



Research Article

Mapping the Evolution of Research Themes on ChatGPT Integration in Education: Thematic and Novelty Keywords

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Received : April 19, 2025

Revised : May 15, 2025

Accepted : June 20, 2025

Available online : July 22, 2025

How to Cite: Nabilah, N., Nakamo, S. J., & Mwakapemba, M. L. (2025). Mapping the Evolution of Research Themes on ChatGPT Integration in Education: Thematic and Novelty Keywords. *Elementaria: Journal of Educational Research*, 3(1), 34–44. <https://doi.org/10.61166/elm.v3i1.90>

Mapping the Evolution of Research Themes on ChatGPT Integration in Education: Thematic and Novelty Keywords

Abstract. This study aims to examine the evolution and novelty of keywords in the field of ChatGPT in Education using a bibliometric approach. By applying a predefined set of keywords, the researchers identified 310 publications from the Scopus database, which were then analyzed using R Program. The analysis focused on main information, publication trends, keyword evolution over time, and keywords novelty. This analysis concludes that research on ChatGPT in the field of education within the Scopus database began in 2022 and continued through 2025, with the highest surge in publications occurring in 2024, reaching 171 documents. Overall, the findings reveal that the topic of *ChatGPT in Education* has experienced significant growth, with several core keywords such as

"chatgpt", "ai in education", and "artificial intelligence" remaining dominant over the years. Furthermore, the emergence of new keywords such as "efl learners", "contrastive learning", "online learning", "self-directed learning", "technology", "virtual reality", and "attitude" reflects an increasingly diverse research direction, encompassing technological innovations, learning strategies, and psychological dimensions. Keywords marked in bright yellow indicate a high level of novelty and strong potential for further exploration. However, behind AI's great potential as an educational technology, it is crucial to recognize that not all aspects of education should be fully run by AI. Ethical considerations must remain a central concern, ensuring that the implementation of AI in education maintains a balanced approach between technological functionality and human values.

Keywords: ChatGPT, Education, Bibliometric Analysis.

Abstrak. Penelitian ini bertujuan untuk mengkaji evolusi dan kebaruan kata kunci dalam bidang ChatGPT in Education melalui pendekatan bibliometrik. Dengan menggunakan serangkaian kata kunci yang telah ditentukan, peneliti berhasil mengidentifikasi 310 publikasi dari database Scopus yang kemudian dianalisis menggunakan R Program dan VOSviewer. Analisis ini mencakup informasi utama, evolusi kata kunci dari tahun ke tahun, serta tingkat kebaruan kata kunci yang digunakan. Analisis ini menyimpulkan bahwa penelitian mengenai ChatGPT dalam bidang pendidikan di dalam basis data Scopus dimulai sejak tahun 2022 dan terus berlanjut hingga 2025, dengan lonjakan publikasi tertinggi terjadi pada tahun 2024 sebanyak 171 dokumen. Secara keseluruhan, hasil penelitian menunjukkan bahwa topik ChatGPT in Education mengalami pertumbuhan yang signifikan, dengan beberapa kata kunci utama seperti "chatgpt", "ai in education", dan "artificial intelligence" tetap dominan dari tahun ke tahun. Selain itu, munculnya kata kunci baru seperti "efl learners", "contrastive learning", "online learning", "self-directed learning", "technology", "virtual reality", dan "attitude" mencerminkan arah penelitian yang semakin beragam, mencakup inovasi teknologi, strategi pembelajaran, dan dimensi psikologis. Kata kunci yang ditandai dengan warna kuning cerah menunjukkan tingkat kebaruan yang tinggi dan berpotensi untuk dieksplorasi lebih lanjut. Namun, di balik potensi besar AI sebagai teknologi dalam pendidikan, penting untuk disadari bahwa tidak semua aspek pendidikan sebaiknya dijalankan sepenuhnya oleh AI. Pertimbangan etika harus tetap menjadi perhatian utama agar penerapan AI dalam pendidikan mampu menjaga keseimbangan antara fungsi teknologi dan nilai-nilai kemanusiaan.

Kata Kunci: ChatGPT, Pendidikan, Analisis Bibliometrik.

INTRODUCTION

Education is a fundamental pillar in shaping an individual's character, knowledge, and skills (Aithal, 2025; Istiyono, 2024; Nabilah et al., 2023). Through education, a person gains enlightenment that broadens their perspective and enhances their way of thinking (Nabilah et al., 2013; Nabilah & Suyanto, 2025; Ramadhani & Retnawati, 2024). The development of education continues to undergo transformation in line with the dynamics of the times and the needs of the global community (Zafrullah, Hamdi, et al., 2024). Innovation and curriculum reform are part of the efforts to improve the quality of learning (Hamdi et al., 2024; Wahyuni et al., 2024). One important aspect of this development is the use of technology in the educational process. Technology not only enriches learning methods, but also creates new opportunities for interaction between learners and learning materials

(Istiawanto et al., 2024). The emergence of many innovations makes the learning process more adaptive and interactive, which marks the presence of new innovations, namely artificial intelligence in the world of education.

Artificial intelligence is the result of technological advances that are able to imitate the way humans think and act (Fitriani, 2023; Zhang & Lu, 2021). This technology is used to process data, recognize patterns, and provide responses automatically (Zafrullah, Sembiring, et al., 2024). In the world of education, artificial intelligence helps create more personal, adaptive, and efficient learning (Glignorea et al., 2023). This system is able to adjust the material according to the needs and abilities of each student (Chen et al., 2020). In addition, the interaction between students and technology becomes more dynamic. One real form of the application of artificial intelligence in education is ChatGPT.

ChatGPT is a form of artificial intelligence designed to understand and respond to human language naturally (Hakim & Angga, 2023; Orrù et al., 2023). This technology is able to answer questions, provide explanations, and assist in various learning activities (Javaid et al., 2023). In education, the need for ChatGPT is increasing along with the demands of more interactive and flexible learning (Elbanna & Armstrong, 2024). ChatGPT can be used as a virtual assistant that accompanies students in understanding the subject matter (Van Poucke, 2024). In addition, educators can also use it to design more interesting learning activities. ChatGPT is one of the innovations that supports digital transformation in the world of education.

Research on ChatGPT in the education has been conducted by many researchers because of its great potential in supporting a more effective and efficient learning process. Therefore, it is important to see publication trends through bibliometric analysis. The results of previous publications show the results of bibliometric analysis on ChatGPT in the educational environment, but the year is limited to 2023 only. This is the basis and opportunity for researchers to conduct further analysis with a wider time span and more up-to-date data.

METHOD

This study explores how research on the integration of ChatGPT in education has evolved over time, using bibliometric methods to gain insights. Rather than focusing on content alone, bibliometric analysis examines the structure of academic publications tracking how often works are cited, the connections between authors, and the recurring themes in keywords. Such an approach offers a broader understanding of how interest in ChatGPT within educational contexts is growing and shifting. To gather relevant data, the researchers selected publications based on specific keyword criteria. The filtering was limited to the *Social Sciences* subject area to ensure alignment with the context of educational management. As a result, a total

of 212 publications were retrieved for further analysis. The specific keywords used are presented in Table 1.

Table 1. Keywords and Number of Publications

Keywords	Number of Publications
(TITLE (chatgpt) AND TITLE (learn*) OR TITLE (school*)) AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))	310 Publications

Source: Data by Researcher

The researchers limited the search to the “*Social Sciences*” subject area and document type *article*, resulting in 310 publications analyzed using a bibliometric approach. The analysis focused on main information, keyword evolution, and keyword novelty within the selected publications. The ultimate goal is to identify research gaps as well as opportunities for collaboration and further study in the future.

RESULTS AND DISCUSSION

Main Information

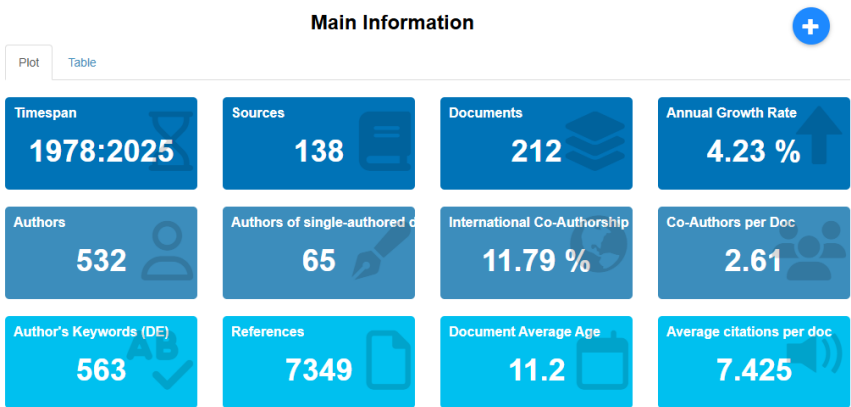


Figure 1. Main Information

The bibliometric analysis of publications on ChatGPT in education, spanning the years 2022 to 2025, reveals a rapidly growing body of research. With a total of 310 documents sourced from 155 different outlets, including journals and books, the annual growth rate stands at an impressive 359.47%. This indicates a sharp rise in scholarly interest within a short time frame. The relatively young average age of documents (0.826 years) suggests that this is a highly current and emerging area of

study. On average, each publication has received 18.24 citations, reflecting strong academic engagement. Furthermore, the 14,446 references cited across the documents highlight a robust foundation of related literature supporting this field.

In terms of content, the documents collectively include 877 author-supplied keywords and 462 Keywords Plus, indicating diverse themes and research focuses. A total of 830 authors have contributed to this body of work, with 71 single-authored publications, demonstrating both individual and collaborative efforts. The average number of co-authors per document is 2.92, showing a moderate level of collaboration. Notably, 20.32% of the publications involve international co-authorship, pointing to growing global interest and cooperation in exploring ChatGPT's educational applications. All 310 documents are categorized as articles, emphasizing the dominance of peer-reviewed academic writing in this field.

Publication Trends

The publication trend from year to year is an important indicator to see the development and consistency of researchers' (Istiwanto et al., 2024; Ramadhani et al., 2024). This trend is analyzed to understand the dynamics of scientific literature growth and to identify periods of increasing or decreasing research productivity (Ayuni et al., 2024).

Table 2. Publication Trends

Years	Number of Publication
2022	1
2023	41
2024	171
2025	97
Total	310

The publication trend on ChatGPT in the context of education shows very rapid growth since it first appeared in 2022 with only one publication. The following year, there was a significant increase with 41 publications indicating the increasing attention of researchers to this topic. The peak occurred in 2024, where the number of publications jumped sharply to 171 documents. This spike reflects the increasing interest and urgency of research on the application of ChatGPT in the world of education, along with the increasing recognition of this technology globally and its increasing use in the teaching and learning process.

Although 2025 is not over yet, the number of publications has reached 97 documents, indicating that this research trend is still ongoing and relevant. This data also confirms that the entire period between 2022 and 2025 has contributed to the development of academic literature on ChatGPT in education. This trend indicates

that the topic of ChatGPT is not just a passing trend, but has become an important part of scientific discussions and educational technology innovation.

Keyword Evolution

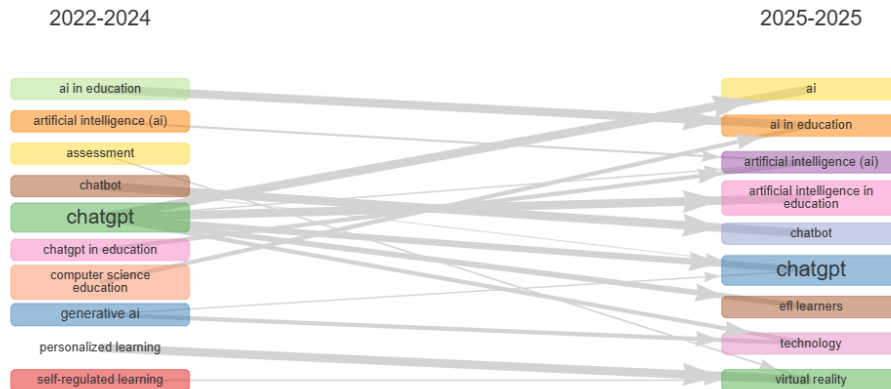


Figure 2. Keyword Evolution based on Author Keywords

The figure above shows the evolution of keywords in research on ChatGPT in education between 2022–2024 and 2025. It can be seen that a number of keywords such as "chatgpt", "chatbot", "artificial intelligence (ai)", and "ai in education" continue to emerge and experience continuity, reflecting that the research focus in the early period remains relevant and expanded in 2025. The strong relationship between keywords from both periods indicates that these key topics are the foundation for the development of subsequent research themes.

In addition to continuity, several new topics also appear in 2025, such as "efl learners", "technology", and "virtual reality". This indicates a diversification of research directions, where "chatgpt" and artificial intelligence are starting to be linked to foreign language learning, the use of educational technology in general, and the use of virtual reality. This shift and addition of focus shows that the study of "chatgpt" is not only surviving, but also developing into an increasingly multidisciplinary and contextual one according to the needs of modern education.

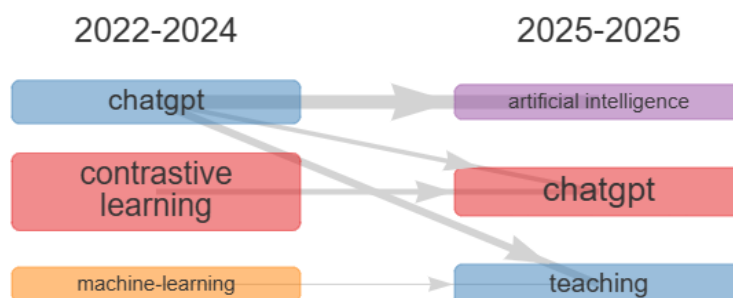


Figure 3. Keyword Evolution based on Keyword Plus

The above visualization shows the transition and continuity of keywords from 2022–2024 to 2025 based on Keyword Plus. There is a strong continuity between the keywords "chatgpt" and "artificial intelligence", indicating that the discussion of "chatgpt" remains a major topic and is even being expanded in relation to artificial

intelligence in general. In addition, a significant relationship is also seen between "contrastive learning" in the early period and "chatgpt" in 2025, indicating that the comparison-based learning approach is still a major concern in current studies related to ChatGPT.

Interestingly, the keyword "machine-learning" that emerged in 2022–2024 has developed into a new focus, namely "teaching" in 2025. This reflects a shift from technical discussions to implementation in the context of education, where machine learning technology is starting to be applied more concretely in teaching practices. Overall, this development confirms that research on ChatGPT and its supporting technologies continues to develop and penetrate the realm of application, especially in the world of education and teaching.

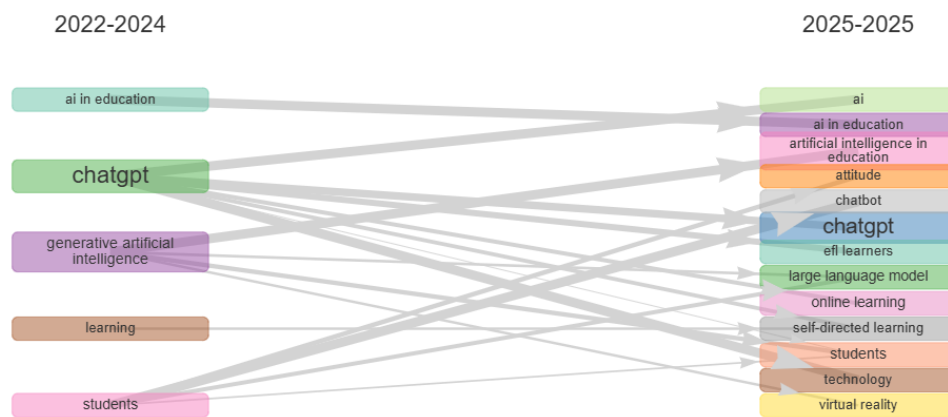


Figure 4. Keyword Evolution based on All Keyword

The figure above illustrates the evolution and continuity of all keywords from 2022–2024 to 2025 in research related to chatgpt in education. Keywords such as "chatgpt", "students", and "ai in education" remain in both periods, indicating that these themes are consistent centers of attention in academic discussions. The existence of strong connections from these words to various other topics in 2025 reflects the expansion of their scope and influence on more diverse research dimensions. This indicates that aspects of ChatGPT use are not only maintained, but continue to be developed and associated with various important elements in modern education.

In addition to continuity, a number of new keywords also emerged in 2025, such as "attitude", "online learning", "self-directed learning", "technology", and "virtual reality". The presence of these words marks a new direction in academic exploration, indicating that research is beginning to highlight broader psychological, methodological, and technological dimensions related to the use of ChatGPT. The brighter colors of some words such as "virtual reality" and "attitude" also signal that these topics are still relatively new and have not been widely explored, thus offering potential as recommendations for further research in the future.

Keyword Novelty

From Figure 2, Figure 3, and Figure 4, it is evident that several keywords such as "chatgpt", "artificial intelligence", "chatbot", and "ai in education" consistently appear from 2022 to 2025, indicating a strong continuity of research focus in the field of ChatGPT in Education. In addition to this continuity, there is also a noticeable shift in focus from technical concepts like "machine-learning" during 2022–2024 to more practical applications such as "teaching" in 2025 signaling that AI technologies are increasingly being implemented in real educational settings. Furthermore, the visualizations highlight the emergence of new keywords such as "efl learners", "contrastive learning", "online learning", "self-directed learning", "technology", "virtual reality", and "attitude". These keywords, displayed in brighter colors, suggest a high level of novelty and mark new directions for research that are more multidisciplinary and contextually relevant. This evolution opens up valuable opportunities for further exploration of ChatGPT in Education, particularly in addressing the demands and challenges of modern learning environments.

The emergence of keywords such as "efl learners", "contrastive learning", and "online learning" within the context of *ChatGPT in Education* reflects a growing interest in the application of AI tools to support language learning and flexible instructional environments. "EFL learners" indicates that researchers are beginning to explore how ChatGPT can aid students learning English as a foreign language through personalized, real-time language interaction. Similarly, the appearance of "contrastive learning" suggests that ChatGPT may be utilized in pedagogical approaches that emphasize comparing linguistic structures, concepts, or writing styles, potentially enhancing students' critical thinking and language acquisition. The inclusion of "online learning" as a novel keyword also reinforces ChatGPT's role in providing adaptive and accessible support in virtual learning settings, particularly as digital education continues to expand globally.

In addition, keywords like "self-directed learning", "technology", "virtual reality", and "attitude" point to broader pedagogical and psychological dimensions that are gaining attention in ChatGPT-related educational research. "Self-directed learning" implies that ChatGPT may empower students to take control of their learning paths by offering on-demand explanations, feedback, and guidance. The presence of "technology" and "virtual reality" highlights the integration of ChatGPT into more immersive and innovative digital ecosystems, opening up opportunities for experiential and interactive learning. Lastly, "attitude" suggests that researchers are beginning to examine how students' perceptions and openness toward ChatGPT influence its effectiveness in educational settings. Altogether, these emerging keywords reveal new and underexplored avenues within ChatGPT in Education that are ripe for further investigation.

The emergence of novel keywords such as "efl learners", "contrastive learning", "online learning", "self-directed learning", "technology", "virtual reality",

and "attitude" reflects the expanding role of AI particularly ChatGPT in addressing diverse pedagogical and psychological dimensions of education. AI is increasingly being used not only as a technical tool but also to support language learning, personalized instruction, and immersive learning experiences. However, while technologies like ChatGPT offer significant potential to promote learner autonomy, enhance online education, and enrich virtual classroom environments, their use must be balanced with ethical considerations. Learners' "attitude" toward AI, as well as the boundaries between the function of technology and the irreplaceable role of human educators, should not be overlooked. Therefore, the development and application of AI in education must not only focus on effectiveness and innovation but also uphold ethical standards to ensure that technology truly serves as a responsible and human-centered support in the learning process.

CONCLUSION

This analysis concludes that research on ChatGPT in the field of education within the Scopus database began in 2022 and continued through 2025, with the highest surge in publications occurring in 2024, reaching 171 documents. Overall, the findings reveal that the topic of ChatGPT in Education has experienced significant growth, with several core keywords such as "chatgpt", "ai in education", and "artificial intelligence" remaining dominant over the years. Furthermore, the emergence of new keywords such as "efl learners", "contrastive learning", "online learning", "self-directed learning", "technology", "virtual reality", and "attitude" reflects an increasingly diverse research direction, encompassing technological innovations, learning strategies, and psychological dimensions. Keywords marked in bright yellow indicate a high level of novelty and strong potential for further exploration. However, behind AI's great potential as an educational technology, it is crucial to recognize that not all aspects of education should be fully run by AI. Ethical considerations must remain a central concern, ensuring that the implementation of AI in education maintains a balanced approach between technological functionality and human values.

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