



Research Article

© 2024 Freire Palacios et al.
This is an open access article licensed under the Creative Commons
Attribution-NonCommercial 4.0 International License
(<https://creativecommons.org/licenses/by-nc/4.0/>)

Received: 6 March 2024 / Accepted: 26 May 2024 / Published: xx July 2024

Learning Styles and Mental Health in Higher Education Students

Verónica Adriana Freire Palacios*

Ramiro Eduardo Torres Vizuet

Adriana Carolina Sánchez Acosta

Renata Patricia Aguilera Vásconez

Diego Armando Santos Pazos

Adriana Salomé Polo Ureña

Universidad Nacional de Chimborazo
Riobamba,
Ecuador

*Corresponding Author

DOI: <https://doi.org/10.36941/jesr-2024-0109>

Abstract

The study examines the relationship between learning styles and mental health in university students through a systematic review and bibliometric analysis. Three specific research questions are formulated: (1) Is there an association between learning styles and mental health outcomes? (2) Do these associations vary based on sociodemographic characteristics? and (3) What are the most used instruments to assess these constructs? The methodology includes a systematic review, bibliometric analysis, and evaluation of methodological quality. After applying strict criteria, 30 relevant observational studies are selected. The NIH tool assesses the risk of bias, and bibliometric analysis identifies patterns in academic production. The diversity of instruments is notable, with the Kolb questionnaire being the most prevalent. Academic production has increased since 2018, with Scopus as the main source. In mental health, depressive symptoms are the most evaluated. Most studies have a low risk of bias. The review provides an updated synthesis of the relationship between learning styles and mental health in university students, identifying patterns and gaps. Although methodological quality is generally high, potential biases and variable instruments are acknowledged. Future research is proposed to explore specific associations and consider contextual factors, emphasizing the importance of addressing this complex relationship in the university environment.

Keywords: Higher education, learning styles, mental health, psychological well-being, educational strategies

1. Introduction

The relationship between learning styles and the mental health of university students is a topic of growing interest in the contemporary educational landscape (Freiberg & Fernández, 2015). The

transition to university can be a time of stress and challenges, which can affect students' mental health (Rossi et al., 2023). On the other hand, understanding students' learning styles, which can vary greatly from one individual to another, is essential for providing an optimal educational experience (Garzón et al., 2019). Learning styles refer to the distinctive approaches' students use when processing information, learning new skills, or understanding new concepts (Dantas & Cunha, 2020). They represent individual preferences regarding the way information is perceived and processed in learning and study contexts (Deri et al., 2023).

It has been widely demonstrated that learning styles impact the way students engage and perform in educational contexts (Álvarez et al., 2018; Fernández, 2018). Students tend to engage more when taught in accordance with their individual learning preferences, while they may become bored, frustrated, and perform poorly when forced to learn in a manner dissonant with their dominant style (Qummer & Zamir, 2020). However, very little research has examined whether learning styles can also be related to students' psychological well-being and mental health. A study conducted by Özer & Yilmaz (2018) found that secondary school students who were taught according to their preferred learning style reported lower levels of anxiety, higher intrinsic motivation, and better academic performance compared to those whose instruction did not match their preferences.

Furthermore, in an experimental study with university students, Lwande et al. (2021) found that providing educational materials tailored to the visual or verbal styles of the participants significantly improved their comprehension and retention of content compared to a control group that received the same materials without adaptation. Additionally, a longitudinal study by Valentine & Kopcha (2013) examined the effects of matching teaching strategies with learning styles over a semester in university students. The authors found that by the end of the course, students in the matched styles and instruction condition exhibited higher levels of motivation, better grades, and less perceived burnout compared to the unmatched group (Robinson et al., 2016). Collectively, these research findings provide preliminary evidence that personalizing education to individual learning preferences could promote well-being and performance of students in educational settings. Further studies are needed to corroborate and deepen these findings.

Given the high prevalence of mental health issues among university students, such as depression, anxiety, and stress (Auerbach et al., 2018; Martínez et al., 2022), it is important to identify potential associated factors that can guide the development of preventive strategies and the promotion of mental health in this population. Some authors, like Samudhar, argue that the lack of congruence between teachers' teaching styles and students' learning styles could generate demotivation, frustration, and psychological stress (Auerbach et al., 2018). Various theoretical models have been proposed to categorize different types of learning styles, such as Kolb's experiential learning model (Ortiz & Canto, 2013; Taneja et al., 2022), the Neuro-Linguistic Programming (NLP) typology by Nagu & Ganesan (2023), the brain quadrants model by Estrada et al. (2019), and the VAK model of Visual, Auditory, and Kinesthetic preferences (VAK) (Bin et al., 2021).

Most theoretical models suggest that there are four main learning styles: active, reflective, theoretical, and pragmatic (Purnama et al., 2018). This is derived from Kolb's theory, which is based on an 80-item self-perception questionnaire (Kumar & Bhandarker, 2020). Students with a predominance of the active style enjoy learning in practical situations and like working with others; they prefer short, varied activities that pose a challenge (González Garza et al., 2018). Reflective learners like to observe and collect data before drawing conclusions; they prefer classes where they can listen and observe and enjoy thinking deeply about something and learning from experience (Uribarri, 2006). Theoretical learners seek models, abstract concepts, and theories. They like to analyze information in a logical and rational way (Forero et al., 2017). Finally, pragmatists focus on the practical application of ideas and like to experiment and find real solutions to problems. They prefer learning that has an evident relation to tasks or real-life issues (Leblanc, 2018).

Considering this, the present systematic review aims to synthesize the current evidence on the possible relationships between learning styles and various indicators of mental health in higher education students. The findings of this study can determine whether certain learning styles are more

consistently associated with mental health indicators in this population. This contributes evidence to guide the development of more personalized educational strategies and mental health promotion initiatives among university students.

Additionally, a bibliometric analysis of the literature was conducted with the aim of identifying trends and patterns in the existing scientific publications on the intersection between learning styles and mental health in higher education students. This analysis examined the annual evolution of publications, the countries with the highest production, the most frequent journals, and keywords. The bibliometric results complement the systematic review by characterizing the current state of knowledge in this emerging field, revealing critical areas for future research.

Overall, this review represents a valuable contribution to consolidating available evidence and advancing understanding of the complex relationship between learning styles and psychological well-being in the context of higher education. The findings will lay the groundwork for more robust longitudinal studies, the standardization of assessment instruments, and the development of educational interventions and mental health promotion strategies informed by the consideration of individual learning styles.

2. Methodology

2.1 Method

Conducting a comprehensive study of the literature plays a pivotal role in providing a robust foundation and a thorough synthesis of published works in a specific research area. This process involves the search, review, and critical analysis of a broad spectrum of academic and scientific sources (Page, Moher, et al., 2021). Through this endeavor, essential goals are pursued, ranging from establishing precise definitions for relevant concepts to the rigorous compilation and evaluation of empirical evidence. In undertaking this analysis, there is a focus on identifying and examining methodologies previously employed by other researchers in the field, with the aim of understanding the diversity of approaches used to address the subject matter. The literature review also serves to highlight key contributions made by various authors, thereby providing a panoramic and contextualized view of the current state of knowledge in the specific area of research (Velásquez, 2015).

Simultaneously, this process involves not only synthesizing existing knowledge but also aims to identify potential gaps in research. Identifying these gaps contributes to defining areas that require further attention and study, thus offering opportunities for the development of new research that can fill these knowledge voids. Supporting this methodological approach, several studies have emphasized the critical importance of comprehensive literature reviews as an essential step in the planning and execution of scientific research (Bardosh, 2014; Hernández & Páramo, 2022). This process not only strengthens the theoretical foundation of a study but also provides an informed perspective on the current state of the discipline, enabling researchers to progress more efficiently and effectively in their projects.

Additionally, bibliometric analysis of the literature can complement the review by identifying gaps and opportunities in the scientific knowledge of a field (López et al., 2022). Using quantitative techniques, bibliometric analysis examines trends in academic production, highlighting areas in need of further research (Talón Ballesteros et al., 2014). Thus, incorporating bibliometric perspectives during the literature review contributes a comprehensive overview of the current state and future research needs of a discipline (Silva Rincon et al., 2021).

2.2 Research Questions

Research questions are fundamental in defining the focus and scope of a study. They facilitate the definition of specific research objectives and delineate the aspects to be addressed (López & Ramos,

2021). In this case, three research questions were established to respond to the primary objective of the study, which was to establish a relationship between learning styles and the mental health of students in higher education institutions as shown in Table 1.

Table 1. Research Question

N.	Question	Motivation
P1	Is there an association between the predominant learning styles in students and their outcomes in various measures of mental health and psychological well-being?	To comprehensively explore the potential relationship between dominant learning styles in students and their performance in various assessments of mental health and psychological well-being.
P2	Do the associations between learning styles and mental health vary according to sociodemographic characteristics such as gender, age, or academic discipline?	To examine whether there are differences in the relationships between learning styles and psychological well-being when considering relevant sociodemographic variables.
P3	What instruments are most frequently used to assess learning styles and mental health in studies with university student samples?	To identify the most used questionnaires or scales for measuring the variables of interest.

Observational studies were included that (1) assessed learning styles with validated instruments in samples of university students, (2) incorporated standardized measures of mental health or psychological well-being, and (3) presented data to examine associations between these variables. Studies were excluded if they did not specify instruments, had insufficient data, were narrative reviews, or qualitative research. Methodological quality was assessed using the Tool for Observational Studies from the National Institutes of Health, USA (Bero et al., 2018). This tool analyzes potential sources of bias across six domains, categorizing the quality of studies as good, moderate, or low.

2.3 Systematization of Search and Data Collection

This systematic review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page, McKenzie, et al., 2021) to ensure proper reporting. Comprehensive searches were conducted in databases including Scopus, Web of Science, PsycINFO, and PubMed using a broad variety of relevant search terms, combined using Boolean operators. Specifically, keywords related to learning styles such as "learning style*", "cognitive style*", "learning preference*", "learning approach*", "learning pattern*", "learning modality", "learning behavior*", "learning attitude*" were utilized. In terms of mental health, terms included "mental health", "psychological health", "emotional health", "psychological wellbeing", "subjective wellbeing", "wellbeing", "life satisfaction", "positive affect", "negative affect", "depress*", "anxiety", "stress", "psychological distress", "mental disorder*", "psychiatric symptom*", "psychopathology", "mental illness".

Additionally, educational concepts like "academic performance", "academic achievement", "educational outcome*", "grades", "GPA", "student engagement", "educational strateg*", "instructional strateg*", "teaching method*", "learning environment" were added. Also included were "university", "college", "higher education", "undergraduate", "graduate", "medical student*", "nursing student*", "health science* student*", to focus on the context of interest. Studies in English published between January 2018 and November 2023 were included. This extensive search strategy enabled the exhaustive identification of relevant research on the intersection between learning styles and mental health in higher education students.

2.4 Selection of Information

A bibliometric analysis was conducted to identify patterns in the literature concerning learning styles and mental health in university students. The annual evolution of publications, countries with the highest scientific output, and the most frequent journals and keywords were examined. This allows for characterizing the current state of this research area. The criteria for including and excluding studies, as well as the methods for assessing their methodological quality, were defined in accordance with guidelines for systematic reviews (Ma & Li, 2023), aiming to minimize potential biases. The bibliometric analysis complements the review by revealing trends and gaps in the research on learning styles and psychological well-being of students.

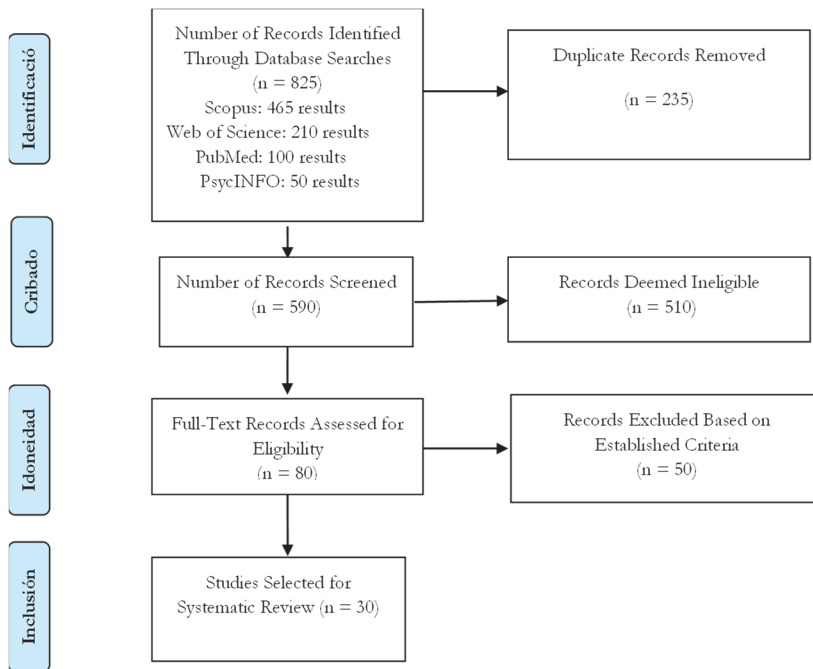


Figure 1. Four-Level PRISMA Flow Diagram

Initially, searches were conducted across both medical and multidisciplinary bibliographic databases (Scopus, Web of Science, PubMed, and PsycINFO), using a search strategy designed to capture potentially eligible studies examining the possible relationship between learning styles and mental health in university students. Keywords and search criteria were established a priori, aiming to balance comprehensiveness and precision. As Figure 1 shows, the initial stage identified a total of 825 unique citations. In the screening phase, 235 duplicate records found across various databases were removed, leaving 590 candidate studies for more detailed evaluation. All these records underwent a third stage of examination, considering pre-specified eligibility criteria, which included type of study, constructs examined, and the presence of relevant data.

Following this review based on titles, abstracts, and full texts, when necessary, works that clearly did not meet the selection criteria or corresponded to unsuitable document types, such as narrative reviews and commentaries (n=510), were discarded. The selection criteria were: (1) observational studies assessing learning styles with validated instruments, (2) incorporating

standardized measures of mental health or psychological well-being, and (3) presenting data to examine associations between these variables.

Thus, 80 articles were selected for a more in-depth full-text reading and final assessment of their relevance according to the objectives set in this research. In the last stage, final decisions on inclusion/exclusion were made after reapplying the selection criteria. As a result, 30 studies were identified and incorporated for the quantitative analysis of their results and qualitative discussion. The remaining 50 studies were excluded, mainly because they did not measure mental health constructs or did not specify valid instruments for assessing learning styles in their samples.

2.5 Data extraction

Data extraction is a critical step in any systematic review, as it allows the relevant information from the selected studies to be collected in a structured manner, and then synthesized to answer the research question initially posed (Delgado et al., 2015). After completing the process of eligibility and identification of the studies to be incorporated into the analysis, we proceeded to design a standard methodology for the systematic collection of relevant data. This stage required defining categories and extraction fields that would allow the information of interest from the different studies to be adequately organized.

Table 2. Selected articles

N	Título	Autor(es) Año	Métodos	Objetivo/Caso	Revista (SJR)	N. citas
1	A novel model to predict mental distress among medical graduate students in China.	(Guo et al., 2021)	The study used an online questionnaire to collect data from 1079 postgraduate medical students, randomly classified into training and validation groups. The questionnaire addressed sociodemographic variables, academic performance, tutoring, and psychological assessment using specific scales such as the Generalized Anxiety Disorder Scale-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). Severe mental distress was defined as the sum of GAD-7 and PHQ-9 scores ≥ 30 .	The objective was to identify risk factors related to mental health and to develop a predictive model to assess the risk of severe mental distress among postgraduate medical students. An online questionnaire was used that addressed sociodemographic variables, academic performance, mentoring, and psychological assessment using scales such as GAD-7 and PHQ-9. The model was developed and validated with training and validation groups, respectively.	BMC Psychiatry (1.291)	34
2	Automatic detection of learning styles: state of the art	(Feldman et al., 2015)	The article reviewed and analyzed automatic approaches for the detection of learning styles, overcoming problems associated with traditional methods, such as lack of student motivation and self-awareness. Emphasis was placed on exploring recent trends in this field.	Address the limitations of traditional identification of learning styles through tests and questionnaires, proposing instead automatic approaches. The article seeks to provide information on current trends and discuss limitations and research gaps in the field of learning styles.	Artificial Intelligence Review (2.490)	177
3	Effects of virtual learning environments: A scoping review of literature	(Caprara & Caprara, 2022)	The scoping review aims to isolate and examine existing data and research that identifies whether the synchronous face-to-face visual presence of a teacher in a virtual learning environment (VLE) is a significant factor in a student's ability to maintain good mental health.	Investigate whether the synchronous presence of the teacher in virtual environments affects student mental health. It highlights the importance of authentic communication and suggests a team approach to creating enriching virtual environments.	Education and Information Technologies (1.249)	50
4	Anxiety, Depression and Academic Performance: A Study Amongst Portuguese Medical Students Versus Non-Medical Students	(Moreira de Sousa et al., 2018)	A cross-sectional study was conducted on a sample of 750 students: 512 medical students and 238 non-medical students. All students anonymously completed a sociodemographic survey and the Hospital Anxiety and Depression Scale (HADS).	The aim of the study was to evaluate the prevalence of anxiety and depression symptoms in Portuguese medical students compared to students from other faculties, as well as to investigate the possible impact that these symptoms had on academic performance.	Acta Medica Portuguesa (0.313)	178
5	The Influence of Learning Styles on Perception and Preference of Learning Spaces in the University Campus	(Wang & Han, 2021)	The study measured the learning styles of 178 university students with the Index of Learning Styles questionnaire and assessed five learning spaces using a 5-point Likert scale. Key spatial factors were identified through focus group interviews.	The research sought to identify the learning spaces preferred by students with different learning styles and the spatial characteristics that impacted their evaluations. Perceptual differences according to learning styles were highlighted, emphasizing the importance of meeting personalized needs.	Buildings (1.608)	5
6	Examining learning styles with gender comparison among medical students of a saudi university	(Bin et al., 2021)	A survey was distributed to medical students at IMBSU in Riyadh. Other questions regarding demographic data are included in the same questionnaire. The research is cross-sectional, and the sample is 146 participants.	The aim was to assess the preferred sensory modality and learning preferences using the VARK questionnaire (Representing the four learning modes: Visual (V), Aural (A), Read/Write (R) and Kinesthetic (K)). In medical school students at Imam Mohammed Bin Saud Islamic University (IMBSU), and analyze the influence of gender and its relationship with academic achievement.	Advances in Medical Education and Practice (0.505)	15
7	Creative students in self-paced online learning environments: an experimental exploration of the interaction of visual design and creativity	(Rosar & Weidlich, 2022)	The experimental study (N = 187) investigated how the visual design of an online learning environment related to students' creativity by randomly assigning them to structured and unstructured visual environments.	We explored how creativity influenced the design of online learning environments, particularly visual structure, to determine whether creative learners benefited from different designs than their less creative peers. Results indicated interaction effects and present implications for the design of online learning environments.	Research and Practice in Technology Enhanced Learning (0.654)	12

N	Título	Autor(es) Año	Métodos	Objetivo/Caso	Revista (SJR)	N. citas
8	The Perceptions of Vocational School Students of Video Animation-Based Learning Media to Operate Lathes in Distance Learning	(Kusuma et al., 2021)	The study, conducted with 73 students from a Vocational School of Mechanical Engineering, measured perceptions on the use of animated visual media for the development of skills in the operation of a lathe in distance education. A questionnaire was used to collect data, with feasibility validation by experts. Descriptive statistical analyses and tests such as t-test and ANOVA were applied to evaluate differences in students' perceptions. The results indicated high feasibility and no significant differences were observed between the perceptions of male and female students.	The objective of the study was to measure the perceptions of students of a Vocational School of Mechanical Engineering on the use of animated visual media for the development of skills in the operation of a lathe in distance education.	Journal of Education Technology (2.116)	27
9	Anxiety, depression and academic performance: A study amongst Portuguese medical students versus non-medical students	(Moreira de Sousa et al., 2018)	A cross-sectional study was conducted with 750 students (512 medical students, 238 from other faculties) to assess anxiety and depression. Participants completed sociodemographic surveys and the Hospital Anxiety and Depression Scale (HADS). Statistical tests were applied for analysis, revealing a prevalence of 21.5% for anxiety and 3.7% for depression. Medical student status was significantly associated with anxiety. A slight association was observed between depressive symptoms and poor academic performance. A significant percentage of students with symptoms did not seek medical or psychological care.	The aim of the study was to evaluate the prevalence of anxiety and depression symptoms in Portuguese medical students compared to students from other faculties, and to analyze the possible impact of these symptoms on academic performance.	Acta Medica portuguesa (0.313)	37
10	Pre-Service Teachers' E-learning Styles and Attitudes towards Elearning	(Özüdögrü, 2022)	Investigated the online learning styles and attitudes toward online learning of 322 teacher trainees during the fall 2020-2021 semester, during pandemic distance education.	Differences were identified in learning style according to gender and department of study, and in attitudes according to department and place of residence. In addition, a low-level positive correlation was found between attitudes toward online learning and various learning styles.	Inquiry in education (0.456)	4
11	Critical analysis of kolb experiential learning process	(Taneja et al., 2022)	The study examined the differences in perception between males and females in experiential learning, specifically in entrepreneurship education in higher education institutions in India. Kolb's Experiential Learning model was employed. Data collection was through a self-constructed questionnaire completed by students actively engaged in experiential learning.	The objective of the research was to examine the differences in perception between men and women with respect to experiential learning, especially in the context of entrepreneurship education in higher education institutions in India.	International Journal of Health Sciences (0.689)	19
12	Learning styles and academic achievement among undergraduate medical students in Thailand	(Jiraporncharoen et al., 2015)	A survey was conducted among undergraduate medical students at Chiang Mai University, Thailand. The Learning Styles Index questionnaire was used to assess students' learning styles in four domains.	The aim of the study was to explore the associations between learning styles and high academic performance, as well as to determine whether the factors linked to high academic performance varied between preclinical and clinical students.	Journal of Educational Evaluation for Health Professions (0.917)	63
13	What influences student situational engagement in smart classrooms: Perception of the learning environment and students' motivation	(Guoqing et al., 2022)	This study collected real-time longitudinal data from 105 undergraduate students at a university in central China to investigate the relationship between situational engagement, personal characteristics, and perceptions of the learning environment. Linear hierarchical modeling was used to analyze how environmental perceptions and personal factors affect situational engagement.	To investigate the relationship between situational engagement, personal characteristics, and perceptions of the learning environment in an intelligent classroom, focusing on the critical factors predicting situational engagement of college students in China.	Thinking Skills and Creativity (1.152)	85
14	Experiential learning and its efficacy in management education	(Kumar & Bhandarker, 2020)	The research was based on a comprehensive review of the literature. Studies using David Kolb's experiential learning model were examined. Studies highlighting the impact of experiential learning in different management disciplines were then reviewed. The paper concludes with a consolidation of findings and suggestions for future work.	To conduct a comprehensive review of the literature beyond the functional silos in which management is taught to examine the use and utility of experiential learning pedagogy in a holistic manner. The goal was to identify the efficacy of this pedagogy in delivering effective management learning.	Computers in Human Behavior (2.464)	72
15	Attitudes of Chinese health sciences postgraduate students' to the use of information and communication technology in global health research	(Huang et al., 2019)	A cross-sectional study was conducted among health science postgraduates from six universities in southern China from December 2016 to March 2017. An online self-administered questionnaire was used to collect data through an online survey platform. Data analysis was performed using SPSS for Windows 13.0.	The objective of the study was to examine the attitudes and practices of health science postgraduates in China regarding the curriculum for the use of information and communication technologies (ICT) in global health research and training.	BMC Medical Education (0.914)	12
16	Self-regulated learning strategies and non-academic outcomes in higher education blended learning environments: A one decade review	(Anthonysamy et al., 2020)	The study employed a systematic review based on PRISMA guidelines. Various sources were searched using predefined terms, resulting in 239 retrievals. After eliminating duplicates and evaluating abstracts and titles, 14 papers were selected for review. These papers were mostly peer-reviewed articles published in social science and educational journals.	The objective of the study was to examine how self-regulated learning strategies (SRLS) are used to influence non-academic outcomes in digital learning environments, specifically blended learning in higher education institutions. It sought to identify the SRLS (Self-Regulated Learning strategies) strategies used and their correlation with non-academic outcomes.	Education and Information Technologies (1.249)	160
17	Course Format and Student Learning Styles: A Comparison of Political Science Courses	(Betsy et al., 2019)	The study used original survey data to assign students to one of six learning styles. It investigated whether there were differences in learning styles among students in political science courses offered online and face-to-face (FTF) by three instructors. We specifically	The purpose of the study was to investigate whether there were differences in learning styles among students in online and face-to-face courses taught by three instructors in the field of political science. We sought to determine whether students with an independent learning style were more prevalent in online courses	American Journal of Distance Education (1.140)	25

N	Título	Autor(es) Año	Métodos	Objetivo/Caso	Revista (SJR)	N. citas
			sought to assess whether students with an independent learning style were more common in online courses.	compared to face-to-face courses.		
18	Differentiating the learning styles of college students in different disciplines in a college English blended learning setting	(Hu et al., 2021)	The study employed a machine learning algorithm called Support Vector Machine (SVM) and a recursive feature elimination technique based on Support Vector Machine-Based Recursive Feature Elimination (SVM-RFE). The learning styles of 790 sophomore students in a blended learning course with 46 majors were systematically analyzed using Biglan's taxonomy of academic tribes.	The objective of the study was to systematically analyze the learning styles of 790 sophomores in a blended learning course with 46 majors. It sought to identify the optimal sets of characteristics that collectively determined discipline-specific learning styles in a university blended learning environment.	Plos One (0.885)	9
19	Advocating for Mental Health Nursing Care Education Using a Flipped Classroom	(Van Der Like et al., 2019)	The study implemented the flipped classroom (FC) model in a mental health nursing course (MHNC) for five semesters. Strategies such as one-on-one discussions, session recordings, changes in the learning space, and simulations were used to personalize learning for more than 200 students. A learner-centered approach and a model called "Cs to FC model" were created to explain and promote acceptance of the model.	Describe the experience of implementing the CF model in the MHNC course over five semesters, highlighting challenges, strategies, and evolving student perceptions. In addition, it sought to provide an evidence-based approach to explain and encourage student acceptance of the model.	Creative Nursing (0.208)	4
20	Mental Health of Higher Education Students in Chile: Scoping Review and Meta-Analysis	(Martinez et al., 2021)	Exploratory review on the prevalence of psychological symptoms in higher education students in Chile. Several databases were searched until October 2019 and the quality of prevalence studies was evaluated. Meta-analysis was used to explore the combined prevalence of psychological symptoms.	To analyze the prevalence of various psychological symptoms, factors associated with mental health, barriers and facilitators to seeking help, and to evaluate the effectiveness of interventions in higher education students in Chile. The need for further research on access to treatment and barriers to seeking help, as well as interventions to improve the mental health of this population is highlighted.	Terapia Psicológica (0.274)	17
21	Gender as an underestimated factor in the mental health of medical students	(Burger & Scholz, 2018)	Literature review on neuroscience as neuroimaging.	Examine applications of neuroscience in medical education.	Annals of Anatomy (0.714)	33
22	The relationship between teacher support and students' academic emotions: A meta-analysis	(Lei et al., 2018)	The study used a meta-analysis approach to investigate the relationship between teacher support and students' academic emotions, differentiating between positive academic emotions (PAEs) and negative academic emotions (NAEs). Sixty-five primary studies involving 58,368 students were identified, providing strong evidence for the connection between teacher support and academic emotion.	To examine the connection between teacher support and students' academic emotions, employing a meta-analysis approach. In addition, it sought to explore how individual factors, such as culture, age, and gender, influenced these relationships.	Frontiers in Psychology (0.891)	149
23	Self-directed learning assessment practices in undergraduate health professions education: a systematic review	(Taylor et al., 2023)	Systematic review of articles in seven databases between 2015 and July 2022 to analyze self-directed learning assessment practices in health professions education.	Examine assessment methods and outcomes of Self-Directed Learning in health professions education at the university level. The diversity of practices is highlighted, and the use of multiple assessments is suggested for more accurate evaluation of student performance.	Medical Education Online (1.070)	1
24	Cross-cultural Adaptation of International College Students in the United States	(Y. Wang et al., 2018)	A survey was used to collect data from 169 international students at a U.S. university. The study examined the temporal patterns of students' psychological and sociocultural adjustment.	To analyze the temporal patterns of psychological and sociocultural adaptation of international students at a U.S. university, identifying specific phases and offering interpretations, implications, and limitations of the findings.	Journal of International Student (0.795)	89
25	Entrepreneurship Education through Successful Entrepreneurial Models in Higher Education Institutions	(Boldureanu et al., 2020)	Using theoretical perspectives such as human capital theory, entrepreneurial self-efficacy, and self-determination theory, it is argued that entrepreneurship education, by exposing students to successful entrepreneurial role models, can enhance their knowledge, skills and motivation to pursue entrepreneurial goals.	Identify the characteristics that students consider unique in a successful entrepreneur, focusing on teaching entrepreneurship based on successful models in educational institutions to promote education for sustainable development.	Sustainability (0.664)	458
26	The influence of transformational teacher leadership on academic motivation and resilience, burnout and academic performance	(Trigueros et al., 2020)	A structural equation model was used with 3354 university students to analyze the relationships between teacher leadership, academic resilience, motivation, burnout and academic performance.	The study sought to understand the influence of teacher leadership on academic resilience, motivation, burnout and academic performance. Positive relationships were found between teacher leadership, academic resilience and motivation, and a negative influence of burnout on academic resilience.	International Journal of Environmental Research and Public Health (0.828)	74
27	The Contribution of Dispositional Learning Analytics to Precision Education	(Shin, 2017)	The article addressed precision education, highlighting the importance of accurate predictions of academic performance and relevant educational intervention options. The significant role of learning analytics (LA) in the first condition was recognized. The proposed method was the application of dispositional learning analytics (DLA), which combines learning data with dispositions measured by self-report surveys.	Advocated the application of DLA to make LA more accurate and applicable. He argued that DLA improves the accuracy of predictions, especially at the beginning of the module with limited data from learning management systems (LMS). He also highlighted that the main advantage of DLA lies in designing effective interventions focused on important, but less developed, learning dispositions. This argument was supported with an empirical analysis in an introductory mathematics module, demonstrating the crucial role of various learning dispositions in precision education.	Educational Technology Society (1.049)	34
28	Matching Learning Style to Instructional Method: Effects on Comprehension	(Rogowsky et al., 2015)	The study followed the experimental design proposed by Fleming (Fleming, 2012) to evaluate the matching hypothesis in learning based on preferred styles. Auditory and visual learning style preferences were established, and verbal comprehension aptitude was assessed in different formats. Participants were randomly assigned to groups that received the same information in digital audiobook or electronic text format.	The study sought to investigate the impact of learning style preferences in college-educated adults, specifically in relation to verbal comprehension aptitude and learning based on the mode of instruction. The results did not statistically support the matching hypothesis, which suggests that tailoring instruction to preferred learning styles improves learning.	Journal of Educational Psychology (2.511)	387

N	Título	Autor(es) Año	Métodos	Objetivo/Caso	Revista (SJR)	N. citas
29	Teaching for innovation competence in higher education Built Environment engineering classrooms: teachers' beliefs and perceptions of the learning environment	(Ovbiagbonhia et al., 2020)	The study involved 94 teachers who completed a questionnaire to investigate their beliefs about the relevance of innovative competence and their creative self-efficacy in Built Environment Engineering education. Multiple regression analyses were used to explore the relationships between teachers' beliefs and perception of the learning environment.	The main objective was to analyze teachers' beliefs about innovative competence and their creative self-efficacy, also comparing teachers' and students' perceptions of the learning environment in Built Environment Engineering.	Business Studies Journal (0.740)	11
30	Learning styles and the use of ICT in university students within a competency-based training model	(Barbosa & Amariles, 2019)	The study applied a quantitative descriptive and correlational approach with a non-experimental and cross-sectional design. A purposive sample of 113 students from psychology, public accounting and business administration programs following a competency-based training model in a private university in Colombia was used.	To determine learning styles and the use of Information and Communication Technologies (ICT) in university students with competency-based training. In addition, to identify possible differences related to the frequency of ICT use according to gender. The results showed no significant differences in learning styles or frequency of ICT use, but a gender gap was observed, with male students scoring higher in ICT use.	Journal of new approaches in educational research (1.034)	69

3. Results

All studies included in the data extraction used cross-sectional designs. All examined undergraduate samples, five examined postgraduate samples; sample sizes ranged from 42 to 6977 participants. Moreover, most of the research was conducted in India, the United Kingdom, China, the Netherlands, and the United States as shown in Table 3. A wide range of disciplines and careers were represented in the samples, including engineering, education, health sciences, social sciences, and management.

Table 3. Number of documents by country of publication

Country	Number of publications	Percentage
United States	5	17%
United Kingdom	4	13%
Spain	3	10%
China	3	10%
India	2	7%
Canada	2	7%
Australia	2	7%
France	1	3%
Italy	1	3%
Brazil	1	3%
Colombia	1	3%
Turkey	1	3%
Netherlands	1	3%
Germany	1	3%
South Korea	1	3%
Iran	1	3%

The findings on the instruments used to assess learning styles in the studies analyzed reveal a diversity of approaches, although with some measures more prevalent. Specifically, Kolb's experiential learning questionnaire, applied in 5 studies, was the most widely used tool. This 80-item instrument categorizes four styles (active, reflective, theoretical, pragmatic) based on Kolb's influential theoretical model. Second, the VAK sensory preference questionnaire was used in 3 studies to classify styles according to visual, auditory, and kinesthetic modalities. The Felder-Silverman ILS questionnaire, also used in 3 items, categorizes styles along four dimensions: active/reflective, sensitive/intuitive, visual/verbal, and sequential/global.

More specifically, one study applied the Neurolinguistic Programming questionnaire and 4 others used correlations between academic performance and learning styles to classify students. Additional research employed a quantitative descriptive and correlational approach. On the other

hand, the greatest variability is observed in the remaining 13 studies, which implemented a diversity of other non-standardized instruments to assess learning styles, a great diversity of methodological approaches is observed, in 3 studies they used self-developed questionnaires by the authors without reported psychometric validation, 2 studies applied Entwistle's ASSIST scale on study approaches, 1 study employed the Information Representation Systems Inventory, 1 research implemented the Honey-Alonso Learning Styles Questionnaire, 1 article used the Learning Styles and Strategies Questionnaire, 1 study applied the Alonso Learning Styles Questionnaire, and in the remaining 4 studies the instruments used were not specified.

In summary, in addition to self-developed questionnaires without validation, a variety of non-standardized tools from different theoretical frameworks on learning styles were used. This methodological variability highlights the need to reach consensus on best practices for the assessment of this construct in university students. The use of validated and standardized instruments would facilitate the comparison between studies and the generalization of results.

3.1 Bibliometric Map

Additionally, a bibliometric analysis was conducted to identify patterns in the literature. It revealed the frequency with which keywords such as "mental health", "covid-19", "stress", "depression", and "education" are associated on the platforms used, as visualized in figure 2 created with the assistance of VOSviewer. Notably, "mental health" is at the center, indicating its central significance and connections with other terms like "covid-19" and "stress". During the analyzed period, there was a significant interaction among these terms, reflecting an increase in the discussion about mental health in relation to education and other factors during pandemic times. It is important to highlight that the number of publications selected is a result of applying inclusion and exclusion criteria. Between 2015 and 2023, the number of publications was relatively low, experiencing a significant increase in 2022.

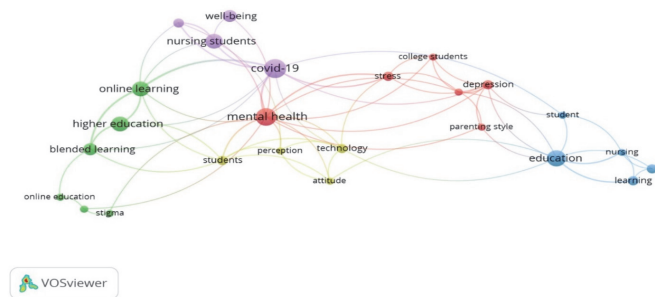


Figure 2. Keyword Concurrency Diagram

Source: Self-made, using the VOSviewer program.

Figure 3 shows the author concurrency diagram generated with VOSviewer, providing a representation of the collaboration networks among researchers who publish on the topic of learning styles and mental health in university students. In these diagrams, each node represents an author, and the size of each node indicates the number of that author's publications on the topic. Authors are positioned closer to each other as they have a higher number of shared co-authorships.

Thus, it allows for a visual identification of the main researchers and groups or clusters of scientific collaboration around this area of study. The proximity between nodes reveals patterns of joint work among authors, while positioning on the periphery indicates researchers less connected to the central networks. In summary, the author concurrency diagram provides a perspective on the

dynamics of knowledge production regarding learning styles and psychological well-being in the context of higher education, highlighting future collaboration opportunities among researchers from different groups visible in the co-authorship network.

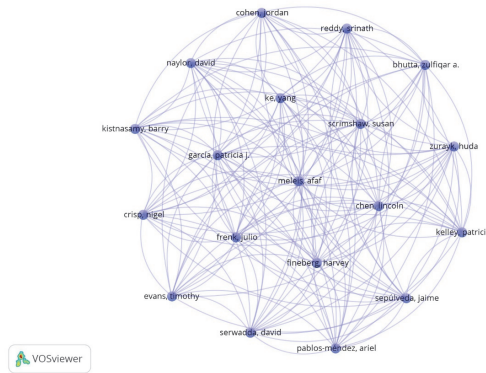


Figure 3. Author Concurrency Diagram
Source: Self-made, using the VOSviewer program.

3.2 Number of Publications

Figure 4 shows that, out of a total of 30 studies, 19 (63%) come from the Scopus database, making it the primary source of articles for this research. This is followed by Web of Science, with 6 studies (20%), also contributing a significant proportion of relevant literature between 2018 and 2022. The databases PubMed and PsycInfo have a smaller representation, with 3 (10%) and 2 (7%) articles respectively. However, they still provide specific research of interest. By year of publication, 2021 and 2022 saw the highest number of studies included, with 5 (17%) and 12 (40%) respectively. In 2018, 5 (17%) research papers on the topic were published. The years with the lowest production were 2020 with 3 (10%) articles, 2019 with 4 (13%) and 2023 with just 1 (3%) study.

In conclusion, the Scopus database contributes most articles for the review, while production significantly grew in 2021 and 2022, indicating a recent interest in this area of research on the relationship between learning styles and mental health in university students.

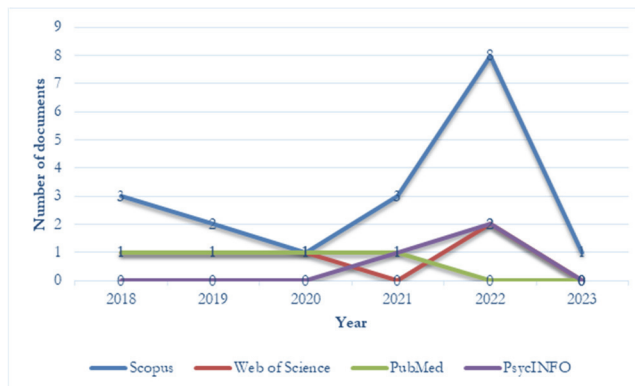


Figure 4. Scientific Production by Year

These data help characterize the current state of scientific knowledge in the field exploring the relationship between learning styles and mental health in university students. A significant finding is that the Scopus database provides the largest number of studies, with 19 out of the 30 analyzed, equivalent to 63% of the total. This demonstrates that Scopus is the primary source of research on this specific topic, followed by Web of Science with an also significant contribution of 6 articles (20%). The databases PubMed and PsycInfo have a lesser presence, with only 3 (10%) and 2 (7%) studies respectively. However, these repositories provide unique works that enrich the review with perspectives from the biomedical field and psychology.

In terms of temporal trends, there is an increase in the production of knowledge on this topic in recent years. Specifically, 2021 and 2022 are the periods with the highest number of publications, with 5 (17%) and 12 (40%) articles each year, indicating a growing interest from the scientific community in examining the intersection between learning styles and psychological well-being in higher education. The year 2018 also contributes a significant amount of research, with 5 studies (17%). In contrast, the years 2019, 2020, and 2023 show lower levels of productivity, with 4 (13%), 3 (10%), and 1 (3%) article respectively.

In conclusion, the bibliometric analysis contained in the table provides solid evidence on the temporal evolution and the main sources of knowledge in this emerging field of study. The findings point to Scopus and Web of Science as key repositories of relevant literature and highlight the growing research interest in recent years, especially in 2021 and 2022, regarding the complex relationship between learning styles and mental well-being in higher education students.

The findings reveal a diversity of mental health indicators examined through valid and reliable psychometric scales. Specifically, the presence of depressive symptoms was the most frequently evaluated outcome, present in 16 of the 30 studies analyzed. Depression measurement was primarily carried out using widely used instruments such as the Center for Epidemiologic Studies Depression Scale (CES-D) and the Beck Depression Inventory-II (BDI-II).

The second most prevalent indicator was anxiety, measured in 10 studies using standardized scales like the Hospital Anxiety and Depression Scale (HADS), the Beck Anxiety Inventory (BAI), and the Manifest Anxiety Scale for Students (AMAS). Stress levels were reported in 7 articles through reliable tools like the Perceived Stress Scale (PSS) and the Academic Stress Questionnaire (ASQ) as indicated in figure 5.

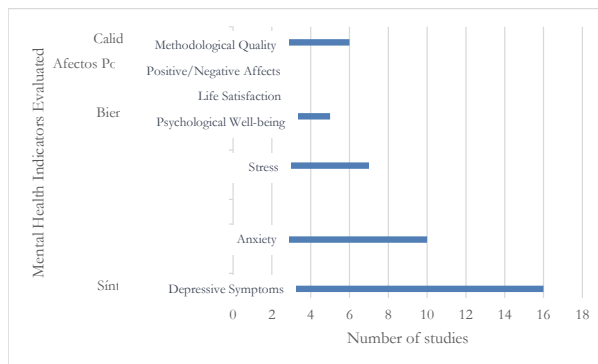


Figure 5. Instruments Used to Assess Learning Styles

Other psychological constructs examined include psychological well-being in 5 studies, assessed using Ryff's Psychological Well-Being Scale, and life satisfaction in 3 studies, measured by the Satisfaction with Life Scale (SWLS). Additionally, one study measured positive and negative affects with the PANAS Scale. Regarding methodological quality, the application of the NIH (National

Institutes of Health) Tool, which is a tool for assessing the risk of bias in observational studies developed by experts from the National Institute of Health in the United States as part of the Cochrane Collaboration, as shown by the Observational Studies, revealed that 22 articles presented a low risk of bias. Another 5 showed moderate risk, while 3 studies demonstrated significant limitations (high risk of bias) as shown in figure 6. This evaluation indicates a relatively high scientific rigor in most of the available research on the interrelation between learning styles and mental health in university students. In summary, the review highlights the solid psychometric measurement of critical outcomes such as depression, anxiety, and stress through widely validated scales, as well as adequate methodological quality in most of the existing literature on this emerging field of study.

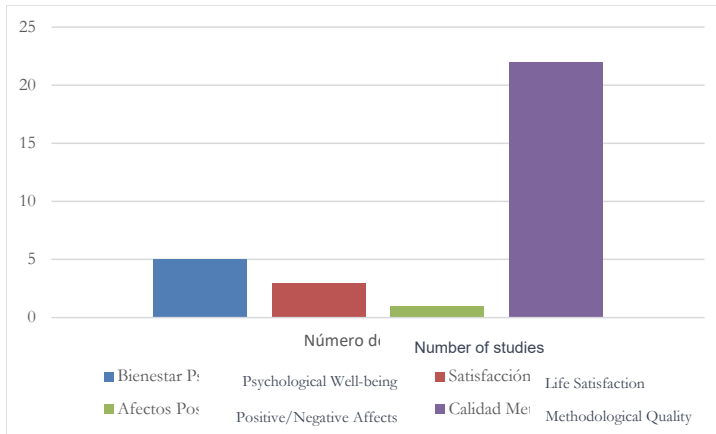


Figure 6. Instruments Used to Assess Mental Health

4. Discussion

The methodology employed in this study is based on a comprehensive approach to the literature, which plays a crucial role in the synthesis and exhaustive analysis of published works within the specific research field (Egger et al., 2022). This process involves searching, reviewing, and critically analyzing various academic and scientific sources to establish precise definitions and evaluate empirical evidence. The literature review not only synthesizes existing knowledge but also highlights potential gaps in research, identifying areas that require further attention and study (Kuzik et al., 2022). Moreover, the review is supported by bibliometric analysis, which complements the review by identifying gaps and opportunities in scientific knowledge through quantitative techniques (Ricart et al., 2023).

The research questions posed are fundamental in defining the focus of the study and its specific objectives (Soler et al., 2021). These questions concentrate on the association between learning styles and outcomes in mental health measures, variations according to sociodemographic characteristics, and the frequency of instruments used in university studies. The review focused on observational studies that assessed learning styles with validated instruments, incorporated standardized mental health measures, and presented data to examine associations between these variables. The methodological quality was assessed using the NIH Tool for Observational Studies (Morgan et al., 2018).

In systematizing the search and data collection, the PRISMA statement was followed to ensure proper reporting, and exhaustive searches were conducted in various databases. The selection of information was based on inclusion and exclusion criteria, discarding studies without specified instruments, with insufficient data, narrative reviews, and qualitative research. A bibliometric

analysis was applied to identify patterns in the literature on learning styles and mental health.

Data extraction was a critical step that allowed for the structured gathering of information from the selected studies. A standard methodology was designed to collect data on authors, year and place of publication, academic discipline, research design, instruments used, mental health indicators, and outcomes obtained. The evidence bases thus formed facilitated the quantitative and qualitative analysis of the findings.

While this work has employed a rigorous methodology, it is important to recognize and discuss in depth the inherent limitations of the systematic review and their impact on the interpretation of the results. Firstly, the review is subject to the availability and quality of the existing literature, and it is possible that some relevant publications were not considered, which could introduce selection biases. The omission of pertinent studies may lead to an incomplete representation of the studied phenomenon and affect the validity of the conclusions.

Furthermore, the inclusion of only observational studies may carry the biases inherent to this research design, such as unmeasured confounding factors or information biases. Observational studies are subject to confounding variables that can distort the observed associations between learning styles and mental health. Additionally, information biases, such as recall bias or social desirability bias in self-report measures, can affect the accuracy of the data collected. These limitations should be considered when interpreting the results and drawing conclusions.

Another important limitation is the exclusion of qualitative studies, which could have provided valuable insights into the individual experiences of students in relation to their learning styles and mental well-being. Qualitative research allows for a deeper exploration of phenomena and may reveal nuances and details that quantitative studies could overlook. By excluding this type of study, important knowledge that could have enriched the understanding of the interrelationships between learning styles and mental health may have been lost.

Moreover, the high variability in the instruments used to measure learning styles poses challenges for the comparison and synthesis of results. Although we found a prevalence of Kolb's experiential learning questionnaire, many studies applied unvalidated or poorly specified tools. This methodological heterogeneity hinders direct comparison between studies and generalization of results. The lack of standardization in the assessment of learning styles can introduce variability and noise into the data, affecting the validity of the conclusions drawn.

Another important consideration is the use of self-report scales to assess mental health, which could introduce social desirability or recall biases. Participants may be inclined to respond in a socially desirable manner or may have difficulties accurately recalling their past experiences, affecting the validity of the data collected. Furthermore, self-report measures capture only the subjective perspective of participants and may not fully reflect their actual mental health status. Future work would benefit from including objective measures of psychological well-being alongside self-reports for a more comprehensive assessment.

Finally, the cross-sectional nature of all reviewed studies precludes establishing causal relationships between learning styles and mental health. Cross-sectional designs only provide a snapshot of associations at a given point in time and do not allow for inferring the direction of relationships. It is possible that learning styles influence mental health, but it is also plausible that psychological well-being affects students' learning preferences. To better elucidate the direction of these associations and examine changes over time, longitudinal designs are needed.

In summary, although we have made efforts to conduct a comprehensive and methodical review, various sources of bias and variability must be considered when interpreting the findings. The detailed discussion of these limitations, including potential selection biases, unmeasured confounding factors, exclusion of qualitative studies, heterogeneity of instruments used, limitations of self-report measures, and the cross-sectional nature of the studies, is essential for a transparent and rigorous interpretation of the results. Recognizing and addressing these limitations not only improves the quality of the study but also provides guidance for future research in this field. As more studies are conducted with rigorous designs, standardized measures, and diverse samples, we will be

able to gain a more robust and nuanced understanding of the complex interrelationships between learning styles and psychological well-being in university students.

Regarding the results, all studies use cross-sectional designs and examine undergraduate samples, with widely varying sample sizes. Most of the research was conducted in India, the United Kingdom, China, the Netherlands, and the United States. There is diversity in the instruments used to assess learning styles, with the prevalence of Kolb's experiential learning questionnaire. Scientific production in this field has experienced a significant increase in recent years, especially in 2021 and 2022.

The findings on mental health indicators reveal that depression was the most evaluated symptom, followed by anxiety and stress. Validated psychometric scales such as the CES-D Depression Scale and the Beck Depression Inventory-II were used. Other psychological constructs, like psychological well-being and life satisfaction, were also examined with specific scales. The methodological quality assessed with the NIH Tool indicated a relatively high scientific rigor in most studies.

5. Conclusion

This systematic review has played an integral role in exploring the intersection between learning styles and mental health in university students. The structure of this document is based on a comprehensive methodology that included an extensive literature review, a bibliometric analysis, and the systematization of data search and collection. Through this approach, we have provided a comprehensive synthesis of studies published between January 2015 and November 2023, highlighting trends in academic production as well as the main instruments used to assess learning styles and mental health in the university context.

The contributions of this document to the specific disciplinary field are manifold. Firstly, the review has provided an updated overview of the relationship between learning styles and mental health in higher education students, identifying patterns, trends, and gaps in the existing literature. The inclusion of a bibliometric analysis has enriched this review by revealing the dynamics of knowledge production, highlighting the importance of platforms such as Scopus and Web of Science in research on this emerging topic.

However, it is important to note the inherent limitations of this work. Although we have employed a rigorous methodology, the systematic review is subject to the availability and quality of the existing literature, and it is possible that some relevant publications were not considered. The selection of observational studies may introduce biases inherent to this research design, and the exclusion of qualitative studies could have overlooked valuable perspectives. Furthermore, the variability in the instruments used to measure learning styles highlights the need for standardized methodological approaches in future research.

These limitations have important implications for the interpretation of the findings. Potential selection biases may have led to an incomplete representation of the studied phenomenon, affecting the validity of the conclusions. Unmeasured confounding factors in observational studies may have distorted the observed associations between learning styles and mental health. Moreover, the methodological heterogeneity in the assessment of learning styles introduces variability and noise into the data, affecting the comparability and generalization of the results.

Regarding future lines of research, we recommend addressing the following specific areas. Firstly, it is essential to further explore the associations between learning styles and specific dimensions of mental health, considering contextual and cultural factors that could modulate these relationships. Additionally, longitudinal research can provide a deeper understanding of the temporal dynamics of these constructs in the university environment. The inclusion of qualitative studies could also offer richer perspectives on the individual experiences of students.

Furthermore, efforts are needed to develop and validate standardized instruments for assessing learning styles in diverse university populations. The adoption of consistent and well-validated

measures will improve comparability between studies and strengthen the evidence base in this field. The use of objective measures of psychological well-being alongside self-reports is also recommended to obtain a more comprehensive assessment of students' mental health.

References

- Álvarez, F., Leyva, M., & Moreno, F. (2018). Learning styles inventories: An update of coffield, moseley, hall, & ecclestone's reliability and validity matrix. *Electronic Journal of Research in Educational Psychology*, 16(46), 597–629. <https://doi.org/10.25115/ejrep.v16i46.2237>
- Anthonyamy, L., Koo, A., & Hew, S. (2020). Self-regulated learning strategies and non-academic outcomes in higher education blended learning environments: A one decade review. *Education and Information Technologies*, 25(5), 3677–3704. <https://doi.org/10.1007/s10639-020-10134-2>
- Auerbach, R., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., Demyttenaere, K., Ebert, D., Green, J., Hasking, P., Murray, E., Nock, M., Pinder, S., Sampson, N., Stein, D., Vilagut, G., Zaslavsky, A., & Kessler, R. (2018). Who world mental health surveys international college student project: Prevalence and distribution of mental disorders. *Journal of Abnormal Psychology*, 127(7), 623–638. <https://doi.org/10.1037/abn0000362>
- Barbosa, S., & Amariles, M. (2019). Learning styles and the use of ICT in university students within a competency-based training model. *Journal of New Approaches in Educational Research*, 8(1), 1–6. <https://doi.org/10.7821/naer.2019.1.296>
- Bardosh, K. (2014). Global aspirations, local realities: The role of social science research in controlling neglected tropical diseases. *Infectious Diseases of Poverty*, 3(1), 1–15. <https://doi.org/10.1186/2049-9957-3-35>
- Bero, L., Chartres, N., Diong, J., Fabbri, A., Ghersi, D., Lam, J., Lau, A., McDonald, S., Mintzes, B., Sutton, P., Turton, J., & Woodruff, T. (2018). The risk of bias in observational studies of exposures (ROBINS-E) tool: Concerns arising from application to observational studies of exposures. *Systematic Reviews*, 7(1), 1–11. <https://doi.org/10.1186/s13643-018-0915-2>
- Betsy, J., Berry, M., & Leah, A. (2019). Course Format and Student Learning Styles: A Comparison of Political Science Courses. *American Journal of Distance Education*, 33(4), 262–275. <https://doi.org/10.1080/08923647.2019.1643697>
- Bin, A., Almutairi, M., Alzahrani, A., Alomair, F., Albinhamad, A., Albarrak, Y., Alzuaki, M., Alyahya, S., & Bin, K. (2021). Examining learning styles with gender comparison among medical students of a saudi university. *Advances in Medical Education and Practice*, 12, 309–318. <https://doi.org/10.2147/AMEP.S295058>
- Bin, A., Almutairi, M., Alzahrani, A., Alomair, F., Albinhamad, A., Albarrak, Y., Alzuaki, M., Alyahya, S., & Khalid, A. (2021). Examining learning styles with gender comparison among medical students of a saudi university. *Advances in Medical Education and Practice*, 12, 309–318. <https://doi.org/10.2147/AMEP.S295058>
- Boldureanu, G., Máriuca, A., Bercu, A., Bedrule, M., & Boldureanu, D. (2020). Entrepreneurship Education Through Successful Entrepreneurial Models in Educational Institutions. *Journal of Development Economics and Management Research Studies*, 12(1267), 1–33. <https://doi.org/10.53422/jdms.2022.91402>
- Burger, P., & Scholz, M. (2018). *El género como factor subestimado en la salud mental de estudiantes de medicina* (pp. 1–6).
- Caprara, L., & Caprara, C. (2022). Effects of virtual learning environments: A scoping review of literature. In *Education and Information Technologies* (Vol. 27, Issue 3). Springer US. <https://doi.org/10.1007/s10639-021-10768-w>
- Dantas, L. A., & Cunha, A. (2020). An integrative debate on learning styles and the learning process. *Social Sciences and Humanities Open*, 2(1), 100017. <https://doi.org/10.1016/j.ssaoh.2020.100017>
- Delgado, T. C., Beltrán, E. M., Ballesteros, M., & Salcedo, J. P. (2015). La investigación-creación como escenario de convergencia entre modos de generación de conocimiento. *Iconofacto*, 11(17), 10–28. <https://doi.org/10.18566/iconofac.v11n17.a01>
- Deri, A., Nursalman, M., & Munir. (2023). *Identifikasi Gaya Belajar Pada Siswa Baru Menggunakan Index of Learning Styles pada LMS Moodle Sesuai Felder-Silverman Learning Styles Model*. 7, 1–7.
- Egger, M., Higgins, J. P. T., & Smith, G. D. (2022). Systematic Reviews in Health Research: An Introduction. In *Systematic Reviews in Health Research: Meta-Analysis in Context: Third Edition*. <https://doi.org/10.1002/9781119099369.ch1>
- Estrada, M., Moliner, M. Á., & Monferrer, D. (2019). The Relation between Learning Styles according to the Whole Brain Model and Emotional Intelligence: A study of university students. *Estudios Sobre Educacion*, 36, 85–111. <https://doi.org/10.15581/004.36.85-111>

- Feldman, J., Monteserin, A., & Amandi, A. (2015). Automatic detection of learning styles: state of the art. *Artificial Intelligence Review*, 44(2), 157–186. <https://doi.org/10.1007/s10462-014-9422-6>
- Fernández, R. (2018). *Estilos de Aprendizaje: una revisión teórica e instrumental*.
- Forero, R., Castaño, L., & Corredor, C. (2017). El estilo de aprendizaje en educación virtual: breve revisión de la literatura. *Virtu@lmente*, 4(1), 70–95.
- Freiberg, A., & Fernández, M. (2015). Estilos de Aprendizaje en Estudiantes Universitarios Ingresantes y Avanzados de Buenos Aires. *Liberabit. Revista de Psicología*, 21(1), 71–79.
- Garzón, J., Rojas, O., Cañizares, L., & Culqui, C. (2019). The impact of psychology in the educational field. *Revista Científica Mundo de La Investigación y El Conocimiento*, 3(2), 543–565. [https://doi.org/10.26820/recimundo/3.\(2\).abril.2019.543-565](https://doi.org/10.26820/recimundo/3.(2).abril.2019.543-565)
- González Garza, B., Hernández Castañón, Ma. A., & Castrejón Reyes, V. (2018). Estilos de aprendizaje para el desarrollo de competencias en estudiantes de la Licenciatura en Enfermería / Learning styles for the development of competences in students of the Degree in Nursing. *RIDE Revista Iberoamericana Para La Investigación y El Desarrollo Educativo*, 8(16), 351–369. <https://doi.org/10.23913/ride.v8i16.345>
- Guo, F., Yi, M., Sun, L., Luo, T., Han, R., Zheng, L., Jin, S., Wang, J., Lei, M., & Gao, C. (2021). A novel model to predict mental distress among medical graduate students in China. *BMC Psychiatry*, 21(1), 1–22. <https://doi.org/10.1186/s12888-021-03573-9>
- Guoqing, L., Xie, K., & Liu, Q. (2022). What influences student situational engagement in smart classrooms: Perception of the learning environment and students' motivation. *British Journal of Educational Technology*, 53(6), 1665–1687. <https://doi.org/10.1111/bjet.13204>
- Hernández, S., & Páramo, P. (2022). School Feeding, an Approach from the Curriculum: A Systematic Review. *Nomadas*, 56, 305–317. <https://doi.org/10.30578/nomadas.n56a16>
- Hu, J., Peng, Y., Chen, X., & Yu, H. (2021). Differentiating the learning styles of college students in different disciplines in a college English blended learning setting. *PLOS ONE*, 16(5 May), 1–26. <https://doi.org/10.1371/journal.pone.0251545>
- Huang, K., Abdullah, A., Ma, Z., Urmi, D., He, H., Quintiliani, L., Friedman, R., Yang, J., & Yang, L. (2019). Attitudes of Chinese health sciences postgraduate students' to the use of information and communication technology in global health research. *BMC Medical Education*, 19(1). <https://doi.org/10.1186/s12909-019-1785-6>
- Jiraporncharoen, W., Angkurawaranon, C., Chockjamsai, M., Deesomchok, A., & Euathrongchit, J. (2015). Learning styles and academic achievement among undergraduate medical students in Thailand. *Journal of Educational Evaluation for Health Professions*, 12, 1–38. <https://doi.org/10.3352/jeehp.2015.12.38>
- Kumar, S., & Bhandarker, A. (2020). Experiential learning and its efficacy in management education. *Purushartha*, 13(1), 35–55. <https://doi.org/10.21844/16202013103>
- Kusuma, W., Sudira, P., Hasibuan, A., & Daryono, R. (2021). The Perceptions of Vocational School Students of Video Animation-Based Learning Media to Operate Lathes in Distance Learning. *Journal of Education Technology*, 5(2), 200–206. <https://doi.org/10.23887/jet.v5i2.33139>
- Kuzik, N., da Costa, B. G. G., Hwang, Y., Verswijveren, S. J. J. M., Rollo, S., Tremblay, M. S., Bélanger, S., Carson, V., Davis, M., Hornby, S., Huang, W. Y., Law, B., Salmon, J., Tomason, J. R., Wachira, L. J., Wijndaele, K., & Saunders, T. J. (2022). School-related sedentary behaviours and indicators of health and well-being among children and youth: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 19(1), 1–32. <https://doi.org/10.1186/s12966-022-01258-4>
- Leblanc, T. (2018). Learning Styles: Academic Fact or Urban Myth? A Recent Review of the Literature. *Journal of College Academic Support Programs*, 1(1), 34–40. <https://doi.org/https://digital.library.txst.edu/server/api/content/bitstreams/f1ea6cd2-a727-440d-9623-0155267d0738/content>
- Lei, H., Cui, Y., & Chiu, M. (2018). The relationship between teacher support and students' academic emotions: A meta-analysis. *Frontiers in Psychology*, 8(JAN), 1–12. <https://doi.org/10.3389/fpsyg.2017.02288>
- López, A., & Ramos, G. (2021). About theoretical and empirical research methods: significance for educational research. *Revista Conrado*, 17(S3), 22–31.
- López, C., Calderón, L., & Mora-Ortiz, M. (2022). La internacionalización de servicios: análisis bibliométrico y revisión sistemática de la literatura entre 2000 y 2021. *Revista Facultad de Ciencias Económicas*, 30(1), 145–164. <https://doi.org/https://doi.org/10.18359/rfce.6008>
- Lwande, C., Muchemi, L., & Oboko, R. (2021). Identifying learning styles and cognitive traits in a learning management system. *Heliyon*, 7(8), e07701. <https://doi.org/10.1016/j.heliyon.2021.e07701>
- Ma, C., & Li, Y. (2023). Clinical effect of different dialyzers used in patients with kidney disease: A meta-Analysis of randomized clinical trials. *Revista Da Associacao Medica Brasileira*, 69(1), 191–194. <https://doi.org/10.1590/01806-9282.20220782>

- Martínez, J., González, N., & Pereira, J. (2022). Las Redes Sociales y su Influencia en la Salud Mental de los Estudiantes. *Reidocrea*, 11(4), 44–57.
- Martínez, P., Jiménez, A., Mac Ginty, S., Martínez, V., & Rojas, G. (2021). Salud Mental en Estudiantes de Educación Superior en Chile. *Terapia Psicológica*, 39(3), 405–426. <https://doi.org/10.4067/S0718-4808201000300405>
- Moreira de Sousa, J., Moreira, C. A., & Telles-Correia, D. (2018). Anxiety, depression and academic performance: A study amongst Portuguese medical students versus non-medical students. *Acta Medica Portuguesa*, 31(9), 454–462. <https://doi.org/10.20344/amp.9996>
- Morgan, R. L., Thayer, K. A., Santesso, N., Holloway, A. C., Blain, R., Eftim, S. E., Goldstone, A. E., Ross, P., Guyatt, G., & Schünemann, H. J. (2018). Evaluation of the risk of bias in non-randomized studies of interventions (ROBINS-I) and the ‘target experiment’ concept in studies of exposures: Rationale and preliminary instrument development. *Environment International*, 120, 382–387. <https://doi.org/10.1016/j.envint.2018.08.018>
- Nagu, S., & Ganesan, K. (2023). *Cognitive and Techno Pedagogical Skills For 21st Century Learners* (Issue March 2019).
- Ortiz, A., & Canto, P. (2013). Estilos De Aprendizaje Y Rendimiento Académico En Estudiantes De Ingeniería En México. *Revista de Estilos de Aprendizaje*, 6(11), 160–177. <https://doi.org/10.55777/rea.v6i11.978>
- Ovbiagbonhia, R., Kollöffel, B., & Brok, P. (2020). Teaching for innovation competence in higher education Built Environment engineering classrooms: teachers’ beliefs and perceptions of the learning environment. *European Journal of Engineering Education*, 45(6), 917–936. <https://doi.org/10.1080/03043797.2020.1784097>
- Özer, S., & Yılmaz, E. (2018). The Effect of Thinking-Style-Based Differentiated Instruction on Achievement, Attitude And Retention. *Kastamonu Üniversitesi Kastamonu Eğitim Dergisi*, 26, 1–9. <https://doi.org/10.24106/kefedergi.374145>
- Özüdoğru, G. (2022). Preservice Teachers’ E-Learning Styles and Attitudes Toward E-Learning. *Inquiry in Education*, 14(1), 1–15.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery*, 88(March). <https://doi.org/10.1016/j.ijssu.2021.105906>
- Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... McKenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. *The BMJ*, 372. <https://doi.org/10.1136/bmj.n160>
- Purnama, A., Sutansi, & Badawi, A. (2018). *Learning Style Preferences of College Student*. 244(Ecpe), 12–15. <https://doi.org/10.2991/ecpe-18.2018.3>
- Qummer, S., & Zamir, S. (2020). Thinking styles of university teachers: A gender based difference. *Journal of Research in Social Sciences*, 8(2), 77–95.
- Ricart, S., Villar-Navascués, R., Reyes, M., Rico-Amorós, A. M., Hernández-Hernández, M., Toth, E., Bragalli, C., Neri, M., & Amelung, B. (2023). Water-tourism nexus research in the Mediterranean in the past two decades: a systematic literature review. *International Journal of Water Resources Development*, 40(1), 57–83. <https://doi.org/10.1080/07900627.2023.2207686>
- Robinson, V., Lloyd, C., & Rowe, K. (2016). The impact of leadership on student outcomes: An analysis of the differential effects of leadership types. *REICE. Revista Iberoamericana Sobre Calidad, Eficacia y Cambio En Educación*, 12(4), 13–40. <https://doi.org/10.15366/reice2014.12.4.001>
- Rogowsky, B., Calhoun, B., & Tallal, P. (2015). Matching Learning Style to Instructional Method: Effects on Comprehension. *Journal of Educational Psychology*, 107(1), 64–78.
- Rosar, M., & Weidlich, J. (2022). Creative students in self-paced online learning environments: an experimental exploration of the interaction of visual design and creativity. *Research and Practice in Technology Enhanced Learning*, 17(1), 1–24. <https://doi.org/10.1186/s41039-022-00183-1>
- Rossi, L., Camminatiello, I., & Zanetti, M. (2023). The learning style of teenagers with callous-unemotional traits. *Statistica Applicata - Italian Journal of Applied Statistics*, 34(2). <https://doi.org/10.26398/IJAS.0034-012>
- Shin, I.-S. (2017). Recent Research Trends in Meta-analysis. *Asian Nursing Research*, 11(2), 79–83. <https://doi.org/10.1016/j.anr.2017.05.004>

- Silva Rincon, J. C., Pabón León, J. A., & Barrientos Monsalve, E. J. (2021). El desarrollo regional y la sostenibilidad: revisión sistemática y análisis bibliométrico. In *Revista Universidad y Empresa* (Vol. 23, Issue 41). <https://doi.org/10.12804/revistas.urosario.edu.co/empresa/a.10403>
- Soler-Costa, R., Lafarga-Ostáriz, P., Mauri-Medrano, M., & Moreno-Guerrero, A. J. (2021). Netiquette: Ethic, education, and behavior on internet—a systematic literature review. *International Journal of Environmental Research and Public Health*, 18(3), 1–15. <https://doi.org/10.3390/ijerph18031212>
- Talón Ballesteros, P., Abad Romero, P., & González Serrano, L. (2014). Entrepreneurship by women in the rural environment: tourism as a spur to development. *ESIC MARKET Economic and Business Journal*, 45(3), 553–578. <https://doi.org/10.7200/esicm.149.0453.4>
- Taneja, M., Kiran, R., & Bose, S. C. (2022). Critical analysis of kolb experiential learning process. *International Journal of Health Sciences*, 6(March), 8713–8723. <https://doi.org/10.53730/ijhs.v6ns1.6962>
- Taylor, T., Kemp, K., Mi, M., & Lerchenfeldt, S. (2023). Self-directed learning assessment practices in undergraduate health professions education: a systematic review. *Medical Education Online*, 28(1), 1–27. <https://doi.org/10.1080/10872981.2023.2189553>
- Trigueros, R., Padilla, A., Aguilar, J., Mercader, I., López, R., & Rocamora, P. (2020). The influence of transformational teacher leadership on academic motivation and resilience, burnout and academic performance. *International Journal of Environmental Research and Public Health*, 17(20), 1–11. <https://doi.org/10.3390/ijerph17207687>
- Uríbarri, G. (2006). Exégesis científica y teología dogmática. *Universidad Pontificia Comillas, Madrid*, 80(64), 547–578.
- Valentine, K. D., & Kopcha, T. J. (2013). Conducting educational design research. In *Educational Media International* (Vol. 50, Issue 3). <https://doi.org/10.1080/09523987.2013.843832>
- Van Der Like, J., Fox, H., Blackburn, A., & Chisholm, J. (2019). Advocating for mental health nursing care education using a flipped classroom. *Creative Nursing*, 25(1), 32–37. <https://doi.org/10.1891/1078-4535.25.1.32>
- Velásquez, J. (2015). Una guía corta para escribir revisiones sistemáticas de literatura parte 3. *DYNA (Colombia)*, 82(189), 9–12. <https://doi.org/10.15446/dyna.v82n189.48931>
- Wang, S., & Han, C. (2021). The influence of learning styles on perception and preference of learning spaces in the university campus. *Buildings*, 11(12). <https://doi.org/10.3390/buildings11120572>
- Wang, Y., Li, T., Noltemeyer, A., Wang, A., Zhang, J., & Shaw, K. (2018). Cross-cultural adaptation of international college students in the United States. *Journal of International Students*, 8(2), 821–842. <https://doi.org/10.281/zenodo.1250383>