

ChatGPT and Education: A Scopus Bibliometric Analysis

Arie Rakhmat Riyadi¹, Tatang Syaripudin¹, Kurniasih¹, Ani Hendriani¹, Cucun Sutinah², Muhammad Aceng Sirojudin¹

¹ Elementary School Teacher Education, Universitas Pendidikan Indonesia, Indonesia ² Elementary School Teacher Education, IKIP Siliwangi, Indonesia arie.riyadi@upi.edu

Abstract. The birth of ChatGPT has caused controversy, especially in the world of education. Various studies have been conducted looking at the positive and negative impacts. This research is a Scopus-based bibliometric analysis to examine trends in the relationship between ChatGPT and education. The articles analysed were sourced from the Scopus database totalling 403 from the end of 2023 to the beginning of 2024. After managing the database from Scopus, this study classified and visualized it using VOSviewer software. The research results are classified based on VOSviewer output starting from the network, overlay, density visualization, and specific topics such as "education", and "higher education". The research results describe 54 keyword items in 11 clusters. The most popular keywords include "academic integrity", "machine learning", "plagiarism", and "ethics". The most popular keywords include "academic integrity", "machine learning", "justice", and "ethics". This review provides an appropriate reference point for further research on "ChatGPT and Education".

Keywords: ChatGPT, Education, Academic Integrity.

1 Introduction

The advent of ChatGPT, a generative language model developed by OpenAI, has opened new avenues in the digital landscape, particularly in the field of education. This AI innovation has garnered global attention for its potential to transform educational processes, as it offers unprecedented capabilities in generating coherent and informative text in real-time. These capabilities extend to various educational applications, ranging from personalized learning to automated assessment production and material suggestion [1], [2].

Recent studies have highlighted ChatGPT's versatility in addressing some of the most challenging issues in education. For instance, its application in science education for automated assessment and material suggestion has been noted for its effectiveness (Frontiers, 2023). Additionally, the model's ability to replicate human-written text poses new considerations for online test security in tertiary education, underlining the need for further research into its implications and potential safeguards ([1]).

© The Author(s) 2024

M. A. Wulandari et al. (eds.), *Proceedings of the International Conference on Teaching, Learning and Technology* (*ICTLT 2023*), Advances in Social Science, Education and Humanities Research 825, https://doi.org/10.2991/978-2-38476-206-4_30

However, alongside these potentials, some challenges and boundaries need exploration. The impact of generative AI on journalism and media education, as well as its efficacy in specific tasks like bug fixing in programming, are areas that require further scholarly attention [1].

Therefore, a comprehensive study on ChatGPT's role in education is essential. Such research would not only illuminate the model's capabilities and limitations in an educational context but also guide educators and policymakers in leveraging this technology effectively. It would provide critical insights into how ChatGPT can support or transform traditional teaching methods, shaping an innovative and effective future for education.

Furthermore, empirical studies have been conducted to explore the impact of AI chatbots, like ChatGPT, on students' learning outcomes. These studies indicate that AI chatbots, when integrated into educational environments, can significantly affect students' learning, especially in higher education settings [3], [4].

By referencing these studies, the importance of researching the relationship between ChatGPT and education becomes evident, especially given the rapid advancements and applications of AI in this field. The integration of Scopus-based research provides a solid foundation for understanding and analyzing the implications of ChatGPT in educational contexts.

2 Methods

This study aims to analyze the relationship between ChatGPT and its applications in education, focusing on identifying key themes, and trends in the current body of research. The primary data for this study will be sourced from the Scopus database. Scopus is chosen due to its extensive collection of peer-reviewed literature, covering a wide range of disciplines including technology and education.

The search conducted using a combination of keywords related to ChatGPT and education. The search will be limited to articles published in 2023 to the present, to capture the most recent developments in the field. Articles will be included if they focus on the application of ChatGPT in educational settings or discuss its implications for teaching and learning. Excluded will be articles that do not directly relate to education, as well as conference abstracts, book chapters, and non-peer-reviewed publications. Relevant data from the selected articles will be extracted, including publication year, keywords, and main findings. This data will form the basis for the subsequent bibliometric analysis.

VOSviewer emerges as a powerful tool for analyzing the interconnectedness between ChatGPT and education. Its capability to visually map and analyze bibliometric networks allows researchers to effectively identify and display the intricate relationships between various research articles, authors, and keywords in this field. By utilizing VOSviewer, one can gain a deeper understanding of the prevailing trends, major contributions, and emerging areas within the realm of ChatGPT's application in education. This analytical approach not only reveals the current landscape of research but also guides future studies by highlighting potential areas of exploration and collaboration [4].

VOSviewer software will be used for bibliometric analysis. This tool is specifically designed to construct and visualize bibliometric networks, such as those of publications and keywords. Through VOSviewer, we created maps that visually represent the relationships and clusters within the research on ChatGPT and education [5].

Analysis Procedure. Network maps to visualize the co-occurrence of keyword patterns. This will help identify the most frequently discussed topics and the most influential authors in the field. On cluster analysis, the data is analyzed to identify clusters within the network maps, indicating sub-themes or specific areas of focus within the broader topic.

The trend analysis is done by examining the temporal distribution of publications and keywords to identify emerging trends and shifts in research focus over time. The bibliometric analysis is expected to provide a comprehensive overview of the current state of research on ChatGPT and education. It will highlight the most prominent themes, identify key contributors to the field, and uncover potential areas for future research [5].

3 Results and Discussion

A total of 403 articles were obtained from Scopus, with 324 from the year 2023 and 79 from 2024. The types of articles sourced for reference include review articles (51), research articles (341), encyclopedias (4), book chapters (4), and book reviews (3). The subject areas covered are social sciences (221), computer science (129), psychology (87), decision sciences (47), nursing and health professions (41).

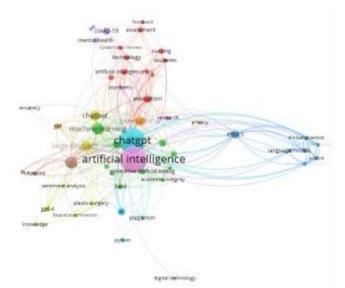


Fig. 1. Network visualization on 403 scopus-based chatgpt articles

After analysis, 54 items were categorized into 11 clusters. Cluster 1 includes artificial intelligence, assessment, education, feedback, learning, nursing, social media, students, systematic review, teaching, and technology. Cluster 2 includes academic integrity, bard, chatbots, creativity, deep learning, generative artificial intelligence, higher education, machine learning, natural language processing, and OpenAI. Cluster 3 includes accessibility, beneficence, clinical practice, ethics, justice, language models, and non-maleficence. Cluster 4 includes board examination, chatbot, GPT-4, knowledge, large language model, plastic surgery, and sentiment analysis. Cluster 5 includes anxiety, COVID-19, depression, mental health, psychiatry. Cluster 6 involves AI, ChatGPT, plagiarism, and Python. Cluster 7 includes generative AI, GPT, and privacy. Cluster 8 includes citations, large language models, and research integrity. Cluster 9 includes artificial intelligence and digital technology. Finally, cluster 10 includes accuracy.

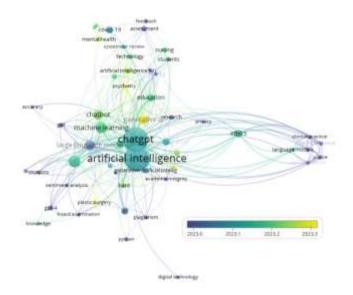


Fig. 2. Overlay visualization of scopus-based articles on chatgpt and education

Based on description of the dataset obtained from Scopus, it appears that articles from the year 2023 dominate the collection. That out of the 403 articles extracted from Scopus, 324 were from the year 2023, while the remaining 79 were from 2024. This indicates a significant focus on recent research and developments, particularly in the year 2023, reflecting the rapidly evolving nature of fields like artificial intelligence, education, and others that are likely to be covered in these articles. This trend could be attributed to the growing interest and advancements in these areas, prompting a surge in research activities and publications.

Overlay visualization in VOSviewer is a powerful technique for bibliometric analysis that provides insights into various aspects of a dataset, typically comprising scientific publications [4]. Overlay visualizations often display the age of items (like publications or keywords) in a dataset. Different colors can represent different years, allowing you to see how certain topics have evolved over time or how recent the contributions in a particular area are. By highlighting the most recent topics or authors in different colors, this visualization helps identify emerging trends and shifts in research focus. This is particularly useful for understanding the development of new fields or the shift in emphasis within established areas. It can also indicate the journals or publication venues where most research on a topic is published, which can be useful for understanding the landscape of publication in a specific field.

enantor enantor inschreiter inschreiter artific			man gathan Angere mana gath	

Fig. 3. Density visualization of scopus-based articles of chatgpt and education

Density visualization in VOSviewer is a method used to graphically represent the concentration of data points (such as keywords, authors, or publications) within a bibliometric network [4].

Density visualization helps to identify the most densely populated areas in a map, which usually indicates key topics or focal areas within the research field. These are areas with a high concentration of publications, citations, or other metrics, suggesting significant research activity. It shows where the 'hotspots' are in a particular field or dataset. Hotspots are characterized by a high density of interconnected nodes (like keywords or authors), suggesting these areas are of particular interest or have seen substantial research activity.

Conversely, areas with lower density can highlight gaps in the research or potential opportunities for new investigations. These might be less-explored topics or emerging areas that haven't yet gained widespread attention.

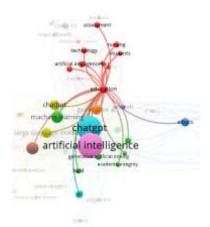


Fig. 4. Visualization on education as the center of the branch

Upon analyzing Figure 4, it becomes apparent that the primary topics associated with 'Education' are ethics, academic integrity, and assessment. Other highlighted topics in the figure predominantly pertain to technology, including terms like chatbot, machine learning, generative AI, and bard. This aligns with the findings in the writings of [6]–[9]

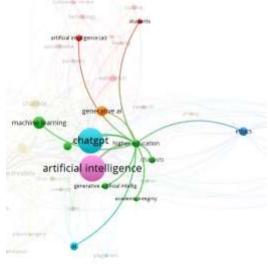


Fig. 5. "Higher education" as the center of the branch

As seen in Figure 5, the branch stemming from "higher education" is linked to ethics and academic integrity. These two aspects are significantly prevalent, regardless of whether the term "Education" or "Higher Education" is used. This concern is justified, as the need for caution in the use of ChatGPT is associated with these issues [1], [10]–[12].

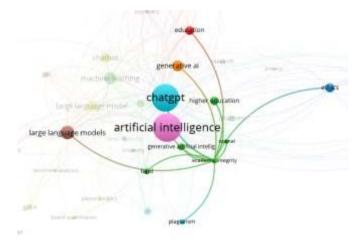


Fig. 6. "Academic integrity" and its branch

When "academic integrity" is selected, the branch that emerges is plagiarism. This has arisen as one of the concerns associated with the advent of ChatGPT [13]–[15].

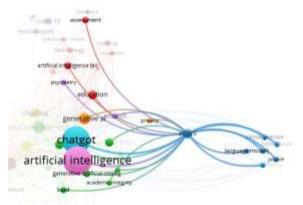


Fig. 7. "Ethics" and its branch

When "ethics" is selected, "justice" emerges. The potential injustice in using ChatGPT relates to unfairness [13]. This is in addition to concerns about plagiarism and academic integrity in the use of ChatGPT.

4 Conclusions

The bibliometric analysis of Scopus database articles examining the relationship between ChatGPT and Education yields both optimism and pessimism. The optimism stems from keywords such as "deep learning", "machine learning", and "creativity", while pessimism arises from concerns about "ethics", "plagiarism", "academic integrity", and "justice". There is a need for educators (teachers and professors) in the educational environment to be prepared to utilize ChatGPT for learning purposes, while also anticipating and minimizing negative concerns.

References

- 1. Dempere, J., Modugu, K. P., Hesham, A., Ramasamy, L.: The impact of ChatGPT on higher education. Front. Educ 8, 1206936, (2023).
- 2. Wang, D., He, Y., Ma, Y., Wu, H., Ni, G.: The era of artificial intelligence: talking about the potential application value of ChatGPT/GPT-4 in foot and ankle surgery. The Journal of Foot and Ankle Surgery, (2023).
- 3. M. AL-Smadi, M.: ChatGPT and Beyond: The generative ai revolution in education. arXiv preprint: 2311.15198, (2023).
- Bukar, U.A., Sayeed, M.S., Razak, S.F.A, Yogarayan, S., Amodu, O.A., Mahmood, R.A.R.: A method for analyzing text using VOSviewer. MethodsX, 11, 102339, (2023).
- Liu, Y., Han, T., Ma, S., Zhang, J., Yang, Y., Tian, J., ... & Ge, B.: Summary of chatgpt-related research and perspective towards the future of large language models. Meta-Radiology, 100017, (2023).
- 6. Eke, D.O.: ChatGPT and the rise of generative AI: threat to academic integrity? Journal of Responsible Technology, 13, 100060, (2023).
- 7. Bin-Nashwan, S.A., Sadallah, M., Bouteraa, M.: Use of ChatGPT in academia: academic integrity hangs in the balance. Technol Soc, 75, 102370, (2023).
- 8. Currie, G.M.: Academic integrity and artificial intelligence: is ChatGPT hype, hero or heresy? Semin Nucl Med, 53(5), 719-730, (2023).
- Meyer, J. G., Urbanowicz, R. J., Martin, P. C., O'Connor, K., Li, R., Peng, P. C., ... & Moore, J. H.: ChatGPT and large language models in academia: opportunities and challenges. BioData Mining, 16(1), 20, (2023).
- Currie, G., Singh, C., Nelson, T., Nabasenja, C., Al-Hayek, Y., Spuur, K.: ChatGPT in medical imaging higher education. Radiography, 29(4), 792-799, (2023).
- Habibi, A., Muhaimin, M., Danibao, B. K., Wibowo, Y. G., Wahyuni, S., Octavia, A.: ChatGPT in higher education learning: Acceptance and use. Computers and Education: Artificial Intelligence, 100190, (2023).
- Currie, G., Singh, C., Spuur, K., Al-Hayek, Y. Nabasenja, C., Nelson, T.: Response to: ChatGPT in medical imaging higher education: Reply to Currie et al. Radiography, 29(5), 868–869, (2023).
- 13. Anders, B.A.: Is using ChatGPT cheating, plagiarism, both, neither, or forward thinking? Patterns 4(3), 100694, (2023).
- 14. Elali, F.R., Rachid, L.N.:AI-generated research paper fabrication and plagiarism in the scientific community. Patterns 4(3), 100706, (2023).
- Anil, A., Saravanan, A., Singh, S., Shamim, M.A., Tiwari, K., Lal, H., ..., Sah, R.: Are paid tools worth the cost? A prospective cross-over study to find the right tool for plagiarism detection," Heliyon, 9(9), 19194, (2023).

A. R. Riyadi et al.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

\bigcirc	•	\$
	BY	NC