

Artificial Intelligence Research in Education: A Bibliometric Analysis

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Abstract

The Importance of Artificial Intelligence cannot be ignored in this era. Artificial Abilities intelligence to process data quickly and accurately allows us to make more informative and intelligent decisions. In the education sector, Artificial intelligence has opened up new opportunities in enhancing the learning experience. The aim of this research is to determine publication trends related to Artificial intelligence in education in the last decade. Data is taken from the database Scopus which was then refined through 4 stages. Method used is method analysis bibliometrics. Research results show that amount publication related Artificial intelligence in continuing education increase since 2014 to in 2022. Analysis of research focus reveals three main clusters in Artificial research intelligence in education, each reflecting a focus on the use of Artificial intelligence in general learning, medical education, and higher education. This information helps researchers and policy makers to understand the dominant trends in research and allocate resources wisely. The emergence of new keywords such as chat gpt shows that Artificial intelligence continues to develop in education. This creates new opportunities for research and development in this area, which researchers and practitioners need to engage in to remain relevant.

Keywords: Artificial Intelligence, Bibliometrics, Education.

Abstrak

Pentingnya Kecerdasan Buatan tidak bisa diabaikan di era ini. Kemampuan Buatan Kecerdasan untuk memproses data dengan cepat dan akurat memungkinkan kita mengambil keputusan yang lebih informatif dan cerdas. Di sektor pendidikan, kecerdasan buatan telah membuka peluang baru dalam meningkatkan pengalaman belajar. Tujuan dari penelitian ini adalah untuk mengetahui tren publikasi terkait kecerdasan buatan di bidang pendidikan dalam satu dekade terakhir. Data diambil dari database Scopus yang kemudian disempurnakan melalui 4 tahap. Metode analisis yang digunakan adalah metode bibliometrik. Hasil penelitian menunjukkan bahwa jumlah publikasi terkait Kecerdasan Buatan dalam pendidikan berkelanjutan meningkat sejak tahun 2014 hingga tahun 2022. Analisis fokus penelitian mengungkapkan tiga kelompok utama dalam penelitian Kecerdasan Buatan dalam pendidikan, masing-masing mencerminkan fokus pada penggunaan Kecerdasan Buatan dalam pembelajaran umum, pendidikan kedokteran, dan pendidikan tinggi. Informasi ini membantu peneliti dan pembuat kebijakan untuk memahami tren dominan dalam penelitian dan mengalokasikan sumber daya dengan bijak. Munculnya kata kunci baru seperti chat gpt menunjukkan bahwa kecerdasan buatan terus berkembang dalam dunia pendidikan. Hal ini menciptakan peluang baru untuk penelitian dan pengembangan di bidang ini, yang perlu dilibatkan oleh para peneliti dan praktisi agar tetap relevan.

Kata Kunci: Kecerdasan Buatan, Bibliometrik, Pendidikan.

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INTRODUCTION

Definition of Artificial Intelligence (AI) has become a major topic of discussion in various fields in this digital era. AI is a branch of computer science that studies how computers can be trained to execute tasks that normally require human intelligence, such as understanding human language, making decisions, and learning from experience. AI has had a revolutionary impact in various sectors, including education (Park & Kwon, 2023).

The importance of AI cannot be ignored in this era. AI's ability to process data quickly and accurately allows us to make more informed and intelligent decisions. In the education sector, AI has

opened up new opportunities in improving the learning experience. With advanced data analysis, AI can help identify student learning needs, provide customized content, and even support teachers in creating more effective learning materials. Not only does AI have advantages, it also carries potential dangers if not managed properly (Baidoo-Anu & Owusu Ansah, 2023). The dangers of AI include issues of data security and privacy, unethical use, and the potential replacement of human jobs by machines. Therefore, it is important for us to properly understand how AI can be applied ethically and responsibly in education.

In an educational context, AI can be an invaluable ally. The use of AI in managing and analyzing learning data can help educational institutions optimize their resources and improve student learning outcomes. However, to understand how far the use of AI in education has progressed, bibliometric analysis can be a very useful tool (Su et al., 2023). In recent years, AI has experienced rapid development, including in the educational context. Bibliometric research is an important approach to examine trends and developments in AI research in education. By analyzing existing literature, we can evaluate existing scientific contributions, identify research trends, and determine future research directions. That way, we can better understand how AI continues to change the educational landscape.

This article will discuss the meaning of AI, its importance, advantages and dangers, as well as explore the role of AI in education, bibliometric analysis related to AI in education, as well as the latest developments in AI in recent years (Leitner et al., 2023). All of this aims to provide a deeper understanding of the contribution of AI in advancing the world of education and explore its potential in providing better solutions for future educational challenges (Hermida & Ferreo, 2011; Nguyen et al., 2023; Thurzo et al., 2023).

In recent years, developments in AI technology in education have created impressive innovations. AI tutoring systems, for example, have provided very effective assistance for students in understanding course material in more depth. They can identify individual student difficulties and adjust learning approaches as needed. In addition, the use of AI chatbots in education can provide quick responses and assistance when students face questions or difficulties in learning, increasing efficiency in managing time and resources (Crompton & Burke, 2023). Apart from its clear benefits in learning, AI also has the potential to change the paradigm of educational evaluation and assessment. The use of AI algorithms in measuring student progress can provide a more holistic and accurate view than traditional evaluation methods. This can help identify potential students who need further development or provide more timely support for those experiencing learning difficulties. However, we also need to be careful of the challenges and dangers that may arise as AI advances in education. These include the risk of discrimination in algorithms, unethical use of students' personal data, as well as over-reliance on technology that can reduce students' social interactions and problem-solving abilities (Cooper, 2023).

Researchers try to collect research data with a database scopus related Artificial intelligence in education in the last decade which will then be analyzed using bibliometrics. Analysis bibliometrics is analysis quantitative nor qualitative For see trend study with topic certain (Angraini et al., 2022;

Angraini, Yolanda, et al., 2023; Muhammad, Elmawati, et al., 2023; Muhammad, Samosir, et al., 2023; Muhammad & Yolanda, 2022; Siahaan, Muhammad, Dasari, et al., 2023; Triansyah, Komaliddin, et al., 2023; Triansyah, Yanti, et al., 2023). This bibliometric analysis has Lots done Good in in the field of Education (Angraini & Muhammad, 2023; Awaliah et al., 2023; Muhammad, Triansyah, et al., 2023; Muhammad & Juandi, 2023; Mustari & Muhammad, 2023; Samosir et al., 2023; Soraya et al., 2023; Triansyah, Komaliddin, et al., 2023), as well as in field other (Angraini, Larsari, et al., 2023; Siahaan, Muhammad, & Dasari, 2023).

Bibliometric analysis can be a powerful basis for monitoring and directing the development of AI research in education. By understanding ongoing research trends and focus points, we can ensure that the use of AI in education goes hand in hand with the values of ethics, equity, and the development of student potential. As such, this article will explore in more depth the aspects mentioned above, providing a comprehensive view of the role of AI in education as well as highlighting the challenges, opportunities and latest developments in this field. It is hoped that this understanding will help guide the development of AI in education towards a brighter and more inclusive future.

METHOD

The method used in this research is bibliometric analysis. Researchers collect data using a database Scopus. According to (Moher et al., 2009) in the process of collecting data there are several steps taken, starting from identification, screening, eligibility, and inclusion. The data collection process can be seen in Figure 1 below as follows.

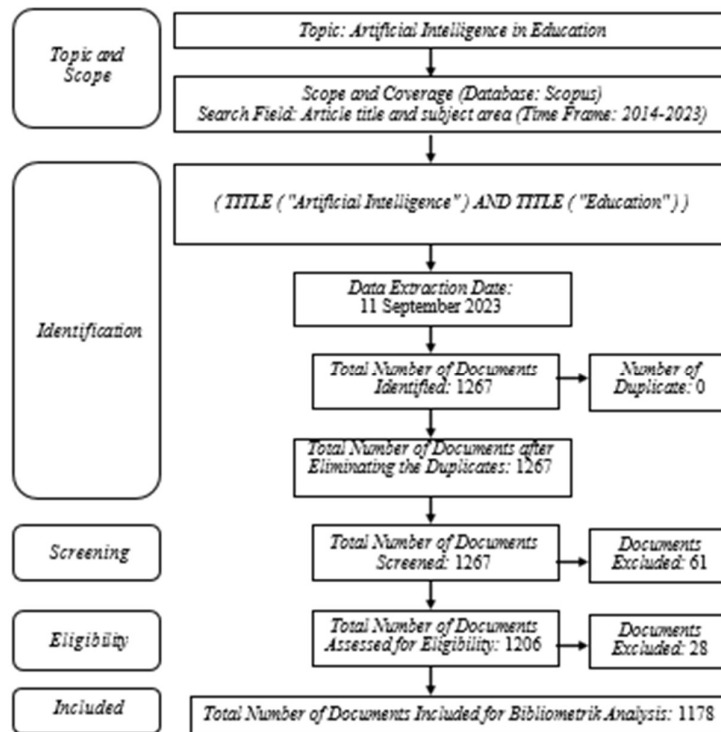


Figure 1. Process collection data

The first step is for researchers to identify research related to Artificial intelligence in education by entering the keyword “Artificial intelligence in education” in the database Scopus. At this stage, 1,267 articles were obtained according to the criteria of the first step. Next, the second step is a screening process where only publications in the last 10 years are included for the next process. Researchers only include articles published in journals. In this second stage, researchers have filtered 61 articles so that the remaining 1206 articles will be continued in the next stage. In the third stage, the researcher assessed the suitability of the article, the researcher determined that the article in English would be continued to the next stage. So, from this eligibility process 1178 articles remained. In the final stage, researchers included 1178 articles from the previous data collection process. The data was taken on September 11 2023, after the 1178 articles were collected, the researchers saved them in RIS and CSV form which will be analyzed using the VOSviewer application.

Current trends in publications related to Artificial intelligence in education by conducting descriptive analysis on bibliometric data taken from databases Scopus. Graph showing the number of publications and the cumulative number of publications each year was generated using Microsoft Excel 2016. Citation trends from related articles Artificial intelligence in education will be separated according to the year of publication. As for the average publication citations as well as calculating NCP, TP, TC, h- index and g- index assisted by software applications Harzing's Publish or Perish. Co-occurrence analysis of Artificial related keywords intelligence in education is carried out to determine the focus of research. The data to be analyzed is taken from the database Scopus requires data processing first. The research focus can be determined from the shared keywords visualized by the software VOSviewe.

RESULTS AND DISCUSSION

Trends publication

Publication trends related to Artificial research intelligence in education in the last decade is shown in figure 2. In 2022 the number of articles published will be 363, this is the highest compared to other years. meaning that more than 30 percent of articles have been published in 2022 of the total publications.

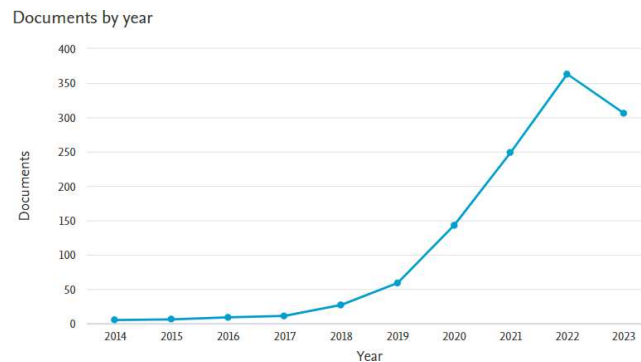


Figure 2. Amount Publication from year 2014 until 2023

The increase can be seen from the research trend line, an increase in the number of articles can be seen from 2014 to 2022. In 2023 the number of publications was lower than in the previous year because when researchers took the data for 2023 it was still ongoing. This shows that there is great research interest in Artificial intelligence in education. From Figure 2 it can be seen that research continues to increase every year starting from 2014 when there were only 5 articles to 363 articles in 2022.

Trends quote

The trend in quotations in the last decade, namely from 2014 to 2023, is related to Artificial intelligence in education. Researchers calculate TP, NCP, C/P and others as in the table below.

Table 1. Citations Analysis of Publications

Year	TP	T.C	h	g
2023	306	701	13	23
2022	363	1300	16	26
2021	249	1798	21	34
2020	143	2066	19	42
2019	59	1598	15	39
2018	27	594	9	24
2017	11	622	5	11
2016	9	522	6	9
2015	6	40	2	6
2014	5	27	3	5

Notes:

TP= total of publication,

TC= total citations,

h= h- index,

g= g- index

In table 1, Over the last decade, there has been a fluctuation in the number of citations related to Artificial intelligence in education. In 2020, there were 143 publications with a total of 2066 citations. Although the number of publications in 2020 was less than the following year, the number of citations in 2020 was the highest. Then in terms of h- index, 2021 will be the year with the highest h- index value, meaning that 2021 will be the most influential regarding Artificial research. intelligence in education.

The article with the highest number of citations is research conducted by (Popenici & Kerr, 2017). Article with the title "Exploring the impact of artificial intelligence on teaching and learning in higher education" is a lot quoted because article the explore phenomenon appearance use intelligence artificial in the learning process teaching at college high. Report This investigate implications education from technology new to method student learn and how institution teach and develop. Progress technology latest and increasing fast adoption technology new to education tall explored for predict nature of the future education high in a world where intelligence artificial is part from the structure of our university. We show a number of challenges for institution education height and learning student in application technology This For teaching, learning, support students, and administration as well as explore direction study more continue.

In picture 4. Yellow color show keyword novelty research, meaning keywords that have color yellow circle is the new keyword researched end this. This becomes possible gap utilized by research next. As for the keyword with color yellow the are higher educations, teacher's, chat gpt, human, and student.

Discussion

The research results illustrate research trends related to Artificial Intelligence (AI) in the field of education over the last decade, as well as analysis regarding citations and research focus.

Publication Trends and Research Interests

From this picture, it can be seen that research interest related to AI in education has continued to increase throughout the last decade. The number of published articles peaked in 2022, reflecting significant developments in the use of AI in educational contexts. This indicates that AI has become a highly relevant topic in education and may have inspired further research in this area. The increase in the number of publications over time reflects the growing interest of the research community in the use of AI in education. This may be driven by several factors, including the success of previous research that has proven the potential of AI in improving the teaching and learning process, as well as the push by educational institutions and governments to integrate this technology into the education system.

Fluctuations in Quotes

Although the number of publications is an important indicator, fluctuations in citations are also important. 2020 stands out for having a high number of citations despite fewer publications. This shows that the research conducted in that year had a significant impact in the literature. This could be a clue that some key research in 2020 may have innovative findings or strong relevance to the educational needs of the day. H- index and Influence in 2021: 2021 has the highest h- index value, indicating greater influence in AI research in education. This could be due to some very influential articles or studies published in that year. This may also reflect that 2021 saw important developments in the concept and application of AI in education that inspired much other research.

Key Articles and Contributions

The article with the most citations (" Exploring the impact of artificial intelligence on teaching and learning in higher education " by Popenici & Kerr, 2017) reflects the importance of this research in the literature. This article seems to explore the impact of using AI in the teaching and learning process in higher education by considering various aspects. The implication is that this research has played a significant role in shaping the understanding of the application of AI in higher education. In the article, Popenici and Kerr appear to have investigated the emerging phenomenon regarding the adoption of artificial intelligence in the world of higher education. They explore the implications of the latest AI technology on the way students learn and how higher education institutions teach and develop. Additionally, the article it also discusses recent technological advances and the rapid adoption of new technologies in the higher education environment. This is especially relevant considering that AI is becoming an increasingly inevitable part of the structure of our universities. In addition, this article has

also identified some of the challenges facing higher education institutions and students in adopting AI technology for teaching, learning, student support, and administration. Additionally, this article paves the way for further research in this area, leading to a better understanding of the potential of AI technologies in enhancing the higher education experience. Therefore, this article is not only one of the most cited sources in the literature, but also an important contribution in guiding the direction of research development and application of AI in higher education. By revealing the impact, challenges, and potential of AI technology in higher education, this article has played a significant role in formulating the vision and practice of higher education in a future increasingly influenced by developments in AI.

Research Focus Analysis

Figure 3 provides insight into the research focus clusters. This indicates that there are three main areas in AI research in education: the use of AI in general learning (cluster 1), machine applications learning in the field of medical education (cluster 2), and focus on higher education (cluster 3). This information can help researchers and policy makers to better understand trends and priorities in AI research in education. Analysis focus illustrated research in Figure 3 gives valuable insight about direction and priorities in AI research in the field education. There is three cluster main thing that appears from analysis These, each of which reflects a specific area in AI applications in context education.

Cluster first (cluster 1), marked with color red, indicates that one focus main study is use of AI in learning general. This thing covers development and implementation AI technology for improve the learning and teaching process in a way general, no only limited to one subject or context certain. These findings highlight the importance of AI technology in supporting holistic education. Cluster second (cluster 2), which is colored green, highlighting application of machine learning in the field education medicine. This thing show that There is interest special in using AI to increase education in the field medicine. In clusters this, machine learning becomes center attention, perhaps For develop tool learning or system supporter more learning effective in training medical.

Cluster third (cluster 3), which is colored blue old, shows that AI research in education also focuses on levels education high. The most dominant keyword in cluster This is "higher education". This indicates that AI is used for study related challenges and opportunities with teaching and learning in universities high. This can cover use of AI in administrative processes, online teaching, or enhancement quality teaching in institutions education high. This information has significant implications. First, it helps researchers understand the dominant trends in AI research in education, which can guide them in selecting relevant research topics. Second, assist policy makers in allocating resources to support research that has a greater impact in the field of education. Third, it provides education practitioners with insight into the latest developments in the application of AI, enabling them to utilize this technology in better teaching and learning. With this understanding, AI research in education can continue to develop and provide greater benefits to the world of education.

New Keyword Implications

Figure 4 shows the new keywords that emerged. This could be a potential area for further research, as yellow indicates novelty and development in this topic. This also suggests that AI continues to evolve in educational contexts, and researchers may need to pay attention to these keywords to remain relevant in this field.

The implications of the emergence of new keywords shown in Figure 4 are particularly important in the context of AI research in education. The yellow color which represents new keywords indicates that there are new developments and a shift in focus in this research. This can be interpreted as a sign that AI continues to develop and change over time, especially in its application in the education sector. These newly emerging keywords create opportunities for researchers to explore unexplored research areas. Thus, researchers need to pay attention to these keywords to understand the latest trends and potential innovations in the use of AI in education. Research focused on these new keywords could provide a deep understanding of how AI technologies continue to impact learning and teaching in a variety of educational contexts, including higher education levels, teacher-student interactions, or even the use of AI to improve administrative efficiency.

In addition, a deep understanding of new keywords can also help policy makers and practitioners in the field of education to identify new opportunities to improve the learning and teaching experience. By understanding the latest developments in AI, educational institutions can adopt this technology more effectively and take advantage of emerging innovations. Thus, this overview of emerging keywords reflects the ever-changing dynamics in AI research in education, and underscores the importance of staying up-to-date in this research to address the ever-evolving challenges and opportunities in the world of modern education.

Overall, this shows the importance of AI in education, as well as trends and changes in research focus and its impact. This can help researchers, practitioners and policy makers to understand and follow the latest developments in the use of AI to improve education.

CONCLUSION

From this description, it can be concluded that the research is related to Artificial Intelligence (AI) in the field of education over the last decade has experienced significant growth. Publication trends show an increase in the number of articles published over time, with a peak reached in 2022. This reflects the increasingly strong interest within the research community in the use of AI in educational contexts. This research has played an important role in forming an understanding of the potential of AI technology in improving the teaching and learning process. Besides the number of publications, fluctuations in citations are also an important indicator. 2020 stands out for its high number of citations, demonstrating the positive impact of research conducted that year. This reflects that several studies in that year have provided findings that are innovative and relevant to current educational needs. Analysis of research focus revealed three main clusters in AI research in education, each reflecting a focus on the

use of AI in general learning, medical education, and higher education. This information helps researchers and policy makers to understand the dominant trends in research and allocate resources wisely. The emergence of new keywords shown in Figure 4 shows that AI continues to grow in education. This creates new opportunities for research and development in this area, which researchers and practitioners need to engage in to remain relevant. Overall, AI research in education is a rapidly growing field, with great potential to improve the educational experience. With a deep understanding of trends, impact, and research focus, we can direct our efforts to take maximum advantage of advances in AI technology in supporting better education in the future

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