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Emerging Dynamics of ChatGPT in Academia: A Scoping Review

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Abstract

Large Language Models (LLMs) and Generative AI tools are revolutionising every aspect of academia, including medical, physical, and STEM education. They have also proved their mettle in blended learning systems and distance learning programs by improving educational sustainability, accessibility, and engagement. Through this scoping review, we aim to provide an essential overview of the state of the art of ChatGPT from the standpoint of exploring its development, analysing its current trajectory, and emerging dynamics in active research responsible for defining regulations and protocols. The PRISMA benchmarking was used on the Scopus dataset, with 109 papers from 2022 to 2023. Interactive results and bibliographic maps are generated using the Bibliometrix library of R-Studio. The findings are aligned with the research questions and represent exceptional growth in scientific production. Furthermore, relevant avenues for research publications, leading countries, and institutions in the area are also listed. The thematic and trends analysis anticipated that artificial intelligence and generative AI will substantially influence nearly every dimension in the coming years. The review also identified the possible advantages and disadvantages of adopting ChatGPT in higher education and analysed its deployment, considering ethical issues. The research concludes that, apart from ChatGPT, other large language models are also transforming artificial intelligence in education. However, ethical concerns and implications in education highlight vital issues for further research to ensure AI's responsible and ethical use.

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Introduction

Artificial Intelligence (AI) in academia is rapidly evolving. With open access availability of Large Language Models (LLMs) and Generative AI tools, generating text, translating languages, writing creative content, and answering questions becomes very easy (Pinzolits, 2023). The acceptance of these models can revolutionise various aspects of the traditional educational process (Karakose & Tülübaş, 2023), including research, publication, and submitting tasks (Habibi et al., 2023). However, challenges like reliability, plagiarism, and ethical implications may arise (Halaweh, 2023; Mills et al., 2023). LLMs found their applications in all facets of the education sector, be it medical education, physical education, or STEM education (Vasconcelos & dos Santos, 2023; Friederichs et al., 2023). ChatGPT's accuracy in medical students' progress tests was 65.5%, with an average response time of 22.8 seconds and a significantly correlated Multiple choice questions difficulty index. Hallal et al. (2023) compared AI chatbots' understanding of text-based structural notations and organic chemistry-related questions, finding that ChatGPT excels in tasks like notation conversion. Vázquez-Cano et al. (2023) simulated and evaluated ChatGPT with the best score when summarising the text from PISA international tests. Kostka and Toncelli (2023) also examined its role in English Language Teaching (ELT), its benefits and challenges, and provided recommendations for future teaching and research, addressing concerns about its impact on scholarly publishing. LLMs also make their way to blended learning (Alshahrani, 2023) systems and distance learning programmes (Naidu & Sevnarayan, 2023) improving educational sustainability, accessibility, and engagement, developing multiple choice questionnaires (Bitzenbauer, 2023) evaluating academic answer sheets (Fergus et al., 2023; Hassoulas et al., 2023) and providing valuable insights for educators and policymakers while harnessing the benefits of AI in education (Zhu et al., 2023).

Among other LLMs, ChatGPT has recently been the subject of academic investigation and analysis (Sullivan et al., 2023). As a result, various unique ideas and patterns have emerged. Researchers compared various versions of LLMs to check the efficiency of community service-learning materials (Roos et al., 2023). Technologists discuss explainability and interpretability, whereas academicians have concentrated on finding approaches to make the decision-making process of ChatGPT ethical and more intelligible (Ray, 2023). Methodologies such as attention visualisation, rule-based explanations, and model distillation are the current points of investigation to offer users

(Lo, 2023). At the same time, statistical pundits concentrate on bias and fairness (Ellis & Slade, 2023). They claim to be actively researching strategies to mitigate biases in ChatGPT answers, ensure fairness, and decrease the amplification of social preconceptions in training data (Tlili et al., 2023). Above all, academia has aggressively researched the social impact of AI-generated material (Michel-Villarreal et al., 2023), investigating concerns such as privacy, disinformation, consent, and misuse (Dwivedi et al., 2023). Regardless of these concerns, the potential benefits of ChatGPT in academia are substantial and undoubtedly open new horizons for researchers looking for work (Floridi, 2023). Furthermore, ChatGPT and other LLMs will likely grow as they evolve, however, the ethical and intellectual property issues involved in deploying them will always spark debate (Rudolph et al., 2023b; Lancaster 2023).

This scoping review investigates the developing concepts and trends of ChatGPT in academia, particularly education. The study also looks at the most prominent keywords, the countries actively collaborating, and the most active researchers responsible for defining regulations regarding ChatGPT in scientific writing. The significance of this study lies in its consolidation of key thematic areas of research, where it explores creative and intellectual aspects of ChatGPT usage and tries to provide a perspective on dynamic trends and progress in integrating advanced language models in academia. The paper's approach aligns with the growing use of thematic analysis to synthesise literature.

While ChatGPT has been embraced for its utility in academic research and writing, concerns about its ethical use and potential impact have also been raised (Plata et al., 2023). Thematic investigation and exploration of the implications of ChatGPT in academia is the need of the hour to understand its full impact better. Therefore, this scoping review aims to critically review the concepts and trends of ChatGPT in higher education based on the following research question:

> **Research Question 1.** What are the emerging dynamics of ChatGPT literature in academia in terms of (a) publication growth and relevant publication avenues, (b) leading countries and institutions, and (c) topical and thematic trends?

Background

Emergence of AI in Education

The conceptualisation through the Turing Test in 1950 and the coining of the term "Artificial Intelligence (AI)" by John McCarthy in 1955 marked the recognition of AI's capacity for tasks like logical reasoning and problem-solving (Nilsson, 1998). However, since Nwana (1990) introduced the concept of AI techniques in intelligent tutoring systems in the 1980-90s, its role in the classroom has grown and is now commonly referred to as "AIEd" (Baker et al., 2019).

In the past, AI was primarily implemented for grading and tutoring capacities. For example, in the 1960s, the PLATO system (Hody & Avner, 1978) developed at the University of Illinois provided students with individualised instruction. In the 1980s, intelligent computer-assisted instruction (ICAI) systems (Duchastel, 1989) were developed to give students personalised feedback and guidance. Periodically, education emerges to display its potential to enhance learning outcomes (Lodge & Ashford-Rowe, 2024) and improve instructional effectiveness, assessment, and efficiency, particularly in personalised tutoring (de Winter et al., 2023; Naidu & Sevnarayan, 2023). Furthermore, incorporating AI in engineering education curricula is necessary due to the emergence of Industry 4.0 (Nikolic et al., 2023) and educational curricula development (Chang et al., 2023). Intelligent tutoring systems (ITS) (Wang et al., 2023) and Intelligent tutoring systems for education (Martín-Núñez et al., 2023) were designed to use AI techniques to provide customised instruction to students. Simulations, digital patients, and personalised feedback become helpful in education (Abbas et al., 2023; Karabacak et al., 2023). Natural language processing (NLP) techniques have been used in educational applications to facilitate language learning and assessment (Saxena & Doleck, 2023).

Additionally, adaptive learning adjusts question difficulty levels or provides customised learning paths based on student performance data that leverages AI algorithms to tailor educational content and delivery based on individual student needs (Wu et al., 2023). AI techniques, such as student performance, engagement, and behaviour, have been used to analyse educational data (O'Dea & O'Dea, 2023). Virtual and Augmented Reality technologies have been integrated with educational systems to create immersive learning experiences. AI has also been employed to evaluate and score essays automatically. Personalised learning platforms that analyse data on students' learning styles, performance, and interests deliver tailored content, recommendations, and support (Akiba & Fraboni, 2023).

Emergence of AI in current or future learning and teaching practice

The emergence of AI has significantly influenced and reshaped current and future learning and teaching practices (Chaka, 2023). The latest AI intervention in academia is the Large Language Models (LLMs). LLMs are artificial Intelligence (AI) tools trained using extensive text and code datasets that allow them to produce text, translate languages, compose various unique materials, and provide insightful answers to inquiries (Hsiao et al., 2023). Large Language Models (LLMs) can significantly contribute to Sustainable Development Goals (Fung & Hosseini, 2023) by processing vast data, job market (Thida, 2023), healthcare (Killian et al., 2023), climate (Kikerpill & Siibak, 2023), disease monitoring (Klang et al., 2023), and automated translation services (Bašić et al., 2023) while ensuring ethical AI development. LLMs like ChatGPT are utilised in the classroom to provide individualised instruction, evaluation, investigation, and innovation

(Zhang et al., 2023). They have several applications, including the generation of practice questions, the development of adaptive exams (Črček & Patekar, 2023), the coding of interview transcripts (Dengel et al., 2023), the discovery of trends in big datasets, the generation of ideas for writing assignments (Chaudhry et al., 2023; Vargas-Murillo et al., 2023) and content delivery (Kiryakova & Angelova, 2023). Li et al. (2023) interestingly explored YouTube channels utilising AI tools like ChatGPT for language learning, focusing on English and Japanese teachers, learners, technology professionals, and e-learning providers. Bin-Nashwan et al. (2023) examined ChatGPT's effectiveness in the US Fundamentals of Engineering Environmental Exam, whereas Al-Zoubi & Aldmour (2023) and Ruiz-Rojas et al. (2023) explored the role of ChatGPT specifically for creating massive MOOC virtual classrooms, highlighting its potential to solve complex engineering problems.

However, LLMs are still in the early stages of development, and researchers have pointed out possible hazards related to students' education, such as test cheating (Gorichanaz, 2023), plagiarism (Barrett & Pack, 2023), and Essay mills for assessments (Sweeney, 2023). AI systems used by health profession education teachers and administrators present ethical concerns about data collecting, anonymity, and privacy (Masters, 2023). Due to its ability to create student-generated material, McIlwraith et al. (2023) examined GPT-3's potential for academic text production, ethical problems, and applicability in anthropological schools. It is crucial to address ethical considerations, data privacy, and the need for a balanced integration of AI to ensure its positive impact on the educational landscape (Lund et al., 2023).

Academicians’ Perception Towards ChatGPT

Another vital insight from the literature is the global perception of students and professors toward ChatGPT. Its use in academic research (Khlaif et al., 2023) and writing has been well received, with academicians and researchers employing Large Language Models for various academic and non-academic tasks, including essay writing, formal and informal speech writing, literature summaries, and idea generation (Liu, 2023). There are mixed observations regarding the potential benefits and risks of misuse when introducing Generative AI tools in classrooms and research (Elkhodr et al., 2023). The literature also underscores the potential for ChatGPT to enhance various academic tasks and foster new ways of educational thinking (Loos et al., 2023).

Chan and Hu (2023) explored students' perceptions of generative AI in Hong Kong, revealing a generally positive attitude and concerns about accuracy, privacy, ethical issues, and personal development. Firat (2023) studied the influence of ChatGPT on students and universities from Turkey, Sweden, Canada, and Australia, revealing nine key themes, including learning system evolution, educator roles, assessment (Ratten &

Jones, 2023), ethical considerations, personalised learning, digital literacy Radovanovic, (2024), and future work. Furthermore, Kieser et al. (2023) and Küchemann et al. (2023) compared ChatGPT's effectiveness in physics task development with a classical textbook from LMU Munich, finding no difference in task correctness but highlighting task specificity and output quality challenges. Marzuki et al. (2023) investigated the impact of AI writing tools on English-as-a-Foreign-Language (EFL) teacher content in Indonesia, indicating improved writing quality. Additionally, Ngo (2023) explored Vietnamese university students' perception of the benefits and challenges of ChatGPT regarding personalised tutoring and writing ideas. Romero-Rodríguez et al. (2023) experience, performance expectancy, hedonic motivation, price value, and habit significantly influenced Granada university students' acceptance of ChatGPT. Schroeder et al. (2022) examined the use of artificial intelligence courseware by two University of Central Florida faculty members, examining its impact on student engagement, exam scores, and teaching practices. However, The University of Hertfordshire revealed that despite being familiar with ChatGPT, many students were sceptical of its positive impact and suggested clear guidelines (Singh et al., 2023). Lai et al. (2023) examined the use of ChatGPT by Chinese students and its potential benefits and risks, revealing polarised opinions, whereas the research by von Garrel and Mayer (2023) suggests that around 75% of students in Germany are using ChatGPT and other AI tools in their studies irrespective of their field of their study.

Method

The Dataset

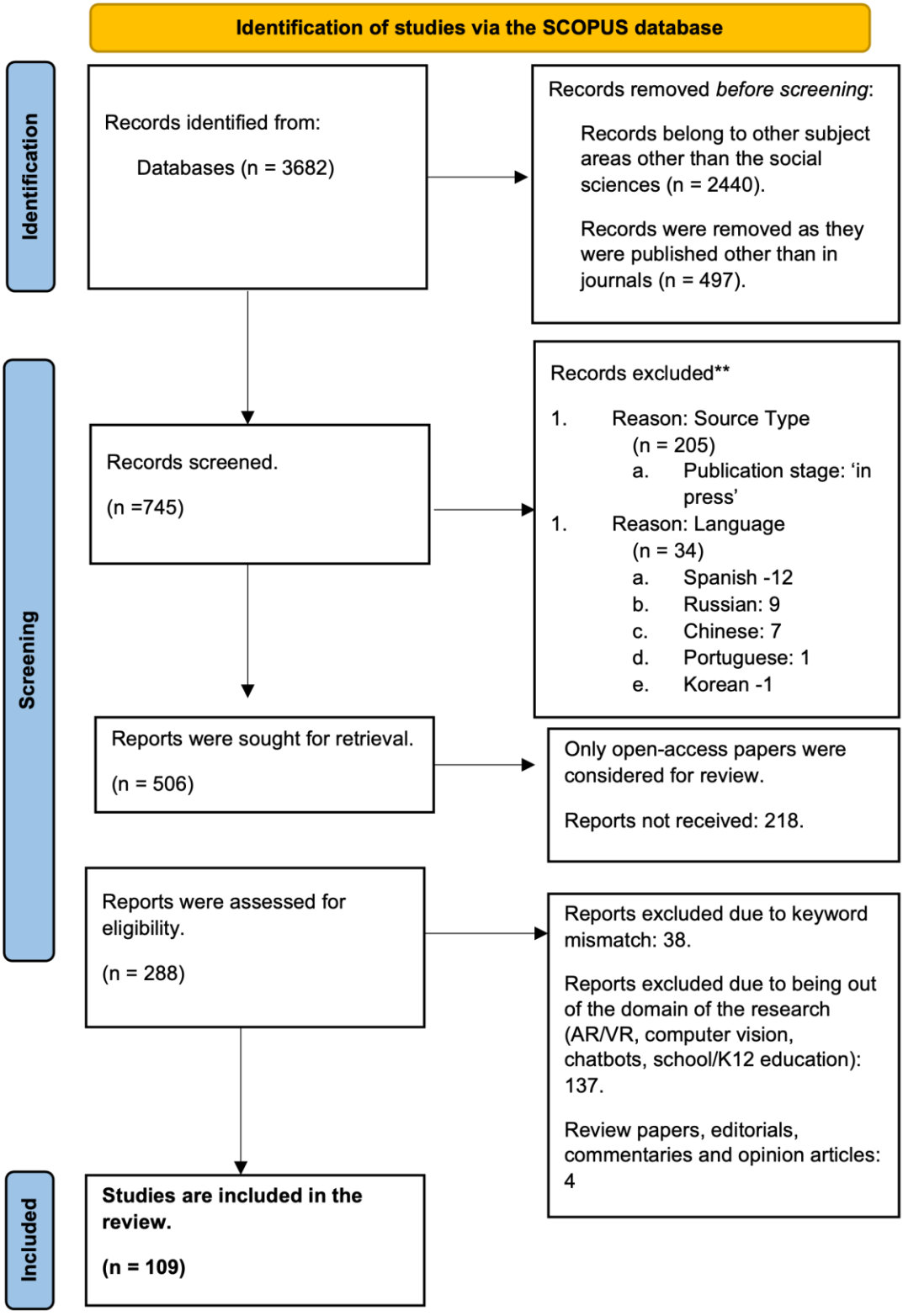
The Scopus dataset in the study comprised 109 documents from January 2022 to December 2023, indicating rapid growth in research publications and authors. The dataset had an exceptional annual growth rate, with 108 papers produced in 2023, meaning it is a rapidly evolving field or a recent data collection process. The dataset included 315 unique author keywords, 434 unique authors, and 18 single-authored documents. All the documents were published articles that are finally available online.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) workflow

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021). It establishes a standard protocol for publishing the results of reviews and meta-analyses. Using the PRISMA Checklist and flowchart makes reporting more open, thorough, and high-quality. Figure 1 shows the findings in a PRISMA flow diagram.

Figure 1.

The PRISMA flow diagram



The authors searched articles in the Scopus database because it is the most popular among researchers, scholars, and educational institutions worldwide for assessing the impact and visibility of research through citation analysis. Nearly 90 million citations may be found (Liang et al., 2021). Scopus is a comprehensive scientific database that indexes reputed scholarly journals from various fields, including Elsevier, Springer, and many more. Table 1 shows the filtered and sans-filtered queries used to access the Scopus database. The search only focused on documents of type "ar" (articles). The query also targeted documents at the "final" publication stage and available online. The search restricted the language to English and included only open-access (OA) articles.

The database provides excellent insights for doing in-depth literature searches and keeping up with the most recent findings in a specific field. The database was searched until December 2023. ChatGPT, Generative AI or LLM (Large Language Models), and higher education were the keywords searched in the 2022-2023 period. The only accepted forms were research articles written in English. The first round of evaluation included the examination of 3,682 titles and abstracts. 1242 records were selected when the published subject area of Social Sciences and Education was selected. 497 papers were discarded because they were published in conference proceedings, book chapters, or authored books.

Furthermore, 205 were limited due to their final stage of production. Twelve articles were in Spanish, Nine in Russian, Seven in Chinese, two in Italian and one each in Portuguese, Korean, Slovenian and Indonesian leaving 506 articles in the English language. Furthermore, only open-access articles were selected due to limited library access, reducing the total to 288. These articles were thoroughly reviewed for their scope, keywords, and relevance in higher education. Some articles related to other AIEd technologies like computer vision, machine learning, and VR/AR were discarded. The articles with other applications of ChatGPT, like media studies, psychological studies, and educational chatbots, were also discarded. The final screening resulted in 109 articles for the review.

Table 1

Query sting to access the Scopus database.

Description	Search query
Query without filter	(ALL (chatgpt) OR ALL (generative AND ai) OR ALL (llm) AND ALL (higher education))
Query with filter	(ALL (chatgpt) OR ALL (generative AND ai) OR ALL (llm) AND ALL (higher AND education)) AND PUBYEAR > 2021 AND PUBYEAR < 2024 AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-

TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (OA , "all"))

Thematic analysis

Thematic analysis entails quantitative analysis through a computer-aided approach. It can discern key research areas or authors and unveil their connections by encompassing all publications associated with a specific subject or domain (Han et al., 2020). This paper analyses the Bibliometric library of R-Studio (Aria & Cuccurullo, 2017). The "Biblioshiny" command provides a web-based interface to generate interactive reports and images.

Results

Developing concepts and emerging dynamics of ChatGPT in higher education

The observations on the trends of the publications in the assessment years represent a tremendous increase in articles (from 4 papers in 2022 to 108 papers in 2023) mentioning one or more keywords. This increase may be attributed, at least in part, to the open-access availability of ChatGPT and other LLMs. This indicates that the research topic is relevant and currently in focus.

Table 2.
Most relevant journal source for publication

Journal name	H Index	Total citations	Number of papers
Journal of Applied Learning and Teaching	10	535	25
Journal of University Teaching and Learning Practice	5	173	11
International Journal of Management Education	5	132	7
Computers and Education: Artificial Intelligence	4	40	19
Sustainability	4	89	23
Artificial Intelligence Review	3	91	3
British Journal of Education Technology	3	26	3
Contemporary Education Technology	3	43	7
International Journal of Education Technology in Higher Education	3	10	4
Smart Learning Environments	3	187	7

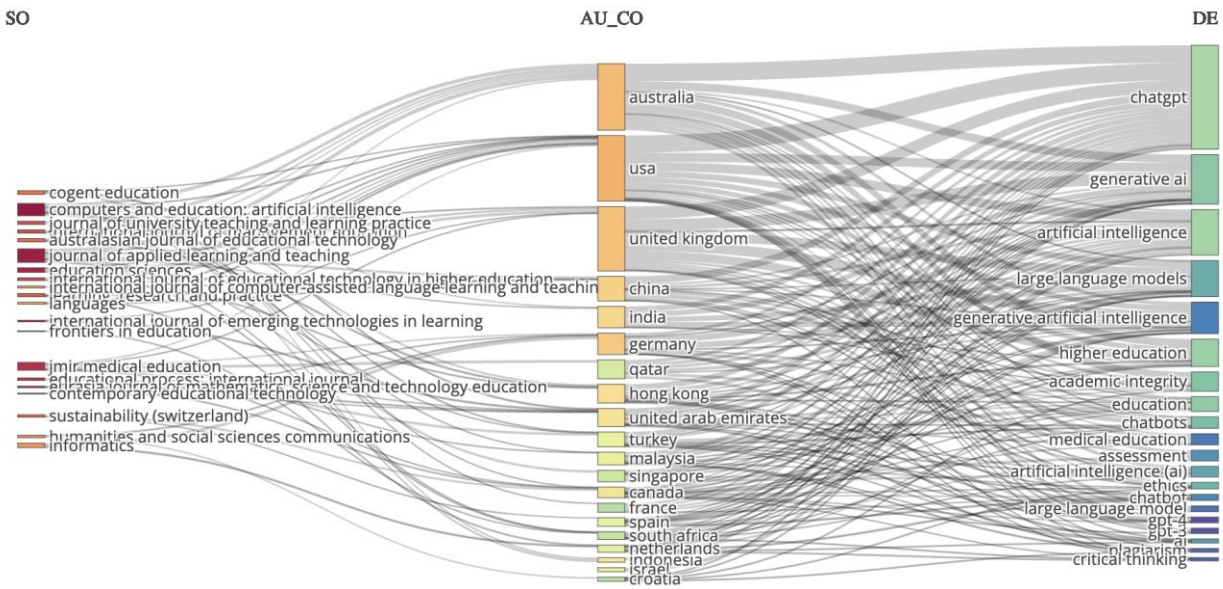
Relevant sources and publications

Table 2 shows the top 10 relevant sources for publication. To improve the scope of suggestion, the relevant sources for publication are identified from screening phase of

PRISMA workflow. Moreover, sources are listed based on impact (H-index) rather than number of papers. The Journal of Applied Learning and Teaching from Simon Fraser University, Canada, is the most relevant source for publication, with all 25 articles published in 2023 and the highest citation count of 535 with H-index of 10. Apart from this source, Journal of University Teaching and Learning Practice and International Journal of Management Education are another intriguing possibility, contributing an impact in terms of citations.

Figure 2's three-field plot provides a more visualised representation of the primary sources of scientific publications based on their countries and keywords from the studies included in the review. The leftmost column represents the leading sources of publication, the middle column represents the active countries, and the rightmost column represents the most used keywords. Journal of Applied Learning and Teaching and Computers and Education: Artificial Intelligence are the most productive sources, with publications from Australia, The United States, The United Kingdom, India, and Turkey. JMIR Medical Education is second on the list, with maximum publications from Canada. The other aspect of the figure depicts that the US has the most publications (17 scientific productions) with the keywords ChatGPT, Large Language Model, Generative AI, and LLMs, followed by Australia (14 scientific productions), the United Kingdom (12 scientific productions), China (11 scientific productions), and UAE (11 scientific productions). On the contrary, the United Kingdom tops the list of most cited countries, with 333 citations and 37 average citations per article. China (130 citations) and Australia (118 citations) follow the list with 32.50 and 14.80 average citations per article, respectively.

Figure 2
A three-field plot of the most relevant sources by country



Further investigations revealed the collaborative networks among active countries. There were 5 clusters of collaborative networks. The most prominent cluster held 28 countries including the USA, Qatar, Australia, UK, China, India etc. with the US has the highest betweenness factor of 78.78.

Table 3 depicts the top 10 authors with highest local impact in terms of h-index and total citations. To improve the scope of suggestion, the relevant sources for publication are identified from screening phase of PRISMA workflow. It can be seen that Samson Tan of Civica Asia Pacific is the most impactful author with the highest h-index (5) and total citation (579). Whereas Michael Cowling from Central Queensland University is 10th in the list with a h-index of 2 and 74 total citations. Author teams from Kaplan Singapore, Singapore and Swansea University, United Kingdom seems to be most impactful with two authors each in the list.

Table 3.
Most productive authors with their affiliation and citation score

No.	Author	Institute	H Index	Total Citations	Number of Papers
1	Samson Tan	Civica Asia Pacific, Australia	4	317	6
2	Shannon Tan	Kaplan Singapore, Singapore	3	314	4
3	Jürgen Rudolph	Kaplan Singapore, Singapore	3	314	4
4	Joseph Crawford	University of Tasmania, Australia	3	77	4
5	Yousef Wardat	Higher Colleges of Technology, Abu Dhabi, UAE	3	41	4
6	Tom Crick	Swansea University, United Kingdom	2	413	2
6	Paul Jones	Swansea University, United Kingdom	2	415	2
8	Michael Agyemang Adarkwah	Beijing Normal University	2	183	2
9	Ryan S. Huang	University of Toronto, Canada	2	183	2
10	Michael Cowling	Central Queensland University, Australia	2	74	4

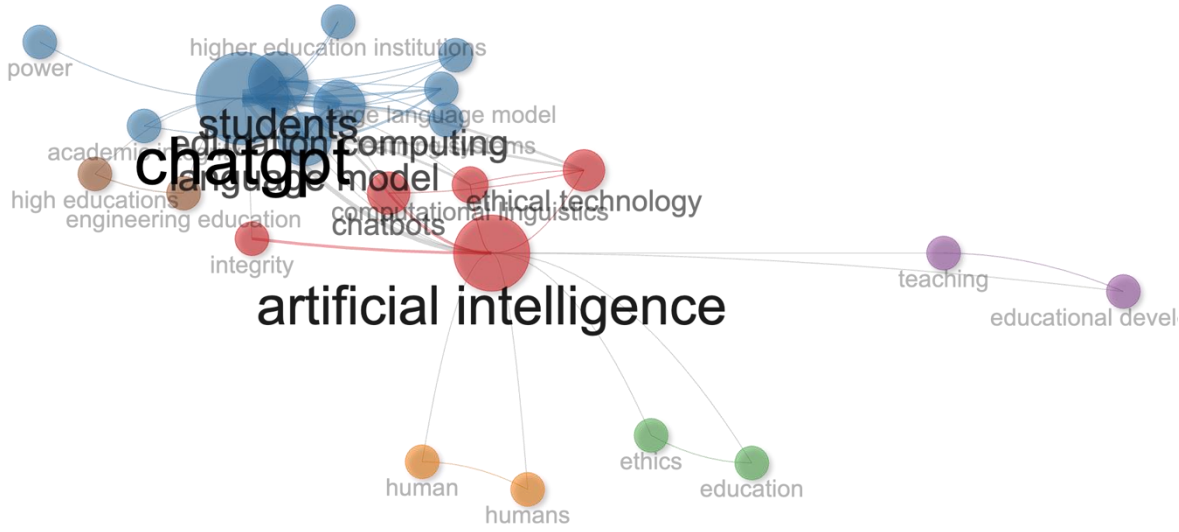
Keyword analysis, trending topics, and thematic findings

A keyword analysis is essential for scientifically and technically exploring current subjects of interest and trending topics within a particular field (Shoufan, 2023). Figure 3 shows

the keyword co-occurrence network analysis from the studies included in the review. The Betweenness is the measure of the correlation among the keywords. It is a way to measure how often a node acts as a bridge between other nodes in a network. It helps us find the crucial nodes connecting different network parts (İpek et al., 2023). As shown in the figure, there are two critical clusters of keywords in the complete research landscape. 'ChatGPT' is the most prominent keyword in cluster 1, with the highest betweenness of 114.68. Students keyword succeeds with the betweenness of 10.63. In cluster 2, 'Artificial Intelligence' is the only primary keyword with a betweenness of 111.71. The findings suggest that apart from ChatGPT, other language models and AI based chatbots are also revolutionising artificial intelligence in the education sector. Thus, an accurate prediction is that artificial intelligence will substantially influence nearly every dimension in the forthcoming years.

Figure 3

Keyword analysis and co-occurrence network



Scientific production by prominent institutions/organisations

Table 4 shows six clusters of scientific productions institutions and their collaborative networks from the studies included in the review. Cluster 1 has 6 collaborating universities with The University of New South Whales having the highest betweenness of 40. Cluster 2 lead by The University of Wollongong with a betweenness of 24 has 3 collaborating universities including Smart Learning Institute of Beijing Normal University, University of South Africa and Anadolu University. The University of New South Wales, which is also among the top collaborators, with the highest PageRank of 0.10 and closeness factor 0.05, suggesting that their influence extends beyond their direct connections in the cluster.

Nonetheless, a few universities with smaller clusters need a significant collaboration network despite their active contributions.

Table 4

Clusterwise Scientific production by institutions, organisations, and collaborative networks

Clusters	Betweenness	Closeness	Page Rank
Cluster 1			
University of New South Wales	40	0.056	0.108
The Education University of Hong Kong	18	0.043	0.064
Bournemouth University Business School	0	0.038	0.055
Delft University of Technology	0	0.038	0.055
Swansea University	0	0.038	0.055
The Chinese University of Hong Kong	0	0.040	0.042
Cluster 2			
University of Wollongong	24	0.045	0.063
Smart Learning Institute of Beijing Normal University	10	0.034	0.069
Anadolu University	0	0.033	0.046
University of South Africa	0	0.026	0.028
Cluster 3			
The University of Hong Kong	10	0.032	0.052
Beijing Normal University	0	0.024	0.031
Cluster 4			
Brigham Young University-Hawaii	0	1.000	0.056
Florida State University	0	1.000	0.056
Cluster 5			
Emirates College for Advanced Education	0	1.000	0.056
Higher Colleges of Technology	0	1.000	0.056
Cluster 6			
MD Anderson Cancer Center	0	1.000	0.056
Mount Sinai Health System	0	1.000	0.056

Discussion

This scoping review highlights the emerging dynamics, potential, and uncertainty of ChatGPT in higher education. The investigation suggests that generative AI has the potential to either disrupt or reform the future of education. Therefore, it is crucial to ensure its responsible and ethical use. We filtered 109 papers using the inclusion and exclusion criteria for the scoping review. This section discusses the periodic journey of educational paradigms that starts with introducing Edtech, the emergence of AI in education, and large language models with generative AI.

Before the integration of AI, there was a notable increase in professional education institutions, showing a growing emphasis on specialised vocational training (Su & Yang, 2023). The pre-AI era primarily involved using computers, basic software applications, and early e-learning platforms. The focus was on computer-assisted learning, which mainly entailed using computers as tools to support instructional processes. Learning management systems (LMS) were used to organise and deliver content, but they lacked the sophisticated capabilities that AI brings (Osamor et al., 2023).

Artificial intelligence in academia has evolved significantly, marking a pivotal moment in its development. Most prominent applications include grading and tutoring, analysing educational data, and using VR and AR technologies for immersive learning experiences and Generative AI and Large Language Models (LLMs) for generating text, translating languages, writing creative content, and answering questions (Slezaka et al., 2023). AI-powered apps have introduced a personalised teaching and learning process (Rudolph et al., 2023a) that identifies students' strengths, weaknesses, interests, and preferred ways of learning (Chan, 2023). Performance prediction models can help teachers decide how to support their students optimally. AI technologies have allowed adding graphics and sound to learning environments and making new learning content possible (Lodge et al., 2023). AI systems may find patterns and structures in vast amounts of data that can help create new content. Intelligent tutoring or automated grading systems help track students' progress, give them specific feedback on their work, and show them where they can improve in real-time (van den Berg & du Plessis, 2023).

Large language models and Generative AI are the new norm in education (Dwivedi et al., 2023). Since the integration of ChatGPT in education, academicians have shared their mixed predictions about the capabilities and potential vulnerabilities due to its seamless ability to write and summarise articles (Li, 2023), answer complex questions, translate language (Xiao & Zhi, 2023) and solve complex mathematical problems (Wardat et al., 2023). Consequently, this immediately raises concerns related to academic fraud, resulting in numerous articles and tools like GPTZero (Habibzadeh, 2023) advocating whether to use ChatGPT in academia.

This study critically reviews the concepts and current dynamics of ChatGPT, particularly in higher education, focusing on the developing concepts and trends in this area. The study also investigated the current and future trends in the publications, discovered relevant sources for thematic literature and appropriate avenues for publication, presented the thematic analysis and trending topics, and the top countries and institutions contributing to the research area.

It can be implied that even though ChatGPT has recently been the subject of extensive academic investigation and analysis, with techniques such as attention visualisation (Hrechanyk et al., 2023), rule-based explanations, and model distillation (Bao & Li, 2023), it still faces challenges like reliability, plagiarism (Jarrah et al., 2023), intellectual property violation, and ethical implications (Schäfer, 2023). Considering the preliminary stages of development, some potential hazards of academic misconduct include creating deepfakes and impersonating students or faculty members, which involve facing many sanctions (Roe & Perkins, 2023).

Several public and private organisations have already banned/restricted the use of ChatGPT in their networks (Perkins, 2023). The US government's Commerce Department is considering regulating AI technologies like ChatGPT by holding formal public opinion hearings on accountability measures (Gao et al., 2023). Academic publications have revised their policies to restrict ChatGPT from being listed as an author or declaring the use of LLM’s generated text in their manuscript (Adarkwah et al., 2023; Crawford et al., 2023). Lim et al. (2023) discovered that 72 per cent of instructors were concerned about the effects of ChatGPT on plagiarism, but only 34 per cent thought it should be banned.

There is always a silver lining to adopting generative AI models in the education sector (Tkácová et al., 2023). They can streamline the admissions process and tailor the academic curriculum to students' requirements and needs. Personalised learning and interactive teaching and learning are other healthy dimensions (Roumeliotis & Tselikas, 2023). Bernabei et al. (2023) investigated the factors influencing the acceptability of ChatGPT by university students and concluded that the technology is beneficial in recapping course material, study material recommendations, and exams. More educational initiatives are needed to teach these skills (Kelly et al., 2023). Yilmaz and Karaoglan Yilmaz (2023) investigated the impact of ChatGPT on students' computational thinking skills, self-efficacy, and motivation in a university-level programming course, finding that the experimental group demonstrated higher performance. On contrary, Sallam and Al-Salahat (2023) evaluated ChatGPT's performance in medical microbiology MCQs compared to students' performance highlighting the need for ongoing refinement and evaluation of ChatGPT performance, as it showed potential but was below-bar compared to students. Mishra et al. (2023) uses TPACK framework to examine the teacher knowledge level required to efficiently use Generative AI tools. Chauncey and

McKenna (2023) and Kooli (2023) claimed that students who interacted with the chatbot outperformed those who interacted with the course teacher at Ghanaian HEIs. In Pakistan, medical students and physicians viewed ChatGPT as a valuable tool for self-directed learning, practice questions, and clinical decision support (Abd-Alrazaq et al., 2023). Australian universities have integrated ChatGPT into its postgraduate supervision to enhance student confidence, critical thinking and accelerate research progress (Cowling et al., 2023; Dai et al., 2023).

Furthermore, ChatGPT has excellent potential to improve writing quality for academic research (Esmaeil et al., 2023). Integrating AI with higher education will improve educational and non-academic performance (Escalante et al., 2023). For instance, ChatGPT has been used as an adjunct for small group education, providing personalised learning experiences (Kayalı, 2023) and enhancing student productivity (Diwan et al., 2023). Its ability to realistically mimic human conversation opens new avenues in language learning, making it an exciting tool for language teaching and learning (Kohnke et al., 2023). ChatGPT can enhance communication skills in healthcare education with proper academic mentoring (Demirkol & Malkoç, 2023). Additionally, the introduction of ChatGPT necessitates a shift in teaching design to incorporate diverse assessment methods such as group projects, hands-on activities, and oral presentations (Eager & Brunton, 2023). Furthermore, ChatGPT can enhance student learning, improve clinical decision-making, facilitate collaboration and communication, and support personalised learning in nursing education (Rasul et al., 2023).

Nonetheless, it is crucial to recognise that AIEd encompasses technological aspects and education's pedagogical, cultural, social, economic, ethical, and psychological facets (Fuchs & Aguilos, 2023). Its over-reliance on information generation, creative thinking, and personalised feedback can result in neglecting human intuition and creativity (Cooper, 2023). AI-powered virtual classrooms may need more human interactions, and technical barriers may hinder effective teaching. The excessive use of Generative AI can diminish human creativity and induce ethical considerations like privacy violations and data commodification. Abu Khurma et al. (2023) examined ChatGPT's use in UAE education, highlighting its benefits and drawbacks and providing ethical recommendations. Ukrainian higher education also demonstrated the impact of ChatGPT, revealing its potential for timesaving and research facilitation but also biased information and the limiting of creativity (Fiialka et al., 2023).

Practical Implications

Based on the above findings, this critical review highlights some practical implications. The primary recommendation to university educators is to embrace ChatGPT as an ally and welcome it as a significant advancement in educational AI technology. They should

consider adapting their teaching practices to harness the potential benefits while mitigating the challenges identified in the review. Secondly, incorporating ChatGPT as a supplementary tool for personalised learning experiences could enhance student engagement and comprehension, resulting in a dynamic learning environment that encourages critical thinking and creativity (Crawford et al., 2023). There are sample cases discussed in literature where these LLMs, especially ChatGPT, proved to enhance skills and critical thinking among students. Thirdly, educators may need to enhance their digital literacy skills before empowering students to interact effectively with AI technologies. Researchers have discovered tools like RoBERTa (Ibrahim, 2023) and other deep learning-based classifiers (Li et al., 2023) that can differentiate human-written and ChatGPT-generated text.

This review advocates for a mutually beneficial partnership between human educators and AI tools to improve student learning outcomes. Establishing an AI governance council within the organisation could oversee and prevent the misuse and inappropriate utilisation of ChatGPT.

Limitations and Future Work

This research has a few limitations. First, the dataset employed for this study came solely from the Scopus database. Collecting sample data from multiple databases, like Web of Science, PubMed, and others, could improve the study's comprehensiveness. Secondly, since the topic is emerging, sampling bias, resource constraints, and external validations are possible. Thirdly, the research was restricted to scoping review only, which limited the scope of the research based on sample size. Lastly, due to the limitations in R-Studio, we faced problems in generating lists citations and h-index by institutions.

In general, the findings of this study provide a brief overview of ChatGPT and its evolving dynamics. Observing the limitations of this research can motivate forthcoming investigations to investigate approaches that involve gathering data from diverse databases and employing a broader set of keywords for a more comprehensive analysis. Additionally, it is worth noting that this research was confined to higher education, but the concept can also be expanded to encompass other educational disciplines.

Conclusion

In conclusion, the scoping analysis observed a tremendous increase in the published articles in the years assessed. The Journal of Applied Learning and Teaching is the most relevant source for publication, whereas Computers and Education: Artificial Intelligence is the most productive source. Furthermore, the US tops the list of total publications, while the UK seems to be the most highly cited country. Finally, the research implied that ChatGPT in education has emerged as an innovative and productive tool with much

current research, irrespective of demographic location. As the potential continuously becomes a reality, it can significantly enhance the educational experience by aiding human-AI collaboration. Restricting or prohibiting ChatGPT will not solve AI ethical issues. Nevertheless, even though AI models are promising for education, the lack of a legal and regulatory framework for ethical AI deployment makes it necessary to investigate its capabilities and influence continuously.

Conflict of Interest

The authors disclose that they have no actual or perceived conflicts of interest. The authors acknowledge not using AI tools or technologies to prepare this article. The authors acknowledge the financial and technical support of the Writing Lab, Institute for the Future of Education, Monterrey, Mexico, in the production of this work.

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