



ChatGPT in higher education - a synthesis of the literature and a future research agenda

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Abstract

ChatGPT has emerged as a significant subject of research and exploration, casting a critical spotlight on teaching and learning practices in the higher education domain. This study examines the most influential articles, leading journals, and productive countries concerning citations and publications related to ChatGPT in higher education, while also shedding light on emerging thematic and geographic clusters within research on ChatGPT's role and challenges in teaching and learning at higher education institutions. Forty-seven research papers from the Scopus database were shortlisted for bibliometric analysis. The findings indicate that the use of ChatGPT in higher education, particularly issues of academic integrity and research, has been studied extensively by scholars in the United States, who have produced the largest volume of publications, alongside the highest number of citations. This study uncovers four distinct thematic clusters (academic integrity, learning environment, student engagement, and scholarly research) and highlights the predominant areas of focus in research related to ChatGPT in higher education, including student examinations, academic integrity, student learning, and field-specific research, through a country-based bibliographic analysis. Plagiarism is a significant concern in the use of ChatGPT, which may reduce students' ability to produce imaginative, inventive, and original material. This study offers valuable insights into the current state of ChatGPT in higher education literature, providing essential guidance for scholars, researchers, and policymakers.

Keywords ChatGPT · Artificial Intelligence · Generative AI · Higher education · Plagiarism · Academic integrity · Systematic review · Bibliometric analysis

1 Introduction

ChatGPT, or Chat Generative Pre-trained Transformer, is a popular generative Artificial Intelligence (AI) chatbot developed by OpenAI, employing natural language processing to deliver interactive human-like conversational experiences (Jeon et al., 2023; Angelis et al., 2023). ChatGPT utilises a pre-trained language learning model, derived from an extensive big-data corpus, to predict outcomes based on a given prompt (Crawford et al., 2023; Geerling et al., 2023; Li et al., 2023). Since its inception, ChatGPT has attracted widespread attention and popularity and has the potential to disrupt the education sector (Rana, 2023). According to a research survey of adults conducted by the Pew Research Centre, approximately 60% of adults in the United States and 78% of adults in Asia possess knowledge of ChatGPT; furthermore, men are more familiar with ChatGPT than women (Vogels, 2023). The study also found that among ethnic groups globally, individuals of Asian descent have the highest level of familiarity with AI-based large language models (LLMs).

People have found value in using ChatGPT for a wide range of purposes, including generating creative content, answering questions, providing explanations, offering suggestions, and even having casual conversations (Crawford et al., 2023; Throp, 2023; Wu et al., 2023). Furthermore, ChatGPT is an effective digital assistant for facilitating a thorough understanding of diverse and intricate subjects using simple and accessible language. Given these features, ChatGPT has the potential to bring about a paradigm shift in traditional methods of delivering instruction and revolutionise the future of education (Tlili et al., 2023). ChatGPT stands out as a promising tool for open education, enhancing the independence and autonomy of autodidactic learners through personalised support, guidance, and feedback, potentially fostering increased motivation and engagement (Firat, 2023). Its capabilities encompass facilitating complex learning, asynchronous communication, feedback provision, and cognitive offloading (Memarian & Doleck, 2023).

However, the rapid expansion of ChatGPT has also aroused apprehensions in the academic world, particularly after reports surfaced that the New York Department of Education had unexpectedly imposed a ban on access to the tool due to concerns about academic integrity violations (Sun et al., 2023; Neumann et al., 2023; Crawford et al., 2023). Students who use ChatGPT to produce superior written assignments may have an unfair advantage over peers who lack access (Farrokhnia et al., 2023; Cotton et al., 2023). Ethical concerns about the deployment of LLMs include the potential for bias, effects on employment, misuse and unethical deployment, and loss of integrity. However, there has been little research on the potential dangers that a sophisticated chatbot such as ChatGPT poses in the realm of higher education, particularly through the lens of a systematic literature review and bibliometric techniques.

In this light, this paper explores the literature on the application of ChatGPT in higher education institutions and the obstacles encountered in various disciplines from the perspectives of both faculty and students. The paper aims to analyse the current state of the field by addressing the following overarching research questions using bibliographic coupling, co-occurrence analysis, citation analysis, and co-authorship analysis:

- a) What are the most influential articles in terms of citations in research related to ChatGPT in education?
- b) What are the top journals and countries in terms of publication productivity related to the implications of ChatGPT in higher education institutions?
- c) What are the emerging thematic clusters in research on the role and challenges of ChatGPT in teaching and learning in higher education institutions?
- d) What are the geographic clusters in research on the role and challenges of ChatGPT in teaching and learning in higher education institutions?

2 Methodology

In conducting this study, publications on the impact of ChatGPT on various aspects of higher education institutions were systematically identified through an extensive search using Elsevier's Scopus database, a comprehensive repository hosting over 20,000 globally ranked, peer-reviewed journals (Mishra et al., 2017; Palomo et al., 2017; Vijaya & Mathur, 2023). Scopus is a widely used database for bibliometric analyses and is considered one of the "largest curated databases covering scientific journals" (pg. 5116) in different subject areas (Singh et al., 2021). Widely acclaimed for its comprehensive coverage, Scopus has been extensively employed in bibliometric analyses across diverse disciplines, as evidenced by studies in capital structure theories, business research, entrepreneurial orientation and blockchain security (Bajaj et al., 2020; Donthu et al., 2020; Gupta et al., 2021; Patrício & Ferreira, 2020). Notably, despite the "extremely high" correlation between the Web of Science and Scopus databases, Scopus's status as a superior and versatile data source for literature extraction is reinforced by its broader coverage of subject areas and categories compared to the narrower journal scope of Web of Science, facilitating scholars in locating literature most pertinent to the review area (Archambault et al., 2009; Paul et al., 2021). To ensure a systematic literature review, we adhered to the preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines (Page et al., 2021) for the search, identification, selection, reading, and data extraction from the articles retrieved through the Scopus database (Fig. 1). Reliance on a single database is acceptable within the PRISMA framework (Moher et al., 2009).

Employing Boolean-assisted search queries, we aimed to capture a comprehensive range of topics related to ChatGPT's impact on higher education institutions. Specific search queries were carefully selected to ensure a broad yet relevant search scope and included the following:

"ChatGPT and Teaching learning in universities" OR "Effect of ChatGPT in higher education institution" OR "ChatGPT and student assessment in higher education" OR "ChatGPT and academic integrity" OR "ChatGPT and teaching pedagogy in higher education institution" OR "ChatGPT and cheating student course assignment" OR "ChatGPT and teaching in higher education" OR "Implications of ChatGPT in higher education institutions" OR "ChatGPT

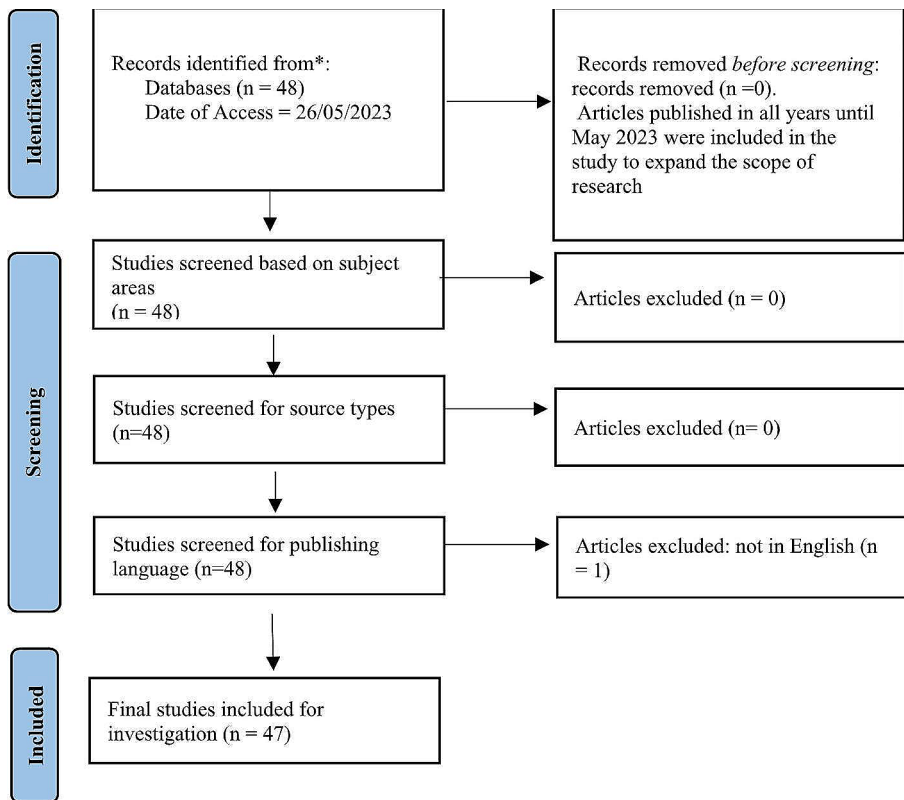


Fig. 1 PRISMA Flowchart

and evaluation criteria in higher education institution” OR “ChatGPT in universities” OR “ChatGPT and student learnings.”

The study includes papers published and included in the Scopus database on or before May 26, 2023 on the theme of ChatGPT and higher education. This timeframe was chosen to encompass the most recent and relevant literature available up to the point of data retrieval. Papers identified through the search queries underwent inclusion or exclusion based on predetermined criteria. Specifically, only papers published in journals were considered for this study, as these undergo a peer-review process and are subject to stringent selection criteria set by the journals, ensuring their quality and reliability. Papers in conference proceedings were excluded from the start of the search. Only papers written in English were included to maintain consistency and clarity, whereas others were excluded. Of the 48 research papers that were initially identified, 47 were ultimately selected for the bibliometric analysis, which was conducted using VOSviewer, a bibliometric analysis tool.

From the identified pool of 47 articles, the analysis uncovered a nuanced distribution of research methodologies. Specifically, 11 studies were grounded in quantitative research methodologies, underscoring a quantitative focus within the literature.

In contrast, a substantial majority of 31 articles embraced a qualitative framework, showcasing a diverse spectrum that included pure qualitative research, editorials, letters to the editor, and opinion pieces. Furthermore, the review brought to light four literature reviews, signifying a synthesis of existing knowledge, and identified one study that strategically employed a mixed-methods approach, blending both qualitative and quantitative research techniques.

To address the research questions, the selected publications underwent analysis using various bibliometric techniques. For the first and second research questions, citation analysis was employed. For the third and fourth research questions, bibliographic analysis was performed in VOSviewer software to generate clusters.

3 Findings and discussion

3.1 Publication trend

Information from the Scopus database indicates that academics began focusing on investigating various aspects of ChatGPT's potential in higher education in 2022, as they published their findings in 2023. All academic articles in reputable publications in the Scopus database were published in 2023.

3.2 Citation analysis

Table 1 presents the top ten articles according to the number of citations. The number of articles increased significantly in 2023, consistent with the emerging nature and growing relevance of the topic. Exploring the ramifications of ChatGPT in higher education is a recent focal point for scholars, with numerous aspects warranting deeper investigation. The limited citation count, as anticipated, underscores that publications from 2023 are in the early stages of gaining visibility and recognition within the academic community.

The article by Thorp (2023), entitled “ChatGPT is fun, but not an author”, has received the highest number of citations (79). Thorp stresses the risks associated with implementing ChatGPT in the classroom. Although ChatGPT is an innovative AI tool, significant barriers remain to its implementation in the field of education. According to Thorp, using ChatGPT in academic writing is still inefficient. Thorp also expresses concerns about the rising prevalence of ChatGPT in the fabrication of scientific publications. The second most-cited work, “How Does ChatGPT Perform on the United States Medical Licensing Examination?” by Gilson and colleagues, has received 27 citations. Gilson et al. (2023) evaluated the accuracy, speed and clarity of ChatGPT's responses to questions on the United States Medical Licensing Examination's Step 1 and Step 2 tests. The text responses generated by ChatGPT were evaluated using three qualitative metrics: the logical justification of the chosen answer, the inclusion of information relevant to the question, and the inclusion of information extraneous to the question. The model attained a level of proficiency comparable to that of a third-year medical student. The study demonstrates the potential utility of ChatGPT as an interactive educational resource in the field of medicine to facilitate

Table 1 Top 10 influential articles

Rank	Article Title and Author, Year	Citations
1	ChatGPT is fun, but not an author (Thorp, 2023)	79
2	How does ChatGPT perform on the United States medical licensing examination? The implications of large language models for medical education and knowledge assessment (Gilson et al., 2023)	27
3	ChatGPT for good? on opportunities and challenges of large language models for education (Kasneci et al., 2023)	13
4	Chatting and cheating: Ensuring academic integrity in the era of ChatGPT (Cotton et al., 2023)	6
5	Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators (Lim et al., 2023)	5
6	The ChatGPT storm and what faculty can do (Sun & Hoelscher, 2023)	4
7	Academic journals cannot simply require authors to declare that they used ChatGPT (Tang, 2023a)	3
8	The Role of ChatGPT, Generative Language Models, and Artificial Intelligence in Medical Education: A Conversation with ChatGPT (Eysenbach, 2023)	3
9	Academic integrity considerations of AI Large language models in the post-pandemic era: ChatGPT and beyond (Perkins, 2023)	3
10	The rise of ChatGPT: Exploring its potential in medical education (Lee, 2023)	2

Source: Scopus Database

the acquisition of knowledge and skills. Third is Kasneci et al.'s article “ChatGPT for good? On opportunities and challenges of large language models for education”, with 13 citations. This paper examines the benefits and drawbacks of using language models in the classroom from the perspectives of both teachers and students. The authors find that these comprehensive language models can serve as a supplement rather than a replacement for classroom instruction. Each of the remaining top-ten articles mentioned the impact of ChatGPT on academic integrity in education and had received fewer than ten citations at the time of analysis.

Table 2 presents the top 10 journals in terms of the number of citations of publications related to the topic of ChatGPT in higher education. The journal *Science*, which published “ChatGPT is fun, but not an author,” was deemed most influential because it received the highest number of citations (79). *JMIR Medical Education* has published two articles that have been cited by 30 other research articles on the same topic. *Journal of University Teaching and Learning Practise* has published the most articles: three. *Innovations in Education and Teaching International* has published two articles on this topic, which together have been cited by six articles.

As shown in Table 3, the majority of research articles pertaining to ChatGPT and higher education have originated from countries in Asia. Six of the top 10 countries for

Table 2 Top 10 influential journals in terms of citations

Journal Name	Citations	Articles	Cita- tions per article
Science	79	1	79
JMIR Medical Education	30	2	15
Learning and Individual Differences	13	1	13
Innovations in Education and Teaching International	6	2	3
International Journal of Management Education	5	1	5
Journal of University Teaching and Learning Practice	5	3	1.4
Nurse Educator	4	1	4
European Journal of Tourism Research	4	1	4
Accountability in research	3	1	3
Anatomical Sciences Education	2	1	2

Source: Scopus Database

Table 3 Top countries by number of publications

Countries	No. of Publications	Citations
United States	11	36
Australia	9	7
China	5	4
India	4	0
United Kingdom	3	7
United Arab Emirates	3	0
Germany	2	13
South Korea	2	2
Hongkong	2	1
Japan	2	0

Source: VOSviewer Output

publishing articles on this topic are located in the Asian continent. However, the most influential studies in terms of citations have been produced by the United States, Germany, Australia, and the United Kingdom. Combined, these countries have received a total of 63 citations, with individual counts of 36, 17, 7, and 7, respectively. These four countries have 90% of the total citations of the top 10 most productive countries in the field of research on higher education perspectives on ChatGPT.

3.3 Bibliographic coupling

3.3.1 Thematic clusters

Four thematic clusters (TCs) were identified from the included research articles, as shown in Table 4. VOSviewer was used to perform clustering based on bibliographic coupling. This method identifies relations between documents by examining publications that cite the same sources (Boyack & Klavans, 2010). VOSviewer clus-

Table 4 Thematic clusters based on research articles

Thematic Cluster (TC)	Article title	Authors
TC1: ChatGPT and Academic Integrity	Chatting and cheating: Ensuring academic integrity in the era of ChatGPT	Cotton et al., 2023)
	ChatGPT for good? On opportunities and challenges of large language models for education	Kasneci et al., 2023
	Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators	Lim et al., 2023
	Academic Integrity considerations of AI Large Language Models in the post-pandemic era: ChatGPT and beyond	Perkins, 2023
TC2: ChatGPT and Learning Environment	Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI)	Crawford et al., 2023
	Unlocking the Power of ChatGPT: A Framework for Applying Generative AI in Education	Su & Yang, 2023
	Letter to editor: Academic journals should clarify the proportion of NLP-generated content in papers	Tang, 2023b
TC3: ChatGPT and Student Engagement	The rise of ChatGPT: Exploring its potential in medical education	Lee, 2023
	Holy or Unholy? Interview with Open AI's ChatGPT	Iskender, 2023
TC4: ChatGPT and Scholarly Research	Game of algorithms: ChatGPT implications for the future of tourism education and research	Ivanov & Soliman, 2023
	Impact of ChatGPT on learners in a L2 writing practicum: An exploratory investigation	Yan, 2023

Source: Authors' compilation

ters articles with a common knowledge base, assigning each publication to exactly one cluster. To implement this clustering technique, we assessed the co-occurrence of bibliographic references among articles within our dataset. Co-occurrence was determined by identifying shared references between articles, indicating a thematic connection (Boyack & Klavans, [2010](#)). Articles sharing common references were considered to co-occur, enabling us to quantify the extent of thematic relationships based on the frequency of shared references. We identified and categorised thematic clusters within our dataset through the combined approach of VOSviewer clustering and co-occurrence analysis. This method typically results in a distribution of clusters, with a limited number of larger clusters and a more substantial number of smaller clusters.

The clusters were derived through an analysis of subordinate articles extracted from the Scopus database. VOSviewer systematically organised similar articles into distinct clusters based on the shared patterns of bibliographic references (Van Eck & Waltman, [2010](#)). To ensure methodological transparency and robustness, we established clear criteria and parameters for clustering. Specifically, keywords with a minimum frequency ($n=5$) were included in the analysis, and co-occurrence was calculated based on a pairwise comparison method. This systematic approach ensured the meaningful representation of thematic relationships within the dataset, guided by insights from previous literature (Jarneving, [2007](#)). Using cluster analysis techniques, the articles were organised into cohesive groups characterised by the degree of thematic homogeneity guided by the nature of the research findings. This

approach ensured a robust representation of the underlying thematic structure (Jarnveing, 2007).

Furthermore, to mitigate the risk of subjective bias in thematic categorisation, a counter-coding approach was employed. A second researcher independently categorised thematic clusters identified by VOSviewer to assess inter-rater agreement. The level of agreement between the two researchers was assessed using Cohen's kappa coefficient, ensuring the reliability and validity of the thematic classification process. The resulting kappa coefficient (0.69) indicated substantial agreement, suggesting a high level of agreement beyond what would be expected by chance alone (Gisev et al., 2013). Furthermore, the nomenclature assigned to each cluster was finalised based on the predominant research theme emerging from the analysis, providing a concise and informative label for each group.

TC1: ChatGPT and Academic Integrity: Cotton et al. (2023) describe ChatGPT as a double-edged sword that potentially threatens academic integrity. AI essay writing systems are programmed to churn out essays based on specific guidelines or prompts, and it can be difficult to distinguish between human and machine-generated writing. Thus, students could potentially use these systems to cheat by submitting essays that are not their original work (Dehouche, 2021). Kasneci et al. (2023) argue that effective pedagogical practices must be developed in order to implement large language models in classrooms. These skills include not only a deep understanding of the technology but also an appreciation of its constraints and the vulnerability of complex systems in general. In addition, educational institutions need to develop a clearly articulated plan for the successful integration and optimal use of big language models in educational contexts and teaching curricula. In addition, students need to be taught how to verify information through a teaching strategy emphasising critical thinking effectively. Possible bias in the generated output, the need for continuous human supervision, and the likelihood of unforeseen effects are just a few of the challenges that come with the employment of AI systems. Continuous monitoring and transparency are necessary to ensure academic integrity while using ChatGPT. Lim et al. (2023) report that ChatGPT poses academic integrity challenges for the faculty of higher education institutions, who must verify whether academic work (assignments, research reports, etc.) submitted by students is derived from the fresh perspective of data analysis or plagiarised and recycled (copying and pasting original work) by ChatGPT. ChatGPT may threaten student learning and classroom engagement if students have access to information and course assignments without assessing their integrity. Perkins (2023) also expresses concerns regarding academic integrity in the use of ChatGPT. Students are utilising ChatGPT to complete their course assignments without attribution rather than producing original work. Higher education institutions must establish clear boundaries regarding academic integrity and plagiarism in light of the growing utilisation of AI tools in academic and research settings. In addition, the challenges posed by AI essay writing systems like ChatGPT necessitate a multifaceted approach to safeguard academic integrity. Educational institutions should invest in comprehensive educational programs that not only teach students the ethical use of technology but also incorporate rigorous assessments of critical thinking skills. Additionally, integrating AI literacy into the curriculum, with

a focus on understanding the limitations and potential biases of big language models, can empower students to discern between human and machine-generated content.

TC2: ChatGPT and Learning Environment: According to Crawford et al. (2023), increased stress levels and peer pressure among university students have created a favourable environment for the use of AI tools. ChatGPT provides enhanced educational opportunities for college-level students. It can help students identify areas they may have overlooked, offer guidance on additional reading materials, and enhance existing peer and teacher connections. In addition, ChatGPT can propose alternative methods of evaluating students beyond conventional assignments. Crawford et al. (2023) recommend providing practical assignments incorporating ChatGPT as a supplementary tool to reduce plagiarism. Su (2023) documents that ChatGPT can provide students with a personalised learning experience based on their specific needs. In addition, the ChatGPT platform can be used to create a virtual coaching system that offers prompt feedback to educators during their classroom evaluations. This approach fosters critical thinking and supports early childhood educators in refining their teaching methodologies to optimise interactive learning outcomes for students. Tang (2023b) proposes that bolstering research integrity can be achieved by imposing restrictions on the utilisation of NLP-generated content in research papers. Additionally, the author advocates for transparency from researchers, emphasising the importance of explicitly stating the proportion of NLP-generated content incorporated in their papers. This recommendation prompts a critical examination of the role of AI-generated content in scholarly work, emphasising the importance of nurturing independent research and writing skills for both students and researchers.

TC3: ChatGPT and Student Engagement: Lee (2023) examines the ability of ChatGPT to provide an interactive learning experience and boost student engagement beyond textbook pedagogy. Iskender (2023) explains that ChatGPT provides a mechanism for students to generate and investigate diverse concepts expeditiously, thereby helping them engage in imaginative and evaluative thinking on specific subject matter. This approach has the potential to optimise time management for students and allow them to concentrate on more advanced cognitive activities. AI tools such as ChatGPT can potentially enhance the personalisation of learning materials by providing visual aids and summaries that can aid the learning process and significantly improve students' competencies. Hence, leveraging ChatGPT in education can revolutionise learning by facilitating interactive experiences, nurturing imaginative thinking, and optimising time management for students.

TC4: ChatGPT and Scholarly Research: Ivanov and Soliman (2023) and Yan (2023) focus on the practical applications and implications of LLMs like ChatGPT in educational settings and scholarly research within the context of language learning, writing, and tourism. Yan's investigation into ChatGPT's application in second-language writing examines its effectiveness in addressing specific writing tasks at the undergraduate level. The findings underscore the nuanced balance between the strengths of ChatGPT and the inherent limitations in handling demanding academic writing tasks. Nevertheless, ChatGPT is also labelled as an 'all-in-one' solution for scholarly research and writing (Yan, 2023). In parallel, Ivanov and Soliman (2023) highlight that ChatGPT can assist scholars in the field of tourism research by composing preliminary literature reviews, substantiating their chosen methodologies, and

creating visual aids such as tables and charts. Furthermore, the researchers outline that ChatGPT could provide valuable methodological ideas and insights by helping researchers generate questions and corresponding scales for inclusion in questionnaires. Hence, ChatGPT has the potential to become a valuable ally as a facilitator in academic writing processes and has the potential to transform the research workflow.

3.3.2 Geographic clusters

The results of the country-based bibliographic analysis are summarised in Table 5. The present study utilised the prevailing research theme in the existing literature as a framework for categorising the countries into four distinct clusters on the basis of the number of documents published from different countries.

Cluster 1: Implications of ChatGPT for Student Examinations and Education: Cluster 1 is composed of five countries: Germany, Ireland, South Korea, Taiwan, and the United States. Researchers in these countries have emphasised the potential role of ChatGPT in higher education within the context of AI language models. Eleven research articles related to this theme were published by researchers based in the United States, the most in this cluster. The top three articles in Table 1 are from the United States. The study entitled “Opportunities and Challenges of Large Language Models for Education,” was authored by German researchers (Kasneci et al., 2023) and has been widely cited in the academic community (13 citations). The

Table 5 Thematic (Geographic) clusters of countries

Clusters	Countries	No. of Documents
Cluster 1	Germany	2
	Ireland	1
	South Korea	2
	Taiwan	1
	United States	11
Cluster 2	Bangladesh	1
	Hong Kong	2
	Japan	2
	Netherlands	1
	Nigeria	1
	Pakistan	1
	UAE	3
	UK	3
	Vietnam	1
Cluster 3	Australia	8
	China	5
	Malaysia	1
Cluster 4	India	4
	New Zealand	1
	Bulgaria	1
	Egypt	1
	Oman	1
	Poland	1
	Bulgaria	1

Source: Authors' compilation

remaining studies were conducted by researchers from South Korea and Taiwan and focused on the impact of ChatGPT on the education sector and its associated opportunities and challenges. This cluster demonstrates that students could benefit greatly from using ChatGPT in performing various academic tasks, such as reviewing and revising their work, verifying the accuracy of homework answers, and improving the quality of their essays. It has also aided postgraduates whose first language is not English improve their writing, as ChatGPT can be instructed to rewrite a paragraph in a scholarly tone from scratch. The outcomes have demonstrated significant efficacy, thereby alleviating the cognitive load associated with translation for these students, enabling them to concentrate on the substance of their writing rather than the intricacies of composing in an unfamiliar language. To harness the potential benefits, future research could focus on developing targeted training programs for students and educators that emphasise the effective utilisation of ChatGPT to enhance not only academic tasks but also language proficiency for non-native English speakers, addressing both cognitive load and language intricacies.

Cluster 2: ChatGPT and Academic Integrity: Cluster 2 comprises research studies conducted by authors from Japan, Bangladesh, Hong Kong, Nigeria, Pakistan, UAE, the UK, Vietnam and the Netherlands. The most influential study in this cluster, “Unlocking the power of ChatGPT: A framework for applying Generative AI in education”, was authored by researchers from Hong Kong (Su & Yang, 2023). They document that ChatGPT can be used to respond to student inquiries, reducing the time and effort required of educators and allowing them to focus their resources on other activities, such as scholarly investigations. Farrokhnia et al. (2023) and Yeadon et al. (2023) state that ChatGPT can write scientific abstracts with fabricated data and essays that can evade detection by reviewers. According to Liebreinz et al. (2023), ChatGPT tends to produce erroneous and incoherent responses, thereby raising the potential for disseminating inaccurate information in scholarly literature. The higher-order cognitive abilities of ChatGPT are relatively low, especially in areas related to creativity, critical thinking, reasoning, and problem-solving. ChatGPT could reduce students’ motivation to explore topics independently, draw their own conclusions, and solve problems independently (Kasneci et al., 2023). Ibrahim et al. (2023) find that ChatGPT can engage students in their academic pursuits. ChatGPT can enhance the writing abilities of non-native English speakers to allow them to concentrate on higher-order cognitive processes. This technological development allows faculty members to allocate more attention to conceptualisation and writing rather than focusing on the mechanics of grammar and spelling. However, there is a debate among intellectuals regarding the implications of AI for content creation, with some asserting that it detracts from innovative content development. The possibility that ChatGPT threatens academic honesty by facilitating essay plagiarism is being acknowledged. In addition, in the absence of appropriate citations, this textual content may violate copyright regulations. Cotton et al. (2023) express concerns about the potential impact of ChatGPT on academic integrity and plagiarism. Their work corroborates Dehouche’s (2021) assertion that students may use ChatGPT to engage in academic dishonesty by submitting essays that are not their original work. According to Cotton et al. (2023), ChatGPT users have a competitive advantage over non-users and can achieve higher grades on their coursework assignments by utilis-

ing the AI-based language tool. They classify ChatGPT as a versatile instrument with the potential to pose a threat to academic integrity, noting that AI essay writing systems are specifically programmed to generate content based on specific parameters or prompts, thereby challenging the discernment between human-authored and machine-generated content. Distinguishing between the academic work produced by students and the content of ChatGPT when evaluating assignments is a significant challenge for faculty. It is recommended that academic staff continually monitor student assignments for academic misconduct infractions, coupled with transparent communication about the potential risks associated with AI-generated content.

Cluster 3: ChatGPT and Students' Learning: Cluster 3 comprises Malaysia, China and Australia. This cluster mainly includes studies of the role of AI-based models in student learning. Researchers from Australia (Crawford et al., 2023; Lim et al., 2023; Lawrie, 2023; Li et al., 2023; Seth et al., 2023; Cingillioglu, 2023; Skavronskaya, 2023; and Johnin, 2023) have contributed the most (8 studies) to this cluster and put their weight behind the role of AI and student learning in various disciplines. One of the most influential papers, “Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators”, was authored by researchers from both Australia and Malaysia (Lim et al., 2023) and reflected on the role of AI in classroom learning and teaching. Rather than banning AI tools, the authors advocate for the productive use of these tools in classrooms to facilitate more engaging student learning. Another Australian study titled, “Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI)” (Crawford et al., 2023) highlights AI as an alternative path of learning for students. ChatGPT can promptly evaluate students' assignments and help them identify areas of weakness. Educators have the option to provide innovative assessments to their students instead of adhering solely to conventional assessments. ChatGPT can augment pedagogical approaches, evaluation structures, and the comprehensive educational milieu by reinforcing the trilateral association among instructors, learners, and technology. The implementation of ChatGPT can provide students with a personalised and interactive learning and research experience facilitated by virtual tutors and customised recommendations. In light of the research in this cluster, the integration of ChatGPT into education should inspire a paradigm shift towards a more dynamic and personalised learning environment. Institutions can explore strategic partnerships with AI researchers to develop context-specific applications of ChatGPT that cater to diverse educational needs, promoting a symbiotic relationship between human instructors, students, and technology for an enriched learning experience.

Cluster 4: ChatGPT and Field-specific Research: This cluster includes research by authors in Asian and European countries (India, Oman, Bulgaria and New Zealand) that has emphasised the potential role of ChatGPT in the medical and tourism industries. Authors from India explored the role of ChatGPT in the medical field (Seetharaman, 2023; Subramani et al., 2023). Seetharaman (2023) reports that ChatGPT offers supplementary language assistance to students who are not proficient in English, enabling them to enhance their language proficiency and effectively communicate in English, the principal language of instruction in medical establishments. The ChatGPT platform has the potential to serve as a tool for medical students to

replicate patient interactions in a simulated environment, such as accurately obtaining medical histories and documenting symptoms. According to Subramani et al. (2023), ChatGPT is a highly efficient and user-friendly AI technology that can aid healthcare professionals in various aspects, such as diagnosis, critical decision-making, and devising appropriate treatment plans. ChatGPT has demonstrated impressive performance on medical exams, indicating its potential as a valuable resource for enhancing medical education and assessment (Subramani et al., 2023) and can support interdisciplinarity in tourism research (Nautiyal et al., 2023). Ivanov and Soliman (2023) note the potential of ChatGPT to serve as a digital instructor to provide students with enhanced and effective learning experiences and outcomes. Digital instructors can impart knowledge in diverse languages and thus can be used to educate individuals of varying nationalities and backgrounds in the field of tourism. Furthermore, LLM-based chatbots, including ChatGPT, can assess written assignments and provide direction on linguistic proficiency, syntax, and composition, ultimately enhancing students' scholarly writing proficiency. In exploring the intersection of ChatGPT with medical education, institutions can pioneer innovative approaches by using the platform to create immersive, simulated patient interactions that go beyond language assistance, allowing medical students to practice nuanced skills such as medical history gathering and symptom documentation. Simultaneously, leveraging ChatGPT as a versatile digital instructor offers a unique opportunity to provide cross-cultural and multilingual education, contributing to a more inclusive and globally competent workforce within the tourism industry.

3.4 Challenges of ChatGPT in higher education

In addition to some previously mentioned challenges, such as the potential for plagiarism, the investigation also identified other key challenges in implementing ChatGPT within the context of higher education's teaching and learning environment. Wu and Yu (2023) found that the benefits of AI-based ChatGPT are more in higher education as compared to primary and secondary education. The study also reported that the novelty effects of AI chatbots may enhance learning outcomes in brief interventions, but their efficacy diminishes in longer interventions.

First, the implementation of ChatGPT within the educational context engenders learning impediments. In the absence of adequate monitoring and regulation, the technology could lead to human unintelligence and unlearning, but teachers will become more adaptive and create authentic assessments to enhance student learning (Alafnan et al., 2023; Lawrie, 2023). Second, the technology could be used in a manner that violates students' privacy. If the model is not adequately secured, it could surreptitiously gather confidential data from students without their explicit awareness or authorisation (Kansci, 2023). Third, the technology could facilitate discrimination against particular students. If the model is not trained on a dataset that accurately represents the entire student population, it has the potential to create disparities in educational access (Cingillioglu, 2023; Lin et al., 2023). Fourth, according to Ivanov and Soliman (2023), ChatGPT lacks access to real-time data. Therefore, its responses may be inconsequential, inaccurate, or outdated. The information provided in response to a specific query may also be insufficient. Gao et al. (2022) highlight the

need for further investigation of the precision and scholarly authenticity of ChatGPT. Fifth, it may be difficult for ChatGPT to comprehend the context and subtleties of complex academic subjects and answer complex questions (Adetayo, 2023; Eysenbach, 2023; Neumann et al., 2023). The system can misinterpret inquiries, offer inadequate or inaccurate responses, or struggle to comprehend the fundamental purpose behind questions (Clark, 2023). In particular, ChatGPT may not have the requisite expertise in highly specialised or advanced subjects such as advanced mathematics or specific sciences. Hence, it may not deliver precise and accurate answers (Neumann et al., 2023; Fergus et al., 2023). Karaali (2023) claimed that the primary emphasis in the field of AI is currently directed towards the enhancement of advanced cognitive abilities and mental processes associated with quantitative literacy and quantitative reasoning. However, it is important to acknowledge that fundamental skills such as writing, critical thinking, and numeracy continue to serve as essential foundational components among students. Although AI is making significant progress in fundamental domains, it appears that students are experiencing a decline in performance in the context of fundamental skills. Consequently, NLP-based adaptive learner support and education require further investigation (Bauer et al., 2023).

In addressing the challenges of ChatGPT in education, educators need to adapt and develop authentic assessments that mitigate the risk of human unlearning, ensuring that technology enhances, rather than hinders, student learning experiences. Simultaneously, recognising the limitations of ChatGPT in comprehending the nuances of highly specialised subjects underscores the importance of balancing advancements in AI's cognitive abilities with continued emphasis on fundamental skills like critical thinking, writing, and numeracy, urging a reevaluation of priorities in AI-driven educational research towards comprehensive learner support.

4 Conclusion, implications and agenda for future research

This study identified the most influential articles and top journals and countries in terms of citations and publication productivity related to ChatGPT in higher education, as well as highlighted emerging thematic clusters and geographic clusters in research on the role and challenges of ChatGPT in teaching and learning in higher education institutions. Articles on the topic of ChatGPT in higher education published up to May 2023 were identified by searching the Scopus database. Given the emergent nature of ChatGPT starting in late 2022, all the included articles were published in 2023. Thus, this specific research domain remains relatively unexplored. The findings of this analysis reveal that the United States is the most productive country in terms of research on the role of ChatGPT in higher education, especially relating to academic integrity and research. US researchers also emerged as the most influential in terms of number of citations in the literature. Our findings corroborate those of previous research (Crompton & Burke, 2023). However, 60% of the articles in our shortlisted literature emanated from Asian countries.

Four thematic clusters (academic integrity, student engagement, learning environment and research) were identified. Furthermore, the country-based bibliographic analysis revealed that research has focused on student examinations, academic integ-

ity, student learning and field-specific research in medical and tourism education (Nautiyal et al., 2023; Subramani et al., 2023). Plagiarism is recognised as a major challenge that hinders students' creativity, innovativeness and originality when using ChatGPT in their academic pursuits. To mitigate the potential drawbacks of using ChatGPT in educational and research settings, proactive measures should be taken to educate students and researchers alike on the nature of plagiarism, its negative impacts and academic integrity (Shoufan, 2023; Teixeira, 2023). Educators may ask students to provide a written acknowledgement of the authenticity of their assignments and their non-reliance on ChatGPT. Such an acknowledgement would discourage students from utilising ChatGPT in their academic and research endeavours and establish accountability for their academic pursuits. In addition, educators should develop authentic assessments that are ChatGPT-proof.

ChatGPT lacks emotional intelligence and empathy, both of which are crucial in effectively addressing the emotional and psychological dimensions of the learning process (Farrokhnia et al., 2023; Neumann et al., 2023). Higher education institutions may encounter challenges in using ChatGPT to deliver suitable assistance, comprehension, or direction to students needing emotional or mental health support. The significance of human interaction in learning cannot be overstated. Achieving a balance between using AI and the advantages of human guidance and mentorship is a persistent challenge that requires attention (Neumann et al., 2023; Rahman et al., 2023). Strzelecki (2023) observed in his research that behavioural intention and personal innovativeness are the two major determinants behind the adoption of ChatGPT among students.

4.1 Implications

The findings of the present study have numerous important implications. This study provides insight into the current state of ChatGPT in higher education and thus can serve as valuable guidance for academics, practitioners, and policymakers. The study's findings contribute to the literature by providing new insights into the role of ChatGPT and strategies for mitigating its negative aspects and emphasising its positive attributes.

First, the implementation of AI in education can improve academic performance and student motivation, particularly by facilitating personalised learning. Educational institutions should monitor and regulate students' use of such technologies proactively. Higher education institutions also ought to prioritise the training of their educators in effectively utilising AI technologies, including ChatGPT. Concurrently, it is imperative for these institutions to equip students with comprehensive academic integrity training, shedding light on the appropriate and inappropriate applications of AI tools like ChatGPT. This includes creating awareness about the potential consequences of utilising these technologies for dishonest practices. Furthermore, educational establishments need to urgently revisit and refine their academic integrity policies to address the evolving landscape shaped by the integration of artificial intelligence tools in various academic facets. This proactive approach will foster a learning environment that embraces technological advancements and upholds the principles of honesty and responsible use. Institutional regulations on accountability

and transparency should guide the frameworks that govern the use of AI in the campus environment (Pechenkina, 2023; Sun & Hoelscher, 2023; Dencik & Sanchez-Monedero, 2022).

Second, faculty members must proactively replace traditional coursework with modern alternatives that foster elevated levels of critical thinking among students, as suggested by Zhai (2022). Educators and learners can augment the academic material produced by ChatGPT with their own insights and information obtained from credible scholarly resources (Emenike & Emenike, 2023).

Third, ChatGPT should not be considered a threat to the education sector but a supplementary tool for human instruction that can enhance teaching and learning. It is imperative to acknowledge that the vital role of human educators cannot be replaced (Karaali, 2023). Moreover, ChatGPT can potentially enhance the accessibility and inclusivity of higher education. Alternative formats, linguistic support, and individualised explanations can help students who are studying English as a second language, are not native English speakers, or have other unique learning needs. Furthermore, Alnaqbi and Fouda (2023) highlight the implications of AI in evaluating the teaching style of faculty in higher education by collecting the feedback of students through social media and ChatGPT.

Fourth, the faculty in higher education institutions could address ethical concerns by providing students with explicit and comprehensive guidelines about the prescribed structure of academic assignments (Cotton et al., 2023; Gardner & Giordano, 2023). This practice can facilitate the production of more cohesive assignments. In addition, teachers can use rubrics to assess assignments and blend automated and manual assessment methodologies to evaluate students' comprehension of the subject matter (Cotton et al., 2023; Shoufan, 2023).

In summary, using ChatGPT is recommended for enhancing creativity, refining writing proficiency, and improving research abilities. Nonetheless, it is crucial to emphasise that ChatGPT should not be employed as a substitute for critical thinking and producing original work. While it serves as a valuable tool for augmentation, upholding the integrity of independent thought and authentic content creation in academic endeavours is essential.

4.2 Limitations

The present study acknowledges several limitations. Firstly, the reliance on Scopus as the primary data source for bibliometric analysis may have limitations in capturing the full landscape of relevant literature. Future research may consider incorporating additional databases like Web of Science to ensure a comprehensive assessment. Secondly, due to the English language restriction in the review, potentially relevant studies may have been omitted. Future research could enhance inclusivity by extending its scope to encompass papers written in languages other than English. Thirdly, the current study exclusively focused on journal articles. Expanding the scope to include diverse sources, such as conference proceedings or book chapters, could offer a more comprehensive overview.

Additionally, as a rapidly evolving field, literature published after our inclusion dates need capturing, and future studies should consider adjusting their inclusion cri-

teria to accommodate the dynamic nature of the subject matter. Lastly, the specificity of the bibliometric data search, centred around terms like ChatGPT, AI, higher education, and academic integrity, may have excluded certain relevant articles. Future studies should consider employing more generalised search parameters to encompass synonyms associated with these terms.

4.3 Future scope

The findings of the study suggest new avenues for future research. The effectiveness of evaluation criteria for assessments incorporating ChatGPT-generated text needs to be investigated. Specifically, the appropriate level of ChatGPT-produced text that students may use in academic tasks or assessments has not been established. Research on the ethical implications of using AI tools such as ChatGPT in higher education is also needed. Issues pertaining to data confidentiality, bias, and transparency in algorithms used for decision-making remain to be addressed. Feasible approaches for mitigating the excessive reliance of scholars and learners on ChatGPT or similar AI models are needed. Researchers could also explore the implementation of verification processes that go beyond traditional plagiarism detection methods, accounting for the unique challenges posed by AI systems. Future research in this domain could focus on establishing guidelines and best practices for the integration of AI tools like ChatGPT in academic settings, ensuring a balance between technological innovation and the preservation of academic rigour. Finally, the literature on ChatGPT in higher education has largely focused on the medical and tourism sectors. Future researchers must explore applications of ChatGPT in other disciplines.

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declarations

Conflict of interest No Conflict of Interest.

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