ChatGPT in Education: Unveiling Patterns and Trends through Bibliometric Lens

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Abstract: The surge in educational research on chatbots, notably ChatGPT, an artificial intelligence technology, promises a revolution in learning. However, concerns about its integration, including ethical considerations and academic integrity issues, have emerged. This paper addresses gaps in understanding the trends and implications of ChatGPT in education through bibliometric analysis. Using the SCOPUS database and VOSViewer, the study explores author collaborations, geographical distribution, and thematic clusters within ChatGPT research. Findings reveal distinct thematic concentrations, top influential authors, and institutions engaged in ChatGPT research, highlighting global collaboration and innovation. The analysis underscores the interdisciplinary nature of research, emphasizing the importance of ethical guidelines and international collaboration in driving progress and innovation in educational technology and artificial intelligence. This study provides valuable insights for informed decision-making and future research directions in ChatGPT in education.

Key Words: ChatGPT, AI Education, Bibliometric Analysis, Chatbots

1. INTRODUCTION

The growing trend in educational research concerning chatbots, particularly since 2018 (Chen & Huang, 2023), has been substantiated by a significant surge in publications. Among these, ChatGPT, an artificial intelligence technology, stands out for its ability to engage in conversational interactions, finding applications across various fields, including education (Fergus et al., 2023; Guha, 2023). In educational contexts, ChatGPT holds promise for revolutionizing learning into a more individualized, quality-centric, and student-focused milieu, capable of delivering tailored feedback and innovative pedagogical approaches (Baidoo-Anu & Ansah, 2023; Xu et al., 2023; Al Shloul et al., 2024).

However, alongside its benefits, the integration of ChatGPT has presented both opportunities and concerns. While it offers personalized tutoring and saves time (Ngo, 2023), ethical considerations, including issues related to academic integrity, accuracy, and potential biases, have been raised (Abdulai & Hung, 2023; Han et al., 2023; Limna et al., 2023; Tlili et al., 2023; Zhu et al., 2023). Challenges such as plagiarism concerns and debates regarding its role as an author in research papers further complicate its use in educational settings (Lin et al., 2023; da Silva, 2023; Goto & Katanoda, 2023).

Therefore, the ethical implications associated with ChatGPT's educational applications have emerged as a notable concern, prompting calls for clear guidelines and training on its responsible utilization (Shabunina et al., 2023; Hasanein & Sobaih, 2023). Despite these challenges, the rising trend in research on ChatGPT in educational contexts underscores the importance of considering both its positive and negative integration aspects, with a crucial need for establishing ethical guidelines

(Watrianthos et al., 2023; Lin et al., 2023; Pradana & Syarifuddin, 2023).

While these analyses have contributed significantly to the field, gaps persist in identifying the most influential researchers on ChatGPT in Education, their geographical affiliations, and the leading topics in recent years. Moreover, limitations such as language restrictions and technological expertise issues have been noted in existing analyses (Lin & Yu, 2024; Reyes-Moreno et al., 2023). Addressing these gaps through subsequent bibliometric analysis is crucial to gaining a comprehensive understanding of the trends and implications of ChatGPT in educational settings.

In light of these gaps, the present study aims to address specific areas to contribute to advancing knowledge. The research questions proposed aim to look deeper into the field of ChatGPT in Education. Firstly, identifying the leading authors contributing to the field based on publication frequency and impact can provide insights into the key influencers shaping ChatGPT research (Seth et al., 2023). Secondly, exploring the geographical distribution of authors in the field can reveal regional disparities and dominant research hubs, addressing concerns about biases and variations in research practices (Qasem, 2023). Additionally, investigating the predominant topics and themes emerging from bibliometric analysis can help identify common trends and areas of focus within the field (Sallam, 2023). Lastly, determining the institutions with the highest engagement in publishing research on ChatGPT in Education based on citation impact and publication frequency can provide insights into the credibility and dissemination of research findings.

Through a comprehensive analysis addressing these research questions, a more nuanced understanding of the trends and implications of ChatGPT in educational settings can be achieved, paving the way for informed decision-making and future research directions.

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2. METHODOLOGY

2.1 Database Selection

For this study, the SCOPUS database was utilized as the primary source of data. SCOPUS, known for its comprehensive multidisciplinary coverage, encompassing a wide range of academic disciplines, was deemed suitable for capturing research trends in ChatGPT in Education (Temsah et al., 2023; Shim et al., 2023; Tsang, 2023). SCOPUS provided access to a vast collection of scholarly literature, including peer-reviewed journals, conference proceedings, and books, ensuring a robust dataset for analysis.

2.1 Data Analytic Procedure

The study utilized VOSViewer, a powerful bibliometric analysis tool (Smith et al., 2023; Chen et al., 2020; Teebagy, 2023), to visualize author collaborations, geographical distributions, and thematic clusters (Bommineni et al., 2023; Teebagy et al., 2023; Chaka, 2022). This facilitated the exploration of key contributors, geographic concentrations, and emerging topics in ChatGPT in Education. By leveraging SCOPUS alongside VOSViewer, the research provided a comprehensive examination of trends (Smith et al., 2023; Chen et al., 2020; Teebagy, 2023), uncovering valuable insights into the field's evolution. The combined approach allowed for a detailed analysis, enhancing the study's analytical capabilities and providing a clear overview of the research landscape.

3. RESULTS AND DISCUSSION

3.1 Author Network

Based on Figure 1, which depicts the VOSViewer network visualization of author links, the analysis reveals notable trends in author collaboration and contribution within the field of ChatGPT in Education.

Certain authors emerged as the most influential based on their strong collaboration links and total link strength values. Notably, Paul Denny and Juho Leinonen exhibited the strongest links and highest total link strength values in the network, with total link strength values of 59 and 56, respectively.

These authors play central roles in connecting multiple co-authors and research communities, highlighting their significant contributions and prominence in the field of ChatGPT in Education research. Additionally, authors such as Brett A. Becker, Arto Hellas, and Stephen MacNeil also demonstrated substantial collaboration and contribution, with noteworthy total link strength values of 34, 39, and 37, respectively. Their active involvement in collaborative networks underscores their impact and influence in shaping research discourse and knowledge dissemination within the field.

3.2 Geographical Distribution

The network visualization reveals key authors shaping ChatGPT in Education, highlighting collaborative networks fostering research advancements (see Figure 2).

Geographically, the United States emerges as a dominant research hub, with 53 authors and 3042 total citations, indicating significant influence. Similarly, the United Kingdom contributes prominently, with 45 authors and 1054 total citations. Noteworthy are Canada, Australia, and Germany, each with substantial authorship and citations. Interestingly, countries like New Zealand, with fewer authors, display high citation impact, reflecting focused expertise. Conversely, countries with more authors, like China, show comparatively lower citation impact per author, suggesting diverse research landscapes.

This analysis underscores ChatGPT in education's global reach, led by hubs in the United States and the United Kingdom, with diverse contributions worldwide. It emphasizes the importance of exploring regional disparities to fully grasp the field's dynamics.

3.3 Themes Generated

The analysis reveals distinct thematic concentrations within the seven clusters. Cluster 1 focuses on medical education and clinical practice, emphasizing patient care and healthcare personnel. Cluster 2 centers on education-related themes like educational technology and teaching methodologies. Cluster 3 emphasizes AI and technology in education, highlighting machine learning and personalized learning. Cluster 4 encompasses diverse topics spanning research methodologies and social media. Cluster 5 highlights healthcare-related themes, particularly in specialized medical fields. Cluster 6 emphasizes education and teaching methodologies, including curriculum development and pedagogy. Cluster 7 encompasses overarching themes such as ethics and data privacy. The top 10 most researched topics span various clusters, including ChatGPT in education, foundation models, access to information, clinical assessment, and demographic analysis. These topics underscore interdisciplinary research efforts in education, healthcare, and technology. Institutions highly engaged in publishing research on ChatGPT in Education, based on citation impact and publication frequency, are identified using VOSViewer output (see Figure 4).

3.4 Institutional/Organizational Engagement

Regional Strategy & Operations in Singapore leads with a total link strength of 10, indicating significant engagement in ChatGPT research. Edith Cowan University in Australia follows closely with a link strength of 5, demonstrating notable presence and influence. Similarly, the Department of Biotechnology at Delft University of Technology and Kaplan Singapore each have a link strength of 3, contributing significantly to the global discourse on ChatGPT in Education. Additionally, Monash University and the University of Tasmania in Australia exhibit moderate engagement with a link strength of 2 each. Other institutions worldwide, including those in South Korea, Poland, the United Kingdom, the United States, China, India, and South Africa, demonstrate varying levels of engagement. Collectively, these institutions form a global network of collaboration, emphasizing the interdisciplinary nature of research in educational technology and artificial intelligence. International collaboration

plays a crucial role in advancing knowledge and practices in education.

The findings from the VOSViewer network visualization of author links in ChatGPT in Education research align with previous research highlighting the collaborative dynamics and thematic clusters within the field. Dis et al. (2023) emphasized the potential of ChatGPT in writing text for essays and scientific abstracts, reflecting the collaborative nature of research in leveraging chatbots for educational purposes. The categorization of authors into distinct clusters based on their research focuses resonates with the study by (Tlili et al., 2023), which underscored the importance of safe and responsible adoption of chatbots, particularly ChatGPT, in education. The identification of influential authors, such as Paul Denny and Juho Leinonen, echoes the role of key figures in driving research advancements and innovation, as highlighted by Smith et al. (2023) in their exploration of ChatGPT functionalities in educational settings.

The geographical distribution analysis of authors in ChatGPT in Education research, with dominant hubs in the United States and the United Kingdom, aligns with the global reach and collaborative nature of research highlighted by Guha (2023) and (Temsah et al., 2023).

4. CONCLUSIONS

In conclusion, the findings from the VOSViewer network visualization of author links, geographical distribution analysis, and thematic clusters provide valuable insights into the collaborative dynamics, global reach, and thematic concentrations within the field of ChatGPT in Education. The identification of distinct author clusters, influential authors, and thematic concentrations underscores the interdisciplinary nature of research in this domain and highlights key trends and research priorities.

The collaborative structures revealed through author clusters and the prominence of influential authors such as Paul Denny and Juho Leinonen emphasize the importance of collaboration and knowledge exchange in advancing research on ChatGPT in Education. The geographical distribution analysis showcases the global nature of research in this field, with dominant research hubs in the United States and the United Kingdom, complemented by diverse contributions from countries worldwide. This global collaboration fosters innovation and knowledge dissemination, driving progress and advancements in educational technology and artificial intelligence research.

The thematic clusters identified through keyword analysis offer insights into the diverse research themes and priorities within ChatGPT in Education, spanning healthcare, education, technology, and interdisciplinary research domains. These thematic concentrations reflect the multifaceted nature of research in this field and highlight the ongoing efforts to address complex challenges in healthcare delivery, education, and research methodologies.

Overall, the comprehensive analysis of author links, geographical distribution, and thematic clusters provides a holistic understanding of the research landscape surrounding ChatGPT in Education. These insights can inform future research directions, collaborations, and innovations in leveraging chatbots and artificial intelligence technologies for educational purposes.

The study contributes to the growing body of literature on ChatGPT in Education, shedding light on key trends, influential authors, and thematic concentrations within the field. By addressing gaps in collaborative dynamics, geographical distribution, and thematic clusters, this research enhances our understanding of the evolving landscape of ChatGPT research in educational contexts.

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6. APPENDIX

Figure 1.

Author Network Visualization in ChatGPT Education Research

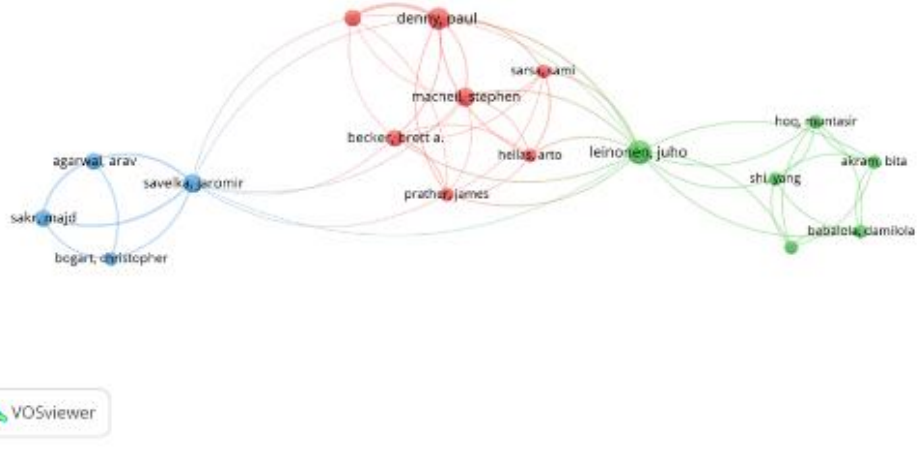

Figure 2.

Geographical Distribution of Authors in ChatGPT Education Research

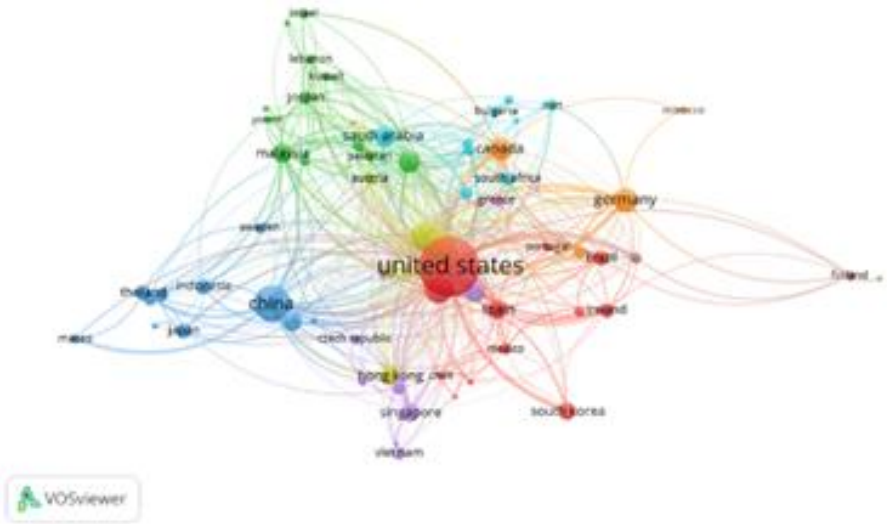

Figure 3.

Themes Based on Total Keywords Identified from Bibliometric Analysis

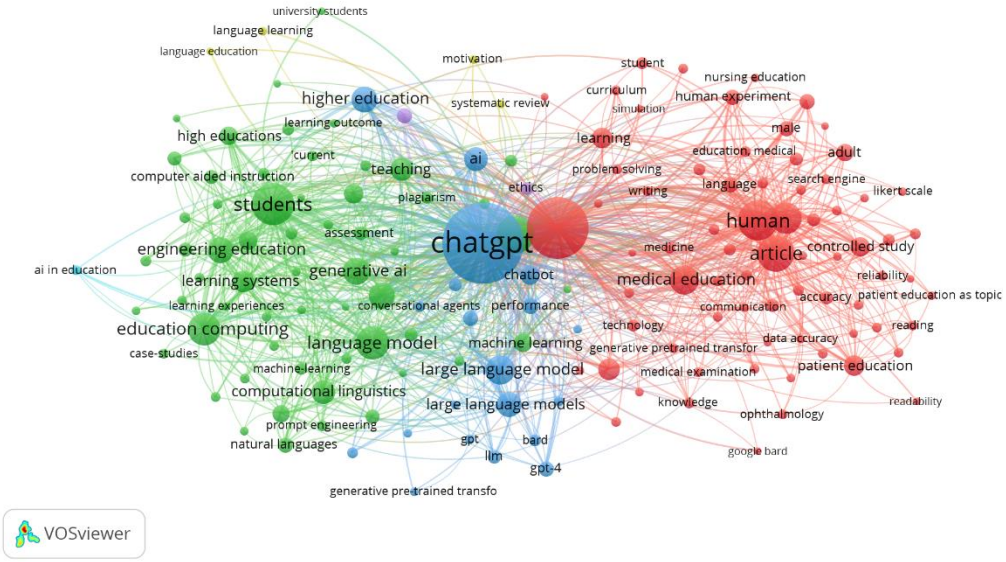

Figure 4.

Institutional/Organizational Engagement