Exploring Research Trends of ChatGPT in Education Through Bibliometric Analysis

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ABSTRACT

This study delves into the burgeoning field of ChatGPT's integration into educational contexts through comprehensive bibliometric analysis. By examining publication patterns, research themes, influential works, and productive institutions, insights are cultivated into the current state of research in this domain. Notably, the analysis reveals a growing interest in ChatGPT for education, evidenced by the increasing volume of research efforts dedicated to this topic. Key research themes, such as the impact of ChatGPT on teaching and learning experiences, emerge prominently, highlighting the diverse applications and potential implications of this technology in educational settings. Moreover, the identification of influential works and productive institutions underscores the collaborative nature of research in this field and provides valuable references for researchers and practitioners. However, the study also acknowledges limitations, including the reliance on specific databases and the emphasis on quantitative metrics. Future research endeavors are recommended to address these limitations and explore distinct subcategories within ChatGPT for education to further deepen understanding and inform practical strategies for leveraging this technology to enhance educational practices.

Keywords: ChatGPT, Education Technology, Biblioshiny, VosViewer

INTRODUCTION

Human societies have undergone profound transformations throughout history, transitioning from hunting to agricultural practices and advancing into more sophisticated civilizations. Alongside these shifts, the emergence of innovative transportation technologies and the rapid rise of the information age, marked by Artificial Intelligence, have reshaped our world in remarkably short spans. Time marches forward, civilizations evolve, and change remains an undeniable constant. The swifter these changes occur, the narrower the window for adaptation (He, 2020). Thus, we confront a pivotal choice: resist or embrace the tide of change (Rumaksari, 2021).

In the realm of education, perpetual evolution is the norm as institutions strive to address contemporary challenges. In Indonesia, educators face a fundamental decision: adhere to traditional pedagogical approaches or embrace emerging methodologies (Khan et al., 2023). Recent breakthroughs, exemplified by innovations like ChatGPT, a sophisticated language model developed by OpenAI, have disrupted conventional educational paradigms. Leveraging Natural Language Processing, ChatGPT exhibits an unparalleled capacity to comprehend human language and generate contextually relevant responses (Lee and Hsiang, 2020). Trained on extensive and diverse datasets, ChatGPT excels at various tasks, including translation, content creation, lesson planning, and addressing intricate queries. Its discernment of underlying contextual cues marks a significant leap beyond conventional chatbot capabilities (Pavlik, 2023).

ChatGPT, hailed as a versatile tool, boasts functionalities ranging from virtual assistance to text analysis (Gupta, 2022). Its prowess in natural language processing enables it to decipher queries, furnish responses, and extract insights from textual data. OpenAI's relentless efforts in refining and enhancing the model result in newer iterations that exhibit heightened sophistication, capable of furnishing more precise and pertinent answers. Widely recognized for its efficacy, ChatGPT finds application across diverse domains (Saravanan and Sudha, 2022).
In the educational sphere, ChatGPT assumes a pivotal role, automating tasks like assignment grading, offering pedagogical support, tailoring learning experiences, aiding research endeavors, facilitating information retrieval, crafting instructional content, and enabling translation (Khan et al., 2023). However, apprehensions loom over its potential to catalyze plagiarism and academic dishonesty, as students increasingly rely on ChatGPT to circumvent critical thinking (Denning and Arquilla, 2022). Addressing these concerns necessitates a paradigm shift in assignment structuring to thwart cheating and safeguard academic integrity. Nonetheless, the prospect of ChatGPT evolving into an educational "companion" holds immense promise (Lund and Wang, 2023).

The proliferation of ChatGPT has sparked a spirited debate on social media platforms, with proponents touting its future educational benefits and detractors expressing reservations about its capacity to stifle human creativity and supplant human roles across domains. Nonetheless, the discourse surrounding ChatGPT on social media platforms serves as a captivating arena for discussion (Dirting et al., 2022). By discerning public sentiments from these discussions, we gain valuable insights into how the education sector should navigate the burgeoning influence of ChatGPT.

Research aimed at comprehensively understanding the utilization of ChatGPT in education stands as imperative. In our progressively digitized landscape, technological innovations such as ChatGPT hold immense potential for revolutionizing education. Yet, to harness this potential effectively, it is imperative to gauge societal perceptions, particularly among students and educators. Such research endeavors furnish insights into public readiness to embrace this technology, alongside identifying and addressing the hurdles and impediments impeding its integration into educational settings. Moreover, these investigations serve as invaluable resources for technology developers, guiding the optimization of features tailored to educational contexts and enhancing the technology's efficacy in facilitating the learning process. Hence, urgent attention towards scrutinizing research trends pertaining to ChatGPT for educational applications is warranted, ensuring the maximization of this technology's utility within the realm of education.

The research aims to conduct a bibliometric analysis to elucidate the prevailing trends regarding the utilization of ChatGPT for educational purposes. By employing bibliometric analysis, the study seeks to systematically map out the landscape of scholarly publications in this domain, encompassing a broad spectrum of research outputs, including journal articles, conference papers, and other relevant literature. Through this approach, the research endeavors to identify key themes, emerging patterns, and areas of focus within the scholarly discourse surrounding ChatGPT's application in education. Additionally, the analysis aims to shed light on the trajectory of research in this field, elucidating evolving trends over time and highlighting potential gaps or areas ripe for further investigation. Ultimately, the research aims to provide valuable insights into the current state of knowledge, inform future research directions, and contribute to the advancement of the field by facilitating evidence-based decision-making and fostering innovation in educational technology.

METHOD

An academic database stands as a meticulously arranged reservoir of scholarly data, digitally stored and curated to offer researchers a robust and exhaustive repository of documentation. In this study, the Scopus databases emerged as optimal choices for analyzing publications on ChatGPT For Educational Purposes. As highlighted by Abdullah (2022), these databases are widely embraced by scholars seeking pertinent scholarly materials. Scopus boast multidisciplinary coverage, housing a diverse array of documents and providing expansive scope (Martín-Martín et al., 2021). Additionally, they offer sophisticated search analysis tools crucial for generating representative statistics in bibliometric analysis (AlRyalat, Malkawi and Momani, 2019). A comprehensive search for relevant publications was conducted using specific search queries within Scopus and WoS, encompassing scrutiny of titles, abstracts, and keywords. The search queries employed were ("ChatGPT" OR "AI" AND "Education"). Notably, the search strategy was executed without imposing filters such as language, article type, or subject area, encompassing scholarly works published until December 31, 2023.

In this study, Biblioshiny and VOSviewer were pivotal software tools utilized to facilitate science mapping and visualization networks. Biblioshiny, tailored specifically for analyzing publication data sourced from the Scopus databases, plays a central role in this endeavor. Notably, its system
Exploring Research Trends of ChatGPT in Education Through Bibliometric Analysis
(Listyanto A. Nugroho)

Programming language is exclusively compatible with the aforementioned databases. Meanwhile, Biblioshiny assumes significance in evaluating various publication parameters, including subject matter, authorship, country of origin, document type, and keywords. Developed by a team of scholars, it provides comprehensive insights into publication metrics. On the other hand, VOSviewer, a Java-based application developed primarily by Nees Jan van Eck and Ludo Waltman at Leiden University’s Centre for Science and Technology Studies, offers a versatile platform for constructing and visualizing bibliometric networks. Its functionalities encompass the visualization of co-citations, bibliographic pairings, and co-authorship associations, empowering researchers to glean valuable insights from complex data structures.

The initial phase of data processing involved the refinement of the dataset, achieved through the removal of duplicate entries and the consolidation of pertinent information. This task was efficiently executed using the Biblioshiny software. Presented in Table 1 are the initial findings, indicating a total of 221 raw entries sourced from Scopus publications. Notably, 23 publications, comprising 10.40% of the dataset, were excluded due to automated document-type filtering. Before the commencement of the process to remove identical datasets, 198 publications were identified in the initial stage. Among these, 55 duplicates were identified, accounting for 48.70% of the dataset, all sourced from the Scopus database. As a result, 143 publications were identified as suitable for inclusion in the study.

RESULT AND DISCUSSION

Most Productive Country

Figure 1 highlights the leading countries in research productivity concerning the integration of ChatGPT in educational contexts. Among the top ten most productive nations in this field are the USA, Australia, China, Germany, the United Kingdom, Canada, Spain, Turkey, Hong Kong, and the United Arab Emirates. These countries have emerged as significant contributors to the advancement of educational technology, with their research efforts driving innovation and shaping the discourse surrounding ChatGPT’s role in education. The USA, with its robust academic infrastructure and a vibrant research community, leads the pack, followed closely by Australia and the United Kingdom, known for their excellence in educational research and technology innovation. Meanwhile, emerging economies like China and Turkey are making significant strides in this domain, reflecting their growing investment in educational technology research and development. The collaborative efforts of these leading nations underscore the global importance of leveraging ChatGPT to enhance teaching and learning practices, ultimately fostering a more inclusive and effective educational landscape.
Additionally, country collaboration plays a crucial role in advancing research in the field of ChatGPT for education. Among the top contributors to collaborative efforts are the USA, UK, China, and Australia, forming the forefront of international cooperation in this domain. These nations have established strong partnerships and networks, facilitating the exchange of knowledge, resources, and expertise to drive innovation and progress in educational technology. In the second tier of collaboration, India and various European countries emerge as prominent collaborators, contributing to the global discourse on ChatGPT’s integration into educational practices. Through collaborative initiatives and partnerships spanning across continents, these countries collectively propel the development and implementation of ChatGPT-driven educational solutions, fostering a collaborative and inclusive approach towards enhancing teaching and learning outcomes worldwide.

**Most Productive Institution**

Figure 3 illustrates the leading institutions driving research on the integration of ChatGPT in educational contexts. Topping the list is Beijing Normal University, with an impressive ten research contributions dedicated to exploring the potential applications of ChatGPT in education. Following closely behind is The University of Hong Kong, boasting nine research endeavors aimed at unraveling the nuances of ChatGPT’s role in shaping educational practices. Notably, Arizona State University, the National University of Singapore, and the University of California each contribute seven research studies, further solidifying their position as key players in this field. Similarly, the University of Tasmania shares the same number of research outputs, showcasing its commitment to advancing educational technology through rigorous inquiry.

Furthermore, several institutions demonstrate significant productivity, with six research contributions each. Al Ain University, Dumlipnair University, Monash University, and Qatar University have all made noteworthy contributions to the body of knowledge surrounding ChatGPT for education. These institutions represent a diverse range of geographical locations and academic disciplines, underscoring the global interest and collaborative efforts driving research in this burgeoning field. Collectively, the research output of these top institutions reflects a shared commitment to
harnessing ChatGPT’s capabilities to enhance teaching and learning outcomes, paving the way for innovative educational practices in the digital age.

**Most Productive Author**

Figure 4 unveils the prolific authors at the forefront of research on ChatGPT’s application in education. Leading the pack is Tan S, whose contributions stand out with a notable volume of research publications in this domain. Following closely behind are Crawford J and Mishra P, whose substantial scholarly outputs underscore their significant contributions to advancing the discourse surrounding ChatGPT in educational contexts. Additionally, Na Na, Chan CKY, Cowling M, Henriksen D, Karakose T, Li B, and Pack A emerge as noteworthy contributors, each with a considerable body of research work exploring the potentials of ChatGPT for enhancing teaching and learning outcomes. These authors represent a diverse range of perspectives and expertise, collectively driving forward the exploration and understanding of ChatGPT’s role in shaping the future of education.

**Research Themes or Topics Emerging**

This research harnesses the capabilities of Biblioshiny and VOSviewer to conduct a thorough analysis of author keywords in the domain of ChatGPT for education. Through Biblioshiny, the study meticulously examines the frequency and distribution of author keywords extracted from a corpus of scholarly publications, unveiling a comprehensive list of the most frequently used keywords. At the forefront of these keywords is "Artificial intelligence," indicating the pivotal role of AI in reshaping educational practices and highlighting the transformative potential of ChatGPT within this sphere. Additionally, keywords such as "chatgpt," "students," "education," and "education computing" emerge prominently, reflecting a keen interest in understanding the impact of ChatGPT on student learning experiences and the broader educational landscape.

Furthermore, the inclusion of keywords like "human" and "humans" suggests a nuanced exploration of the human-computer interaction dynamics inherent in the adoption of ChatGPT in
educational contexts. Moreover, technical aspects are underscored by keywords such as "language model" and "large language model," shedding light on the intricate workings of ChatGPT and its implications for language processing and generation in educational scenarios. Lastly, the presence of "engineering education" among the most used keywords hints at a growing interest in integrating ChatGPT into engineering curricula and educational programs. Through meticulous analysis and visualization, this research offers valuable insights into the multifaceted landscape of research trends surrounding ChatGPT for education, guiding future endeavors aimed at leveraging its potential to enrich teaching and learning experiences.

Figure 6. Author keywords network mapping

Revailing research trends and evaluate the evolution of research topics. In this study, VOSviewer serves as a crucial tool for conducting mapping analysis within the realm of keyword analysis. Through visually representing the co-occurrence of these keywords, VOSviewer offers insight into the interconnectedness of various terms and concepts. The spatial arrangement of nodes in this network visualization indicates the strength of association between phrases or ideas, with each node representing a specific term or concept. As depicted in Figure 5, the overlay visualization highlights the prominence of keywords such as "ChatGPT," "Artificial Intelligence," "Generative AI," "academic Integrity," and "Large Language Model" in the year 2020. These keywords underscore the current research focus on ChatGPT for education.

Most Influential Author

Figure 7. Author with most citation
Exploring Research Trends of ChatGPT in Education Through Bibliometric Analysis
(Listyanto A. Nugroho)

In bibliometric analysis, identifying the most cited authors is crucial for understanding the impact and influence of their contributions within a specific research domain. In this study, the three most cited authors are Dwivedi, Gilson, and Kasneci, each garnering significant attention with 369, 304, and 302 citations, respectively. Notably, all three authors have focused their research efforts on the intersection of ChatGPT and education, as evidenced by the data presented in Figures 7. Their prolific output and the substantial citation counts underscore the significance of their work in shaping the discourse surrounding ChatGPT's applications in educational contexts. By elucidating the most cited authors in this field, this bibliometric analysis offers valuable insights into the scholarly landscape and highlights key contributors driving advancements in ChatGPT for education.

Discussion

The exploration of ChatGPT's applications in education has garnered widespread attention globally, with researchers from diverse geographic regions and academic institutions contributing to the burgeoning body of literature in this field. Through bibliometric analysis, it becomes evident that certain countries, such as the USA, Australia, China, and the United Kingdom, emerge as leaders in research productivity, underscoring the global interest and collaborative efforts driving advancements in ChatGPT for education. Additionally, collaborative efforts among nations further enrich the research landscape, fostering international partnerships and knowledge exchange to propel innovation and progress in educational technology (Zain Abdillah, Partino and Madjid, 2023).

Moreover, the analysis of institutional productivity reveals key players in the field, with institutions like Beijing Normal University, The University of Hong Kong, and Arizona State University spearheading research endeavors aimed at unraveling the potential applications of ChatGPT in educational settings. Likewise, prolific authors such as Tan S, Crawford J, and Mishra P have made significant contributions to the discourse, shaping research trends and driving scholarly inquiry into the transformative impact of ChatGPT on teaching and learning practices.

Further examination of author keywords elucidates prevailing themes and research emphases within the field. Notably, keywords such as "Artificial intelligence," "ChatGPT," and "education" feature prominently, reflecting a keen interest in exploring the intersection of AI technologies and educational practices. Additionally, the visualization of keyword co-occurrence patterns using VOSviewer provides valuable insights into the interconnectedness of concepts and the evolving research landscape surrounding ChatGPT for education.

The collaborative nature of research in this field is also highlighted, with countries like the USA, UK, China, and Australia emerging as key collaborators. This international collaboration fosters the exchange of ideas, expertise, and resources, driving innovation and progress in ChatGPT research for education. Furthermore, the analysis of the most cited authors sheds light on the influential figures shaping the discourse, with Dwivedi (2024), Gilson (2023), and Kasneci (2023) standing out for their significant contributions to the field.

Overall, the discussion underscores the dynamic nature of research trends in ChatGPT for education, highlighting the collaborative efforts of scholars, institutions, and nations worldwide in advancing knowledge and innovation in this rapidly evolving field. As the educational landscape continues to evolve, driven by technological advancements and pedagogical innovation, the findings presented in this discourse serve as a foundational framework for future research endeavors aimed at harnessing the full potential of ChatGPT to enrich teaching and learning experiences globally.

CONCLUSION

In conclusion, this study has made a significant contribution to the understanding and practices surrounding the integration of ChatGPT in educational contexts through comprehensive bibliometric analysis. By scrutinizing publication patterns, research themes, influential works, and productive institutions, valuable insights have been gleaned into the current state of research in this field. The findings underscore the growing attention devoted to ChatGPT for education, reflecting a rising tide of research efforts aimed at harnessing the potential of this technology to enhance teaching and learning experiences. Moreover, the identification of key research themes and influential works highlights the evolving discourse surrounding ChatGPT for education and provides crucial references for researchers and practitioners alike. However, it is important to acknowledge the limitations of this study, including
the reliance on specific databases and the emphasis on quantitative metrics over qualitative aspects of publications.

Future research endeavors should aim to address these limitations by incorporating a broader range of databases and adopting a more comprehensive assessment of publication quality and impact. Additionally, exploring distinct subcategories within ChatGPT for education, such as the effectiveness of different teaching strategies or the impact on student learning outcomes, could provide further depth and insights into this burgeoning field.

Overall, the application of bibliometric analysis in examining ChatGPT for education offers a valuable framework for understanding research trends, guiding future research directions, and informing practical strategies for leveraging ChatGPT to enhance educational practices. By continuing to explore and innovate in this area, researchers and practitioners can contribute to the advancement of educational technology and ultimately enrich teaching and learning experiences in diverse educational settings.

REFERENCES


Exploring Research Trends of ChatGPT in Education Through Bibliometric Analysis
(Listyanto A. Nugroho)


