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PAPER

Enhancing Psychological Well-being in Higher Education Post-Covid-19 Pandemic. The Role of AI-Based Support Systems—Bibliometric Reviews

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ABSTRACT

Psychological well-being is a cornerstone of student success in higher education. However, many students struggle with mental health challenges like stress, anxiety, and depression during and even after the Covid-19 pandemic. These challenges, often stemming from academic, personal, social, or career concerns, negatively impact student learning and development. This underscores the need for robust support systems within higher education (HE). Artificial intelligence (AI) emerges as a promising field in educational technology, offering students readily available guidance on their path to well-being. This research, guided by the PRISMA Statement 2015, provides an overview of AI applications in higher education through a systematic review. From an initial pool of 270 publications identified between year 2021 and 2023, finally, 24 articles met our inclusion criteria and were analyzed for the final synthesis. This paper revealed three key areas where AI-based systems can support student well-being: i) AI's Advancement and Potential: Exploring the evolving capabilities and promise of AI in this context. ii) Building Effective AI Systems: Identifying crucial components for successful AI-based well-being interventions. iii) Barriers to Implementing AI in Higher Education: Addressing ethical considerations and challenges unique to academic settings. The conclusions and the road ahead from this research is the critical need for ethical, well-designed AI-based systems to overcome existing barriers and deliver exceptional student well-being support services. By prioritizing student mental health and providing them with the necessary tools and resources, we can empower them to achieve their full potential and thrive in their academic endeavors.

KEYWORDS
AI based system, psychological well-being, student development, higher education

1   INTRODUCTION

Psychological well-being is a cornerstone of student success in higher education. However, the Covid-19 pandemic and its aftermath have amplified mental health challenges for many students, including stress, anxiety, and depression. The normalized stress in students is called a pandemic legacy [1]. Students initially experienced high levels of Covid-related stress and anxiety. Over time, however, these high levels became normalized, leading to a potential underestimation of their negative impact on student life and academic performance [2].

During Covid-19 pandemic, while online learning platforms offer benefits like flexibility and cost-effectiveness, they also present challenges for student well-being. Reduced opportunities for in-person peer interaction in online settings can contribute to feelings of isolation and loneliness, exacerbating stress and anxiety in some students [3]. This may contribute to the high prevalence of stress among students even post pandemic. Currently, with the support by AI-based support system, this complex landscape underscores the pressing need for innovative solutions to support student well-being in higher education [4]. This is where AI-based support systems hold immense potential. By offering personalized assistance, promoting social connection, and providing mental health resources, AI can become a valuable tool for mitigating the negative impacts of stress and anxiety on student success.

The rise of AI based system support in HE for Student Well-being needs to balance support and integrity. Digital advancements have paved the way for AI to become a crucial tool in academic institutions. [5] highlights how AI tools can simplify learning and research, providing students with valuable assistance. However, this ease of access has ignited concerns about critical thinking, academic integrity, and plagiarism prevention. These concerns, coupled with the inherent stress of navigating a new learning environment, can put additional pressure on students [6].

In the wake of the Covid-19 pandemic, AI technology has taken a new direction, morphing into a comprehensive student support system designed to alleviate both financial and academic burdens. Notably, however, research exploring the intersection of AI utilization and student well-being, particularly in the realm of psychology, remains scarce. This paper aims to fill this gap by reviewing and analyzing how students' use of AI can foster a positive mental state, enabling effective learning, greater contentment, and reduced stress and anxiety. Ultimately, we seek to understand how AI can empower students to thrive in the challenging socio-economic climate of the post-pandemic era [7, 8].

The following research questions will be investigated in this study: 1) To what extent can AI-based support systems be used to enhance psychological well-being in higher education? 2) What are the most effective ways to design and implement AI-based support systems in higher education? 3) What are the barriers to the adoption of AI-based support systems in higher education?

2   MATERIALS AND METHODOLOGY

This research adheres to the PRISMA Statement 2015 in reporting its findings and developing its framework. This widely adopted standard ensures transparency and replicability in systematic literature reviews (SLRs) and meta-analyses [9, 10]. The PRISMA Statement template guides our process for selecting and excluding articles in this SLR **on** focused investigation of "AI and student well-being".

Our SLR focuses solely on published literature related to AI-based support systems in higher education for student well-being. This narrow scope allows for an in-depth exploration of this emerging field through comprehensive search in two databases, targeted keywords and abstracts in Web of Science and Scopus. This comprehensive search lays the foundation for a meticulous selection process, ensuring we capture the most pertinent research on this vital topic. Figure 1 of PRISMA statement 2015 below illustrate the inclusion and exclusion criteria.
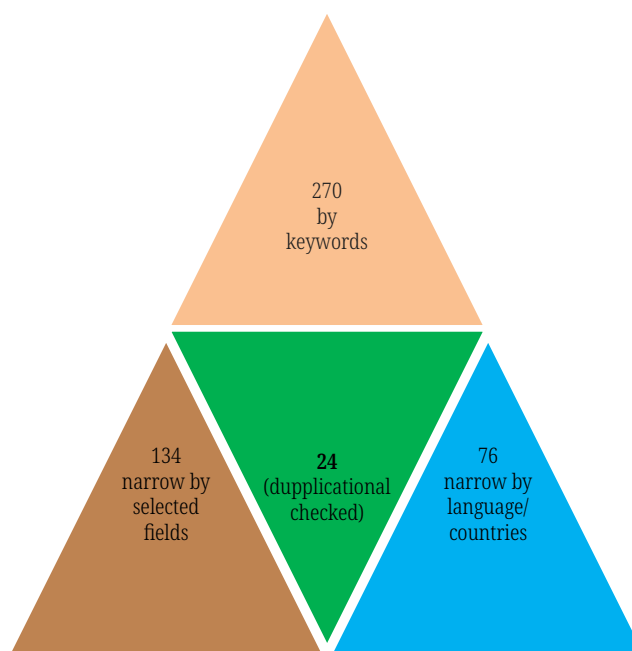

Fig. 1. PRISMA statement 2015

Subject selection followed a rigorous process. Within the fields of Social Sciences, Engineering, Environmental Sciences, Computer Science, Mathematics, Business & Management, Accounting, Environmental Science, Arts & Humanities, Economics & Econometrics, and Finance, along with multidisciplinary studies, we initially identified 134 articles focusing on student well-being. Further criteria narrowed this down to 76 articles published in English with final versions accessible in databases. Duplicates, off-topic articles, and those not focused on the post-pandemic period were then excluded, resulting in a final selection of 24 studies for the literature review. Qualitative data will be collected through a Systematic Literature Review (SLR) of these reputable documents. Thematic analysis and development based on the research questions will guide the data analysis.

3   RESULTS

3.1   Digitally databased analysis

Our study, AI-based support systems for student well-being in Post-Pandemic Higher Education, delves into the burgeoning field of AI-based support systems for well-being psychology in higher education, particularly in the wake of the Covid-19 pandemic. To understand the research landscape's evolution, we analyzed the year-wise distribution of publications.
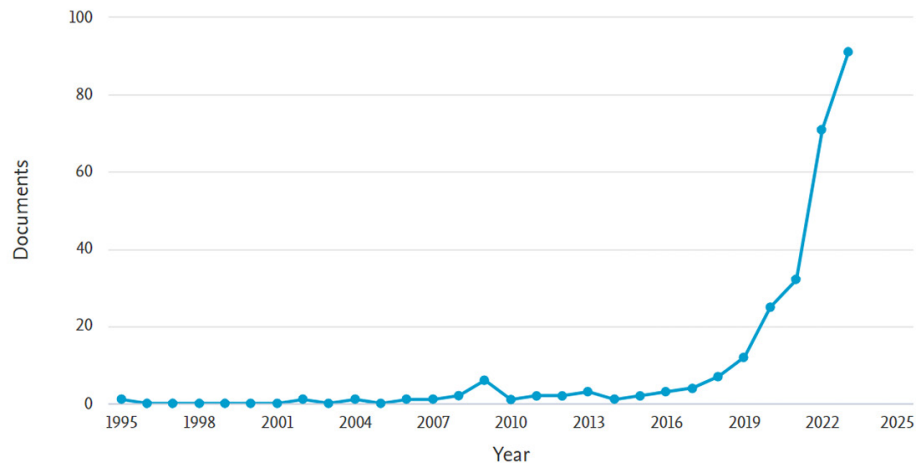
Documents by year

Fig. 2. Number of studies from each year, the graph increased

The Figure 2 witnessed a staggering increase in research on AI-based support systems in higher education. With over 71 and 91 papers published, respectively, these years far outstrip the pre-pandemic output. This dramatic rise underscores the heightened interest in leveraging AI for student well-being in the face of unprecedented challenges.

The global scholarly spotlight. This surge in research transcends geographical boundaries. The post-pandemic focus on well-being psychology in higher education has attracted scholars from diverse countries, indicating a global recognition of its critical importance. This widespread engagement promises a rich tapestry of perspectives and approaches to enrich the field. Notably, the post-pandemic era has demonstrably propelled AI-based support systems for student well-being in higher education to the forefront of scholarly inquiry. This surge in research, evident in Figure 2, and the global participation, signifies a collective determination to address the evolving needs of students through innovative technological solutions. By fostering international collaboration and harnessing the power of AI, we can create a more supportive and resilient learning environment for all.

Documents by country or territory

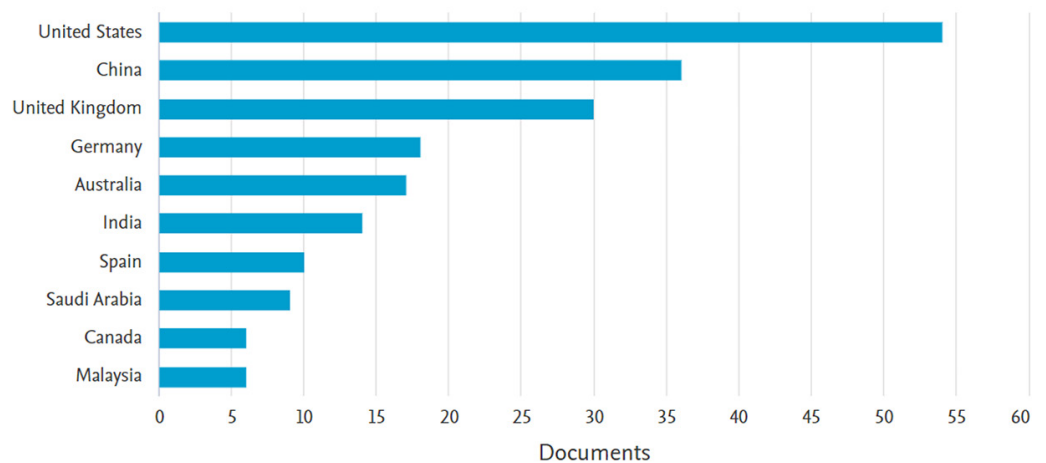Compare the document counts for up to 15 countries/territories.

Fig. 3. Showing the number of articles from each country in detail

The post-pandemic landscape. The Covid-19 pandemic ushered in a new era for many fields, and research on AI-based support systems in higher education for well-being psychology is no exception. The literature review reveals the United States leading the charge with 54 studies, followed by China with 36. Notably, the United Kingdom's contributions to AI support systems in higher education deserve recognition. Rounding out the top ten with over ten articles each are Germany, Australia, India, and Spain. Finally, Saudi Arabia, Canada, and Malaysia each contributed around 9, 6, and 6 papers, respectively. As depicted in Figure 3, computer science and social sciences dominate the research landscape, accounting for nearly half of all published papers.
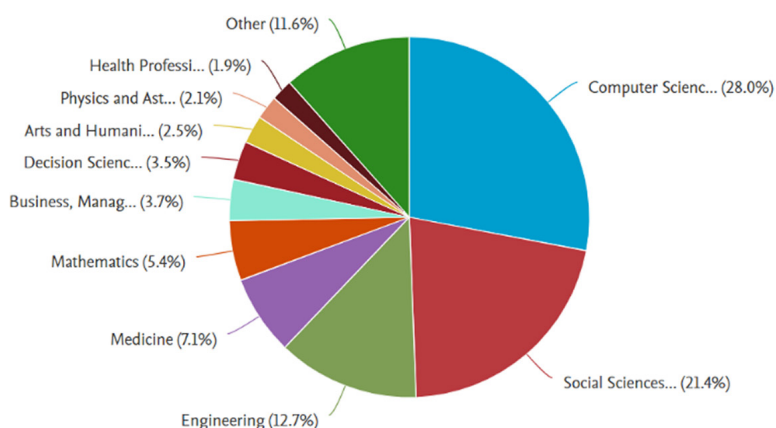

Fig. 4. Showing the number of articles from each country in detail

Figure 4 is illustrating the number of articles, Figure 5 is showing the number of articles from each year, and Figure 6 is illustrating the funding sponsors. Computer sciences, social sciences, and Engineering attracted highest number of papers regarding to AI based support system published, over 50% total articles.
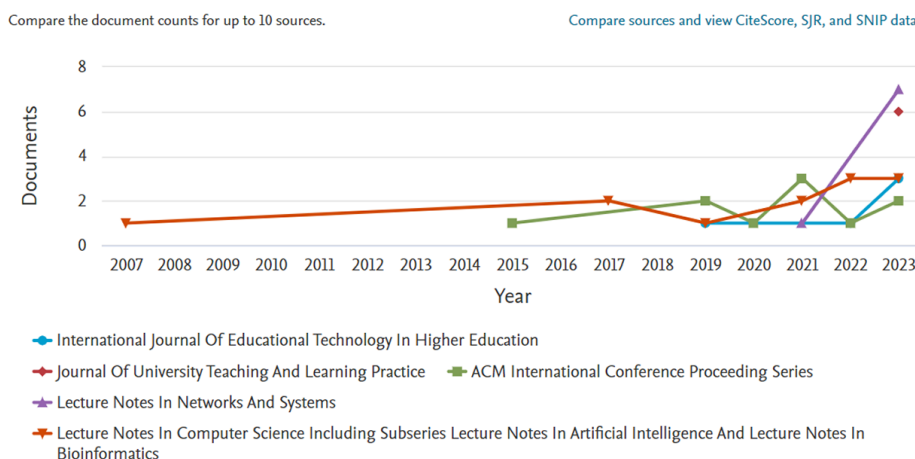

Fig. 5. Showing the documents per year by source and funding investment

The top journal for publications related to this study is the International Journal of Educational Technology in Higher Education. Notably, the Journal of University Teaching and Learning Practice also saw a high number of selected publications. Emerging contender: An interesting newcomer is Lecture Notes in Network and

System, which has experienced a significant increase in publications since 2021. Shifting tides: In Journal of Lecture Notes in Computer Science, the number of relevant studies has been gradually declining. Diversification: Beyond these mainstays, Information and Learning Science contributed four articles, demonstrating the growing diversity of publishing outlets in this field.

Fig. 6. Show documents by funding sponsor
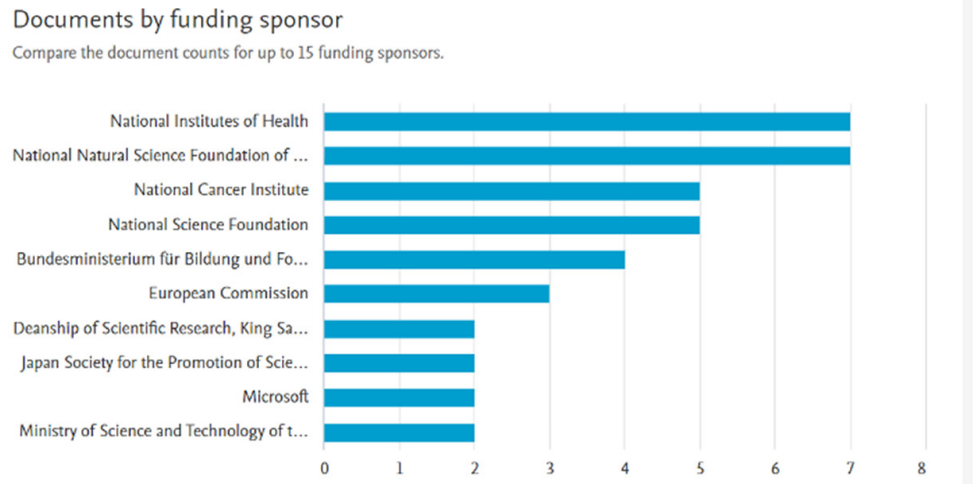
An analysis of funding sources revealed that the National Institutes of Health and the National Natural Science Foundation topped the list of contributors to studies on this topic. Notably, European countries and Japan were also well-represented among the sponsors.
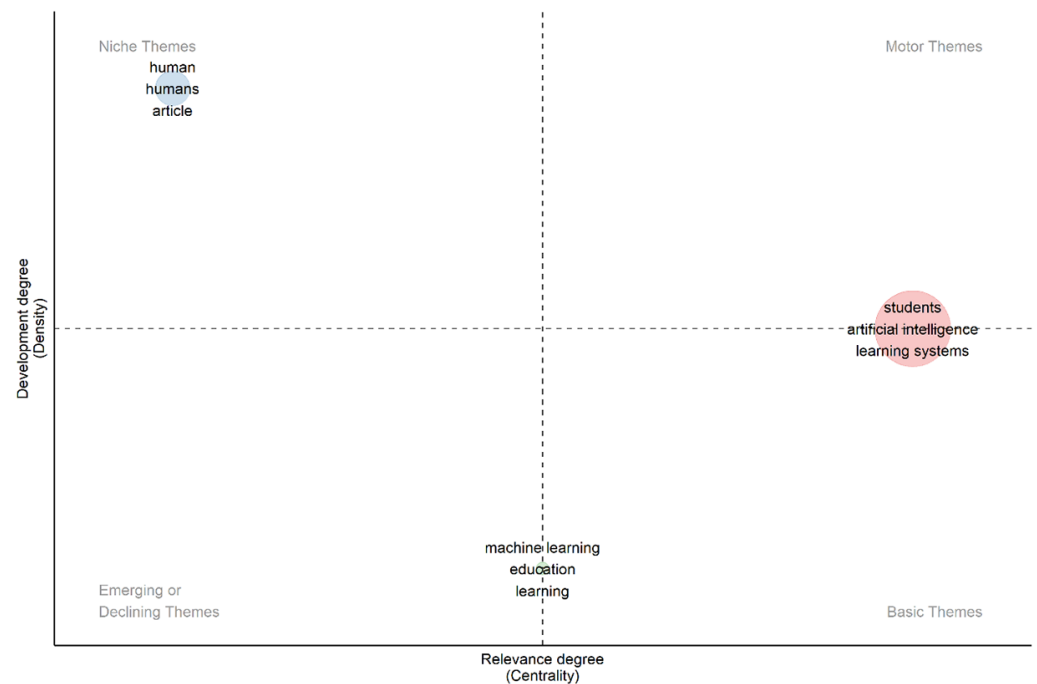
3.2 Keywords and abstract analysis results

Fig. 7. Show the themes based keywords/ abstracts in Scopus database

Figure 7 show that the rise of artificial intelligence (AI) is having a significant impact on all aspects of society, including higher education. AI is being used to develop new teaching methods, personalize learning, and automate administrative tasks. The increasing importance of teaching is also driving a shift in research topics. Educators are looking for new ways to improve the quality of teaching and learning.
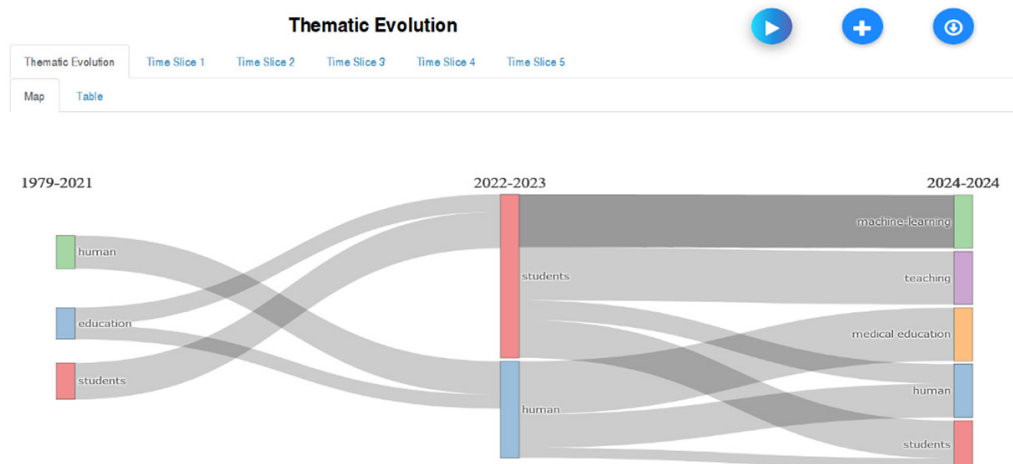

Fig. 8. Show thematic evaluation in the field of research education

Thematic evolution of research education is illustrated in Figure 8. There has been a clear shift in the research themes in higher education. Previously, the three main themes in HE research themes were "student", "education", and "human". However, since 2022, post-covid19, the new themes are "machine learning", "teaching", "medical education", "human", and "student".
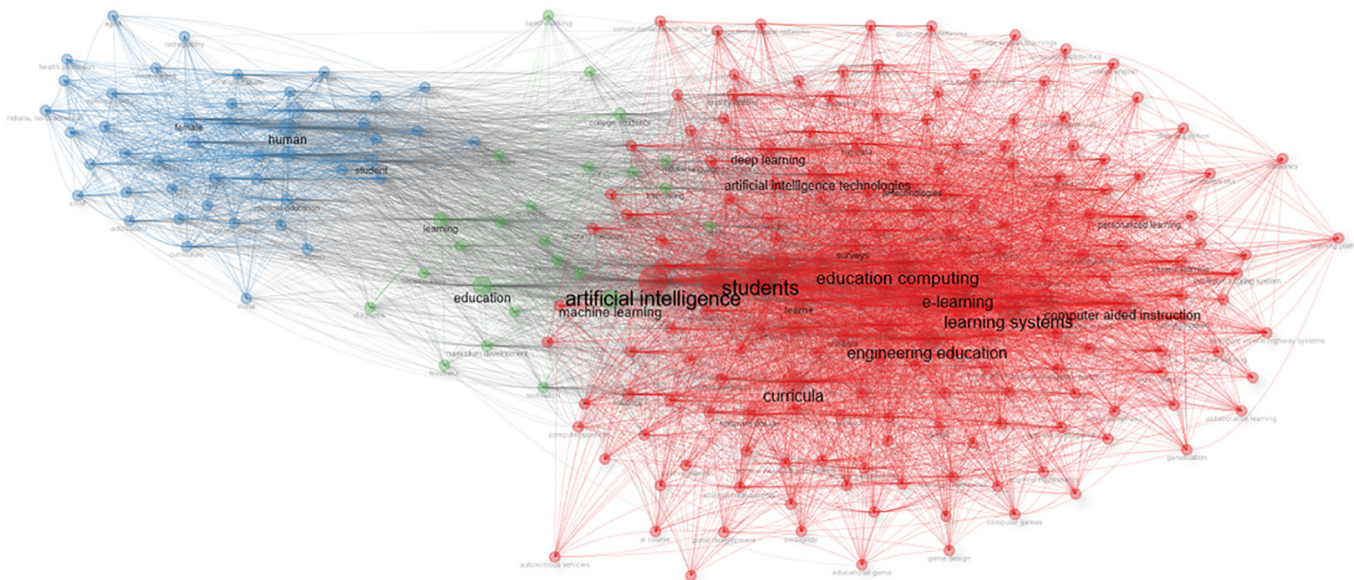

Fig. 9. Show the connecting map of keyword and abstract analysis

Figure 9 is illustrating the keywords and abstract analysis. The connection map shows a significant growth in articles focused on AI education contributing to the shift in research topics. AI based support system for student development is becoming increasingly complex and specialized (red color). The database seems to

include developing subjects related to education computers, e-learning, machine, artificial intelligent. learning system, engineering education, curriculum, deep learning, learning.
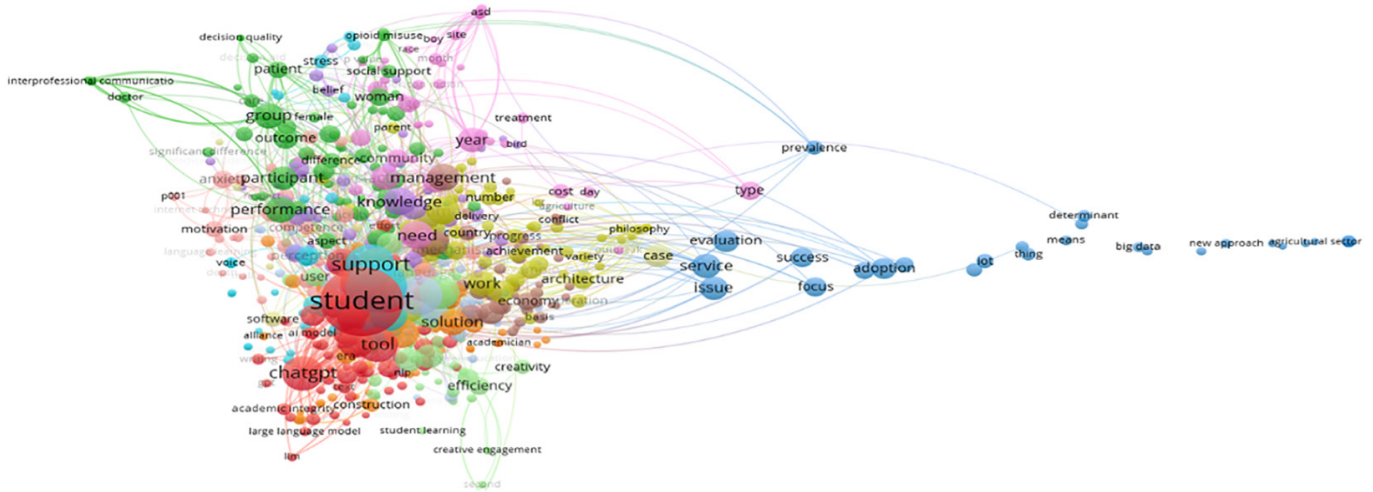

Fig. 10. Clusters networking map in Scopus database

Student support has emerged as the most prominent area in the database. This is due to the increasing impact of digital technology on higher education and the need for students to acquire the knowledge and skills necessary to adapt to this changing environment.

4   FINDINGS

4.1   RQ 1. To what extent can AI-based support systems be used to enhance psychological well-being in higher education?

Support systems for artificial intelligence (AI) present bright opportunities for improving students' psychological well-being in higher education. Artificial Intelligence has a number of clear advantages over traditional support approaches [11]. Obviously, Improved Accessibility is one of AI based system advances. The reach of traditional counseling institutions is limited by their appointment-based scheduling. On the other hand, AI systems are always available and can offer prompt assistance when required. Students who are reluctant to ask for aid because of time restrictions or social shame would especially benefit from this [11, 12]. Secondly, Personalized Interventions has been known as AI's strength. Although students may be reluctant to confide in others, personalized difficulties are frequently the main barrier to optimal psychological well-being. AI provides a substitute. These systems can tailor recommendations, resources, and interventions by examining user behavior, preferences, and previous encounters. Student involvement with support services and satisfaction can both rise with this customized approach [11, 13]. Next is scalability. AI-based solutions have the ability to simultaneously serve a substantially bigger student population than traditional services that are limited by human resource constraints. In environments where the student-to-counselor ratio is high, this is essential [14, 15]. AI is also capable of analyzing enormous volumes of data to spot patterns and trends in student behavior that might be signs of mental health issues. By using this data, support services

may be provided more effectively overall and with more specific interventions. AI chatbots trained to identify crisis symptoms, for instance, might have been able to offer urgent assistance during the Covid-19 pandemic, perhaps saving lives and averting suicide or self-harm [14, 15].

However, recognizing that AI is not a cure-all is crucial. It is imperative to traverse the obstacles of addressing privacy issues, assuring ethical data collecting and usage, and overcoming any bias in algorithms. Moreover, the human component of care and support shouldn't be replaced by relying exclusively on technology. Effective AI integration necessitates meticulous preparation, training, and cooperation between technological and human resources. Even with its remaining obstacles, AI has the power to completely transform the way higher education supports students' mental health. AI has the potential to be a useful tool in building a more resilient and supportive student body if it is used to leverage its strengths in accessibility, customization, and scalability while appropriately addressing ethical concerns.

4.2   RQ2. What are the most effective ways to design and implement AI-based support systems for student well-being in higher education?

Although AI-based system psychology can immediately demonstrate its ability to support students in becoming well-adjusted, system innovation is necessary to prevent low effectiveness due to the diversity and complexity of students' requirements in the new norms. Research has shown that the best approaches to develop and execute AI-based support systems are to: i) conduct a thorough needs assessment of the students in order to precisely identify and categorize their difficulties; the system must be able to handle new problems in order to meet the demands of the students. More focused problems can be accommodated by a more efficient method, ensuring that students receive the necessary knowledge or information [16, 17]. ii) If an AI-based system incorporates emotional intelligence, it will make dealing with technology less tedious for students. The closer it is to human behavior styles, the more engagement students will get [18, 19]. iii) The function of "alerts and early intervention" in the system is also significant for effectiveness. When students have serious issues and keep it to themselves, it can be dangerous, and that is why the system should predict and give warning to stakeholders to pay attention and help the student effectively. iv) The personal difficulties mentioned above also provide their own obstacles to inquiry, thereby necessitating the implementation of an effective system that prioritises [20, 25]. v) Anonymous reporting and communication. The system must ensure students share their thoughts without fear, as otherwise the system will become useless when a small number of students engage looking for advice vi) AI- based system designed by integrated gamification elements to encourage students to participate in activities that promote well-being. Similarity, the system uses rewards and challenges to incentivize positive behavior related to health and stress management [21, 26] vii) An effective AI based system provides a virtual discussing platform where all stakeholders in HE such as lecturer, student, staff and counsellor, participate and the intelligent tutoring system will become more effective. They can share ideas in the system. This way, it will become more reliable and persuade the student to look for professional help and right direction for what they need [18, 22, 5] viii) As in the use of a technology system, ethical consideration and privacy are a concern, and strict privacy standards when dealing with sensitive well-being data is crucial. The AI based system must clearly communicate how student data will be used and ensure compliance with relevant regulations [23, 24].

However, it is important to note that AI-based support systems should not replace human interaction entirely. The ideal approach is to use these tools as a complement to existing services, allowing human professionals to focus on providing more complex and personalized care to students who need it most [25, 26].

Even with its remaining obstacles, AI has the power to completely transform the way higher education supports students' mental health. AI has the potential to be a useful tool in building a more resilient and supportive student body if it is used to leverage its strengths in accessibility, customization, and scalability while appropriately addressing ethical concerns.

4.3   RQ3. What are the barriers to the adoption of AI-based support systems for student well-being in higher education?

The burgeoning field of AI holds immense potential for revolutionizing higher education, particularly in the domain of student well-being. However, widespread adoption faces a multitude of challenges. First of all, ethical hurdles and cultural discord. [27] identifies ethical concerns as the primary obstacle, highlighting the need for responsible AI development. Biased data can lead to discriminatory outcomes, therefore ensuring fairness, openness, and accountability is paramount. Cultural norms and expectations can also clash with AI-driven systems, particularly in communication, assessment, and personalization. [28] warns of potential cultural conflicts arising from divergent values and behaviors, jeopardizing the harmonious campus environment. Next is lack of acceptance and interdisciplinary friction. Fujimori et al. (2022) point to limited user acceptance as a significant barrier. Skepticism can stem from unfamiliarity with AI's capabilities and advantages. To cultivate trust and address these concerns, active collaboration between data scientists, educators, and psychologists is crucial. However, forming such interdisciplinary teams can be hindered by communication gaps, differing priorities, and methodological discrepancies. The resource constraints and resistance to change in HE become one of challenges. Implementing and maintaining AI systems demands substantial resources, often scarce in many institutions, particularly in developing nations. Staff may also require specialized training, further adding to the resource burden. Additionally, educational environments are typically resistant to change, and AI adoption may be met with opposition from students, faculty, and staff due to various anxieties, including job displacement or loss of control. The issue of legal and regulatory concerns arise when AI systems pose unique challenges within the legal and regulatory landscape. Educational institutions must navigate complex laws surrounding student data, privacy, and ethical considerations. These intricate regulations can significantly constrain and complicate AI implementation.

A comprehensive strategy is necessary to effectively overcome these challenges. This strategy should encompass meticulous planning, fostering strong teamwork, facilitating open communication, and upholding a steadfast commitment to ethical and responsible AI practices within the context of student well-being. While AI presents a wealth of opportunities for enhancing student well-being in higher education, addressing the multifaceted challenges outlined above is critical for successful implementation. Through strategic planning, collaborative efforts, and unwavering dedication to ethical considerations, the transformative potential of AI can be harnessed to create a more supportive and empowering environment for students worldwide.

5   DISCUSSION AND CONCLUSION

The university has prioritized the development of AI-based systems to support student well-being through psychology. This focus stems from the undeniable benefits of AI for student development. Powered by advanced tools and technology, AI can empower educators to personalize learning experiences, both in the classroom and online, by pinpointing student strengths and weaknesses and tailoring support accordingly. Data analytics capabilities allow AI to identify areas for growth and customize learning paths for each student. However, implementing AI in higher education faces challenges. Concerns around fairness, student honesty, and ethical considerations require careful navigation. Unlike applications in other sectors like banking or business, the sensitive environment of higher education, where stringent standards and rigorous training programs are paramount, demands a nuanced approach to AI integration. This paper aims to provide a comprehensive overview of research in this area for those interested in leveraging AI to enhance student well-being through psychological support. By acknowledging the obstacles and potential pitfalls, we hope to facilitate informed discussions and responsible implementation of AI in the delicate ecosystem of higher education.

6   ACKNOWLEDGEMENT

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