the London School of Economics and Political Science.

At the University of North Carolina, a slow sensory experience linked to meditation techniques is introduced in the modern dance program to improve concentration [64]. According to the study by Bóo et al. [27], mindfulness increases academic performance, emotional self-regulation, and self-awareness in the UK. However, Damião et al. [65] found no significant increase in mindfulness skills of medical students at the Federal University of Juiz de Fora, Brazil, following a 6-week mindfulness training program. Stress, anxiety, or depression did not decrease. Quality of life and mental health also showed no change.

A study by Williams et al. [40] concluded that medical students at the University of Florida improved their mindfulness skills, perceived social support, empathy, and prosocial behavior after 11 weeks participating in the Promoting Resilience in Medicine (PRIMe) program, although they did not reduce stress. Behaviors characterized by empathy and prosociality. As a result, the general well-being and learning experience have also improved.

There were three articles published in 2021. First, the University of Manitoba in Canada, second, Bilkent University in Turkey, and third, Johns Hopkins University in the United States. Altay and Porter [4] found that mindfulness practice among design psychology students in Turkey increased non-judgmental acceptance, exploratory thinking, creative thinking, spatial awareness, sensory awareness, and empathy.

An evaluation of the effectiveness of the Headspace mobile application was conducted by Carullo et al. [33]. Over the course of four months, anesthesiology and medical students from the United States practiced mindfulness. Depression levels were reduced and personal accomplishments were increased. The level of emotional exhaustion nor the level of depersonalization burnout, however, did not improve. Based on research conducted by Litwiller et al. [21] among college students in Canada, mindfulness, meditation, Tai Chi, yoga, exercise, and animal therapy have been found to be effective in reducing stress, anxiety, depression, and negative mood.

The year 2022 saw the publication of nine papers. The first was completed by the Aix-Marseille University in France, the second by the Department of Anthropology at the University of Missouri in the United States, and the third by the University of Central Arkansas in the United States in collaboration with the University of Missouri. It was also submitted by the University of Illinois in the United States, Kirikkale University in Turkey, Arizona State University in the United States, the University of Seville in Spain, Brock University in Canada, and the University of Lisbon in Portugal.

Researchers in Turkey found that mindfulness practice increases life satisfaction among nursing students. According to Bernárdez et al. [8], mindfulness enhanced academic performance, productivity, task quality, and academic speed in

Spanish students. Devillers-Réolon et al. [66] found that stress, anxiety, and depression were reduced in their research. The ability of French university students to regulate their attention did not improve, despite improvements in their well-being.

Researchers at Arizona State University found that mindfulness practice increased concentration, non-judgmental acceptance, and resilience among arts and design students. An opinion survey conducted by Klonoff-Cohen [67] revealed that college students in Illinois believe meditation and mindfulness exercises are effective coping mechanisms. The study by Sensiper [26] from the Anthropology Department concluded that after 10 weeks of structured in-class meditations, mindfulness exercises, contemporary text readings, and reflective writing, college students exhibited reduced anxiety, improved well-being, increased emotional self-regulation, concentration, and dispositional mindfulness.

As part of the research conducted by Sobral and Caetano [58], the University of Lisbon conducted a self-study on emotional education. Teachers evaluated the students' portfolios in order to identify recurrent problems, and students evaluated mindfulness practices, collective and individual projects.

Strickland et al. [68] reported that mindfulness combined with a modified version of Dr. Robert Boice's blocked writers program increased positive mood and resilience to stress and anxiety in students and teachers in higher education.

According to Woloshyn et al. [31], mindful writing stimulates creative thinking, increases empathy and prosocial behavior in higher education students and teachers in Canada. A positive emotional state can also be achieved through non-judgmental acceptance, increased self-awareness, self-compassion, and non-judgmental acceptance. In addition, it enhances well-being and the learning experience.

Six papers have been published in 2023. One by the University of Rome in Italy, one by Griffith University in Australia, another is the result of a collaboration between the University of South Carolina and Winthrop University both in the United States; and another due to collaboration between the Institute of Psychology of Lorand University in Hungary, the University of Vienna and the University of Artois in France.

One paper is the result of a collaboration between the University of the West of England in United Kingdom, and Dongguk University in South Korea. And another article was the result of a collaboration between University of Limoges, University of Montpellier and University of Paris Cité in France and University of Brussels in Belgium.

In the research by Fagioli et al. [32] University students in Italy practice mindfulness online for 28 days. An improved sense of belonging increased academic self-efficacy and self-regulation of attention skills were observed. In the study by García et al. [69], mindfulness was practiced for 1 week, 5 min daily. This exercise reduced anxiety, increased physical activity and improved sleep in United States students. Nagy et al. [70] found that mindfulness practice can increase persistence in those with a strong disposition toward a growth mindset or mindfulness.

In the research of Hagège et al. [71] it was found that the Meditation-Based Ethics of Responsibility (MBER) program had a positive impact on sense of responsibility and convergent and divergent creative writing tasks in undergraduate science students. In undergraduate music therapy students, it was found that eight weeks of practicing mindfulness can reduce stress and improve mindfulness and well-being [72]. While Pearson's [73] looks for strategies on how mindfulness can be introduced into law education programs in Australia.

So far in 2024, three papers have been published. One by the Virginia Tech College of engineering. Another by the collaboration of Idaho State University and the University of Wisconsin Oshkosh, in the United States. Another by Kaohsiung Medical University and Meiho University, both from Taiwan.

In the research of Giesler et al. [74] the Caring Action Leadership Mindfulness model is proposed to increase mental health and sense of belonging in undergraduate social work students. In the study by Liu et al. [75] it was found that practicing mindfulness for 50 min a week for 8 weeks reduced stress and increased mindfulness skills in nursing students. On the other hand, Martini et al. [76] found that although most engineering students after practicing mindfulness experienced a reduction in perceived stress, a sense of calm, increased energy, and greater concentration, other students who expressed feeling more tired and distressed after meditation practice.

3.4 Book chapters

Book chapters are rare. One by Queen Margaret University in 2015 and one by the University of Surrey in 2020, both UK universities. In the Oberski et al. [35] study, it was documented that mindfulness in college students allows for increased information retention and a positive emotional state. In Kilner-Johnson and Udofia's [77] research, techniques for incorporating mindfulness in the humanities in higher education are proposed.

3.5 Books

On the other hand, only one book was published by the University of Groningen in the Netherlands in 2021. This work addresses the benefits of incorporating mindfulness into higher education courses. It documents the results of the Munich model named mindfulness and meditation in the university context. It also includes practical exercises with instructions for implementation in educational institutions.

3.6 Conferences

Three conferences have been published from the United States. One in 2006 by the University of Arkansas, another by the University of Denver Colorado in 2021, and another by Northeastern University in 2023. Holland [6] presents a course developed and implemented in some universities in the United States through his personal experience, while Wu [41] states that sonic meditation for higher education students improves the learning experience. In the study by Grahame et al. [78] it was found that daily mindfulness practice enables engineering undergraduates to reduce stress.

3.7 Reviews

Six reviews have been published. One was in 2004 by Southeastern Illinois University in the United States. In 2017 there were 2 publications. One by the University of Portland in the United States and one by LaTrobe University in Australia. In 2019 the Medical Department of the University of Amsterdam in the Netherlands also published a review. In 2021, a collaboration between three UK universities—Queens University, the University of Suffolk and the University of York was published. In 2024 another was published by Padjadjaran University in Indonesia.

Holland [79] outlines how mindfulness can be incorporated into higher education and the benefits this can bring for students with disabilities and promote health. McConville et al. [33] found that mindfulness reduces stress, anxiety, and depression. It also increases mindfulness skills, empathy, a positive emotional state, and academic self-efficacy. Stillwell et al. [80] found that both the MBSR program, yoga, breath work, meditation, and mindfulness in nursing students reduced stress.

Breedvelt et al. [81] evaluated the effectiveness of meditation, yoga, and mindfulness on symptoms of depression, anxiety, and stress in college students. They concluded that most publications regarding mindfulness have a high risk of bias, are of poor quality, and do not specify which technique provides the benefits. For it is unclear whether it is mindfulness, yoga or another meditation technique that is effective. McVeigh et al. [28] found that mindfulness practice in nursing students reduces stress, increases clinical academic performance and self-awareness. In the research of Yosep et al. [82] it was found that digital mindfulness through audios and videos is effective in improving the mental health of university students.

5. What are the countries where mindfulness and higher education students are most widely published?

Based on the description of the universities in question three, Fig. 3 illustrates the countries and locations where publications on mindfulness and higher education students have been published.

As can be seen, the United States leads in mindfulness research and higher education students. It is followed by the United Kingdom, Canada, Australia and Spain. Spain is the only Spanish-speaking country on the list.

On the other hand, although the research is carried out in 22 countries, the collaboration networks include 14 countries. Figure 4 shows the collaboration networks detected.

Figure 4 shows a collaborative network of 14 countries composed of four nodes. One is formed by Austria, Belgium, Canada, France and Hungary in red. In green by the United Kingdom, Turkey, South Korea and Ireland. In blue, Germany, Switzerland and Poland and in yellow, Australia and the Netherlands.

6. What are the benefits of mindfulness practice for higher education students' mental health?

Mindfulness practice reduces stress [21, 25, 28, 33, 38, 59, 63, 66, 80, 84] anxiety [21, 25, 26, 33, 37, 38, 61, 63, 66, 69] and depression [21, 25, 33, 34, 66].

Mindfulness reduces negative mood [21, 22, 61]. As well as increasing positive mood [31, 33, 35, 68]. In research by Bernárdez et al. [9], mindfulness was found to reduce emotional exhaustion and depersonalization burnout. While Van D'Ijk et al. [61], that it improves mental health. Schwind et al. [37] found that it increases the feeling of calm.

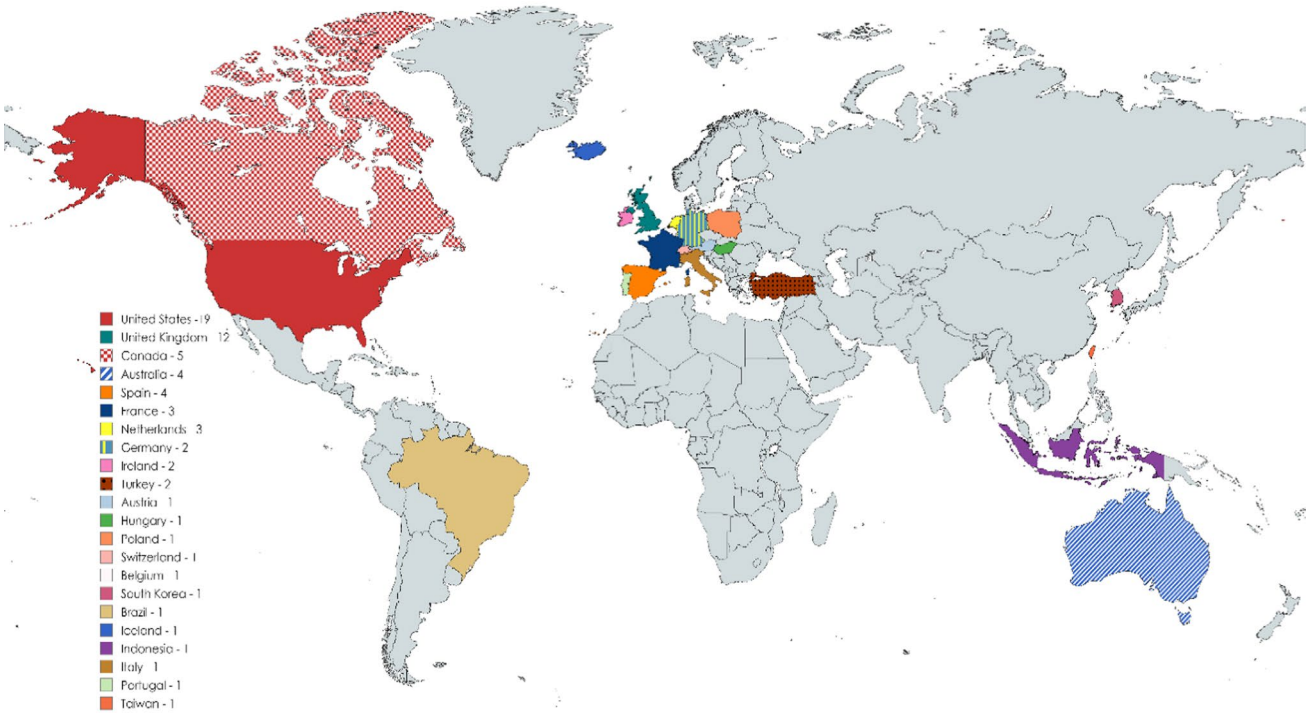

Fig. 3 Geographical location of countries where mindfulness research has been conducted. Font: Own elaboration in the Mapchart application [83]

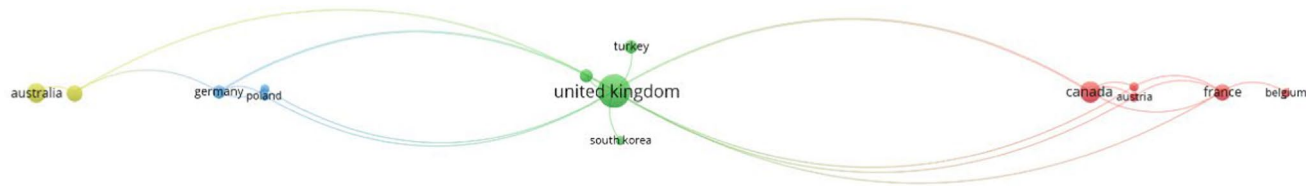

Fig. 4 Cross-country collaboration networks based on a VOSviewer version 1.6.20 elaboration

3.8 Stress reduction

In the case of Devillers-Réolon et al. [66] and Spadaro & Hunker [38] the mindfulness practice was conducted online and lasted for 17 days and 8 weeks respectively. Greeson et al. [59] study was also practiced online using the Koru program. Although the duration of this is not specified.

In Lynch et al. [25] research, the MBSR program was used for 8 weeks. While Stiwell et al. [80] the same program was used, although the duration of time is not specified. Of the five studies in which mindfulness is practiced traditionally through guided meditations, only one, that of Lemay et al. [63] indicates that the program lasted 6 weeks in 60-min sessions. The other investigations do not indicate weeks or practice sessions.

According to Yogeswaran and Morr [16] online mindfulness practice can be effective in addressing stress. However, at least for medical students, the evidence was not sufficient to prove its efficacy in decreasing symptoms of depression and anxiety. In contrast, the study by Ahmad et al. [12] found that, among university students in Toronto, Canada, internet-based Cognitive Behavioral Mindfulness Therapy interventions could reduce symptoms of anxiety, depression and stress after 8 weeks.

7. What are the benefits of mindfulness practice on higher education students' academic performance?

Mindfulness increases clinical performance [28] and academic performance [8, 27, 28]. Stimulates exploratory thinking [4], creative thinking [4, 31] and critical thinking [2].

It increases productivity, task quality and academic speed [8]. As well, it also increases academic self-efficacy [9, 32, 33], improves the learning experience [31, 37, 39–41], and improves observation skills [39].

Coupled with the above, it improves information retention [35], increases concentration [22, 26, 36, 37], and attention self-regulation skills [32, 37, 38]. Another finding in relation to academic performance is that mindfulness can increase persistence in people with a strong disposition toward mindfulness or a growth mindset [70].

3.9 What benefits does mindfulness practice have on higher education students?

Mindfulness practice increased perceived social support [31, 40], improves well-being [3, 22, 26, 31, 40, 66] and improve dietary decision-making [84]. It also increases sense of belonging [32], life satisfaction [61, 85], physical activity [69]; and improves sleep quality [22, 59, 69]. Damião´s et al. [65] research showed no improvements in quality of life after the intervention.

Mindfulness allows increasing self-compassion [31, 59], sense of personal achievement [34], self-regulation of thoughts, feelings and behaviors [3, 26, 27]. It stimulates the development of resilience for stress and anxiety management [36, 39, 68]; and it helps to manage the judgmental voice. That is, it facilitates non-judgmental acceptance [4, 31, 36, 39].

9. What are the benefits of mindfulness practice on mindfulness and prosocial behavior in higher education students?

Mindfulness allows for increases in self-awareness [27, 28, 31], sensory and spatial awareness [4], mindfulness skills [25, 33, 39, 40, 59, 61, 63] and disposition toward mindfulness [3, 26, 39, 68].

It also stimulates prosocial behavior [40], collectivism [31, 57]. It increases empathy [4, 31, 33, 39, 40] and benevolence [57]. It improves interpersonal relationships [31, 39, 40], clarity of thought [22]; and increases the sense of universalism and transcendence [57].

10. Is virtual reality the most effective way to promote mindfulness among higher education students?

Virtual reality could facilitate mindfulness habituation. In the study by Navarrete et al. [86] conducted with university medical students in Valencia, Spain, it was found that those who participated in the virtual reality program meditated twice as long as those who only practiced through regular guided meditation. Along these lines, Pascual et al. [48] found that health professionals who practiced meditation completed more sessions than those who did not use VR.

Likewise, in the study by Modrego-Alarcón et al. [15] and Miller et al. [49] it was found that VR students acquired greater immersion and mindfulness practice. Therefore, immersive virtual reality environments favor habituation toward mindfulness practice.

4 Discussion

The benefits of mindfulness in higher education students at the psychoemotional level have been widely documented [12–17, 87]. One of the most frequently highlighted benefits of mindfulness in higher education students is the positive effect on self-esteem, as evidenced by the findings of several studies [88, 89]. Additionally, mindfulness has been shown to reduce stress levels [25, 33, 39, 40, 59, 61, 63, 90]. These types of benefits have also been observed in other demographic groups. For example, a study conducted by Chandna et al. [91] with an adult population demonstrated that mindfulness practice was associated with significant improvements in self-esteem and self-efficacy.

As previously stated, mindfulness practice has been identified as a potential solution to the emotional difficulties experienced by higher education students in the current context [12]. The positive effects of mindfulness on students' psychoemotional well-being have been demonstrated in numerous studies [66, 67, 85]. It can thus be inferred that these benefits will also affect other areas of students' lives, reducing their difficulties both psychoemotionally and academically, for example.

In terms of academic performance, the findings of Bóo et al. [27], Bernárdez et al. [8] and McVeigh et al. [28] are worthy of note. This is not exclusive to students in higher education. A study by Artika et al. [92] with a sample of 469 secondary school students indicates that mindfulness is a significant predictor of student participation in the school context, with an associated increase in participation through improved self-esteem. In contrast, Cordeiro et al. [93] conducted an experimental study with a control group of third-grade students and found that mindfulness significantly enhanced cognitive flexibility and handwriting fluency.

Prosocial behaviour has been identified as another key area of interest by a number of studies [4, 22, 31, 33, 39, 40, 57]. A study by Akhavan et al. [90] demonstrates the efficacy of mindfulness practice in a sample of teachers, including enhanced relationships with students and reduced stress.

With regard to the manner in which these mindfulness programmes can be supported, the utilisation of VR has been found to confer considerable benefits [15, 48, 49, 86]. This is primarily attributable to the degree of adherence to the programme. In their seminal work, Friedlander et al. [94] introduced the concept of the 'therapeutic alliance' to describe this phenomenon of patient adherence in a therapeutic context. They posited that it represents a crucial factor in the efficacy of any therapeutic intervention. In this case, although it is an educational context, the effects of such adherence are similar; therefore, it is worthwhile to explore the potential of the VR format as a key factor for the success of mindfulness.

5 Conclusions

In response to the research questions initially posed, it can be stated that they have been addressed, resulting in comprehensive data pertaining to the volume, language and year of publication of the various research projects. It is notable that there has been a significant increase in publications over the past four years, as well as the prevalence of the article format. As is to be expected, the majority of publications have been in English. It is also evident that universities in countries with an Anglo-Saxon tradition have published the most research on this topic, with the USA being the country with the highest volume of studies.

In answer to questions 6, 7, 8 and 9, it might be stated that mindfulness practice has been shown to promote mental health, academic performance, awareness, prosocial behaviour and well-being in student populations. Mindfulness practice might promote mental health, and well-being in the student population. The positive impact of this practice is not limited to how it is performed. That is, whether it is through traditional guided meditations, mobile applications, videos, online exercises or virtual reality.

However, according to the available literature, habituation is easier to acquire. Therefore, additional benefits can be obtained by increasing the number of sessions completed or minutes of practice. In answer to question 10, in studies where VR was effective for mindfulness practice, students practiced longer than those in the control group. Therefore, VR could be a more effective way to introduce contemplative science by introducing meditation techniques in higher education.

The objective has been fulfilled by analysing the benefits of mindfulness on mental health, academic performance, well-being, mindfulness and prosocial behaviour of university students, as well as identifying the most effective way to achieve habituation to the practice. It is also noteworthy that these benefits are highly relevant, and it would be beneficial to introduce mindfulness practice in the context of higher education.

6 Limitation and implication

One of the issues highlighted is the lack of comprehensive data that would allow for a more thorough comparison. For example, aspects such as the geographical location of the study subjects or the duration of the mindfulness programme applied mean that there are a large number of studies whose effectiveness is not entirely clear. At the same time, this is a topic that is becoming increasingly relevant, but there is still no consensus among researchers.

With regard to prospective implications, it is evident that the implementation of mindfulness in educational settings offers substantial advantages. Consequently, higher education institutions should facilitate the availability of structured mindfulness programmes for students. Undoubtedly, this would prove to be a valuable addition to their psycho-emotional and academic development.

Author contributions C.L.R.M., S.M.C. and E. L. M have designed the study. C.L.R.M. and S.M.C. carried out the methodology and results sections. V. D. B. and C.L.R.M have written the Introduction C.L.R.M. and E.L.M. have written the Discussion, Conclusions and Limitations. All authors wrote and reviewed the manuscript.

Data availability The author confirms that all data generated or analysed during this study are included in this published article.

Declarations

Competing interests The authors declare no competing interests.

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