Unveiling Artificial Intelligence Trends in Higher Education: A Bibliometric Perspective

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***Abstract*—The use of Artificial Intelligence (AI) in higher education has become commonplace. Even the number of publications made with the help of Artificial Intelligence has soared in recent years. Various phenomena of the use of AI in education, especially higher education, have increased interest in research related to Artificial Intelligence to optimize its use. This study aims to analyze journal articles on AI in higher education. This study analyzed 1,725 journal articles in the Scopus database since 1986. The number of journal articles in 2024 has increased significantly by 165% compared to the previous year. The research was conducted with bibliometric analysis using VOSviewer software. The results of the analysis show that ChatGPT is the most researched computer program in AI research in higher education. In addition, the keyword generative AI is a hot topic that has been researched in the last year. The keywords plagiarism, AI literacy, and academic writing are current keywords that have not been researched much. Thus, research on AI in higher education is a research topic that still has high potential to be further developed in the future.**

***Keywords*—artificial intelligence, bibliometric analysis, higher education**

I. Introduction

Currently, various computer programs using Artificial Intelligence (AI) have emerged that can be used to assist the learning implementation process, especially for higher education conducted by students. One of the learning processes carried out by students using AI is in the process of making lecture assignments. Various computer programs used include ChatGPT, Gemini, and Copilot. ChatGPT can serve as a transformative tool for traditional teaching, learning, and research practices [1]. Additionally, in higher education, AI has the benefit of improving learning outcomes and creating a more student-centered and technology-adaptive learning process [2]. AI is considered promising for increasing engagement with education [3].

The use of AI, especially by students to complete course assignments, has become commonplace. Therefore, there is a need to develop guidelines for students to effectively utilize AI as part of the learning process [4]. Even the number of publications discussing higher education with the help of ChatGPT has surged since the end of 2022. The phenomenon of using AI in education, especially higher education, raises concerns about its limitations and potential threats. Another concern is the decline in the quality of knowledge and practice, especially in training. However, education actors remain optimistic about the more appropriate use of AI in education [5]. Therefore, various measures are needed to reduce the risks that can occur and optimize the use of AI effectively and efficiently while still in accordance with applicable ethics [1, 2].

The increasingly massive use of artificial intelligence, especially in higher education, has attracted special attention in recent years. Thus, it is necessary to conduct in-depth research on the use of artificial intelligence from various aspects. This study was conducted to find out the trends of research that have been conducted on the use of AI in higher education. By knowing these research trends, researchers can identify the focus of research that can be done as an effort to optimize the use of artificial intelligence in higher education appropriately.

II. Methodology

This research is a quantitative study using the bibliometric analysis method to determine research trends regarding artificial intelligence in higher education. Bibliometrics is a method to determine the relationship between authors, institutions, keywords, or countries that will be depicted in the form of a bibliometric map [6]. Making bibliometric maps using the VOSviewer program, which will then be interpreted [7]. The bibliometric map will display the relationship between keywords from research publications [8].

This bibliometric analysis was conducted from 1,725 documents that have been published in journals from the reputable Scopus database with a wide journal coverage and diverse citation analysis [9]. This bibliometric analysis will focus on performance analysis and science mapping. Performance analysis is an analysis to determine the results of publications and research based on authors and institutions, while science mapping is to map the fields of research conducted.

Bibliometric analysis consists of five stages, namely Defining Search Keywords, Initial Search Results,

Manuscript received May 28, 2025; accepted September 9, 2025; published April 17, 2026.

Refining the Search Results, Compiling the Initial Data Statistics, and Analyzing the Data. In the first stage, the process of identifying keywords that will be used to search for research publications in accordance with predetermined topics is carried out. The search for research publications was conducted in the Scopus database with the search strategy TITLE-ABS-KEY ("artificial intelligence" and "higher education"). In the second stage, researchers will find the results of research publications according to the keywords. The search results display 4,675 documents. In the third stage, the results of the documents found were filtered so that the documents found were appropriate and precise. Researchers limited the documents to only those sourced from journals that were already in the final stage of publication. In addition, documents are also limited to the type of English-language articles. The final result was 1,725 suitable documents. In the fourth stage, the data results in the form of various research publications were compiled along with a graph of the number of research publications by year, country, institution, author, and field of study. Search results from the Scopus database were downloaded in Comma Separated Values (CSV) data format, which contains important information including citation information, bibliographical information, abstracts & keywords, and conference information. In the fifth stage, researchers analyzed the data based on the visualization results of the keyword linkage map of the research publications that had been found. The process of analyzing the data that has been obtained using VOSviewer software to present a bibliometric map of the relationship between co-occurrence keywords and co-authorship.

III. Result and Discussion

Based on data from 1,725 documents from the Scopus research publication database on AI in higher education research, the results are depicted in the form of graphs and bibliometric maps as follows.

Fig. 1 shows the number of research publications on artificial intelligence in higher education, which stagnated from 1986 to 2017. This is because, before 2017, research on Artificial Intelligence in higher education was still limited, and that year was marked as the beginning of the growth of artificial intelligence research in higher education [10, 11]. Since 2018 the number of articles has continued to increase and jumped very significantly in 2024, which is 773 articles. The increase in the number of research articles in 2024 reached 165% compared to 2023, which had 289 articles.

In this year until April, the number of articles has reached 283, so it can be predicted that the number of articles until the end of this year will continue to exceed the number of articles in 2024. This very significant increase occurred due to the impetus of the COVID-19 pandemic, which made the education process run with the full help of technology, one of which is AI, which makes the use of this technology continue in the following year [12]. In addition, at the end of 2022, ChatGPT appeared, which is a popular generative AI tool whose use is getting more widespread from year to year [13].

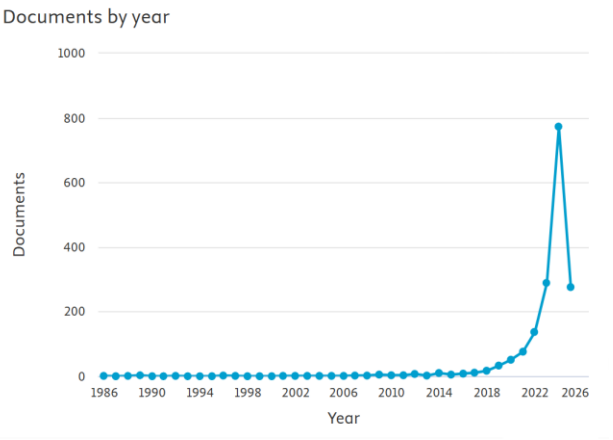

Fig. 1. Number of research publications on artificial intelligence in higher education.

The publication of research results on AI in higher education consists of 118 countries. The large number of countries conducting research shows that the phenomenon of using AI in higher education has become a global concern [10]. Fig. 2 shows the 10 countries that have the highest number of publications, with China, the United States, and the United Kingdom being the three highest countries. The 10 countries are dominated by countries from the Asia-Pacific. This is due to the growth in the number of research institutions in the Asia-Pacific region, which has an impact on increasing the number of scientific publications [14]. China has 247 published research articles, the United States has 233 articles, and the United Kingdom has 147 articles. The dominance of China in this study is because the Chinese Government supports various research and development that can improve science and technology by providing funding for research and scientific publications [15].

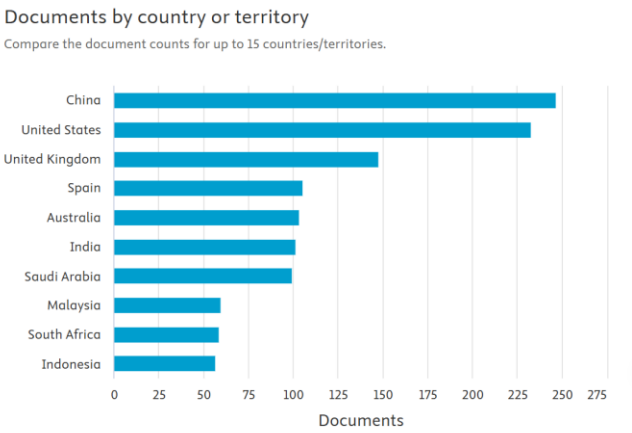

Fig. 2. Number of publications by country.

Fig. 3 shows the distribution of publications by subject area, which indicates that AI research in higher education covers a wide range of disciplines. The most researched subjects are Social Sciences with 33.9%, Computer

Sciences with 22.2%, and Engineering with 8.6%. This is because the number of AI research in the Social Science field continues to increase significantly every year. This increase shows that researchers have great concerns about the implications of AI for the field of social science [16]. The high level of research on AI in higher education in the field of computer science is partly due to the interdisciplinary collaboration between computer science and education to develop AI applications in learning [17].

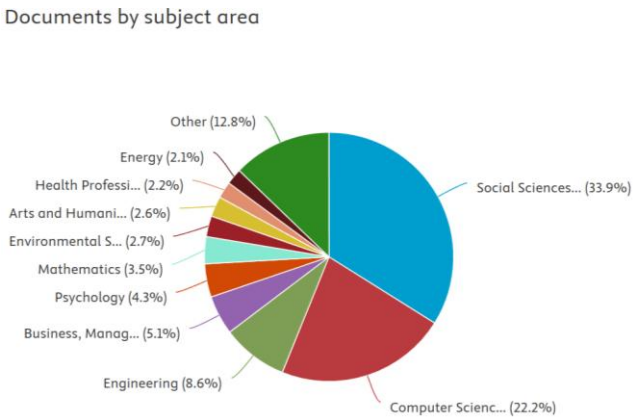

Fig. 3. Distribution of publications by subject area.

The universities with the highest number of publications on AI in higher education can be seen in Fig. 4. Tecnológico de Monterrey is the university with the highest number of publications, with 41 articles. Then King Abdulaziz University published 18 articles, followed by the University of South Africa with 17 documents and King Faisal University with 16 documents. Then there are four universities with a total publication of 13 articles, namely King's College London, Beijing Normal University, CQUniversity Australia, and the University of Jordan. After that, the University of Tasmania and Qatar University have published 12 articles.

Based on Fig. 5, it can be seen that the author with the highest number of publications on AI in higher education is Jürgen Rudolph, who is Director of Research, at Kaplan Singapore has published nine studies. Authors who have published eight articles include Thomas CHIU Kin-fung who is a Professor from the Chinese University of Hong Kong, Joseph Crawford who is a Senior Lecturer in Management from the Tasmanian School of Business and Economics, and Shannon Tan a Research Executive and Lecturer at Kaplan Singapore.

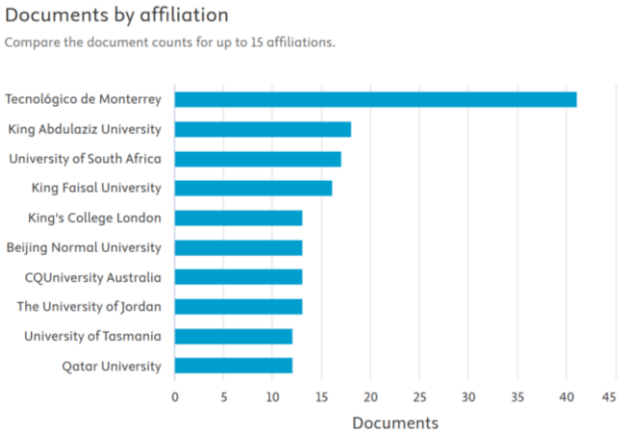

Fig. 4. Number of publications by university.

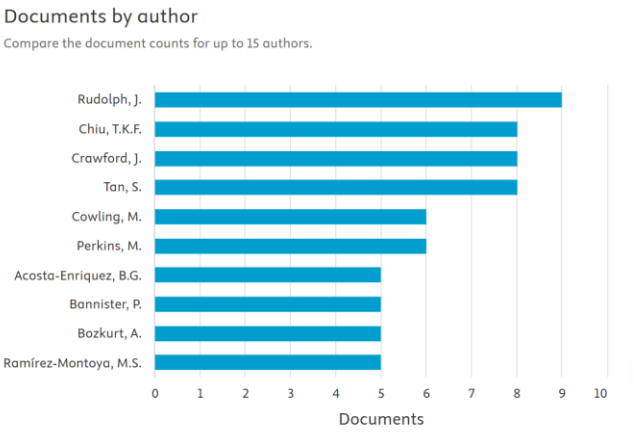

Fig. 5. Number of publications by author.

To find out which research documents have the most significant influence and contribution, can be seen from the highest number of citations [18, 19]. Of the 1,725 research articles on AI in Higher Education, the 5 most influential publications characterized by the highest number of citations are listed in Table I.

TABLE I. INFLUENTIAL AUTHORS BASED ON NUMBER OF CITATIONS

Authors	Title	Source	Year	Citation
J. Rudolph, S. Tan, S. Tan,	ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?	Journal of Applied Learning and Teaching, 6(1), pp. 342–363	2023	868
D. R. E. Cotton, P. A. Cotton, and J. R. Shipway	Chatting and cheating: Ensuring academic integrity in the era of ChatGPT	Innovations in Education and Teaching International, 61(2), pp. 228–239	2024	849
S. A. D.Popenici and S. Kerr,	Exploring the impact of artificial intelligence on teaching and learning in higher education	Research and Practice in Technology Enhanced Learning, 12(1), 22	2017	767
M. Farrokhnia, S. K. Banihashem, O. Noroozi, and A. Wals	A SWOT analysis of ChatGPT: Implications for educational practice and research	Innovations in Education and Teaching International, 61(3), pp. 460–474	2024	471
C. K. Y. Chan,	A comprehensive AI policy education framework for university teaching and learning	International Journal of Educational Technology in Higher Education, 20(1), 38	2023	439

Based on the table, the publication document ranked first is the article with the title ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? written by Jürgen Rudolph, Samson Tan, and Shannon Tan has been cited 868 times. In second place is an article with the title Chatting and cheating: Ensuring academic integrity in the era of ChatGPT, written by Debby R.E. Cotton, Peter A. Cotton, and J. Reuben Shipway which has been cited 849 times. The article entitled Exploring the impact of artificial intelligence on teaching and learning in higher education with authors Stefan A.D. Popenici and Sharon Kerr, is in third place with 767 citations. Based on these results, it can be said that Jürgen Rudolph was the greatest producer, with the highest impact index.

Fig. 6. Co-authorship relationship map.

Based on published research results, there are 5,432 authors involved in research on AI in higher education. However, based on the analysis in Fig. 6, there are only 8 authors who have collaborative relationships with other authors. The figure shows a close collaboration between Jürgen Rudolph, Shannon Tan, Joseph Crawford, and Michael Cowling. This relationship indicates that the research was conducted together and collaborated with each other. This collaboration can lead to the exchange of ideas and the development of methodologies in AI in higher education [20].

The co-authorship analysis conducted shows very few relationships between authors, which means that collaboration between researchers is still needed to produce higher-quality research. Collaboration between researchers is very important because it can accelerate the innovation process and increase the impact of research, especially in a rapidly developing field such as AI [21]. In addition, collaboration between institutions and across disciplines can also produce research that is more comprehensive and relevant to the needs of education [22].

The next analysis is about the relationship between keywords from 1,725 articles consisting of 6,920 keywords, there are 434 keywords that are interconnected with a minimum of 5 connections with other keywords resulting in eleven clusters. Fig. 7 illustrates the visualization of interconnectedness between keywords in eleven clusters marked with different colors. The size of the circle of each keyword indicates the number of occurrences of that keyword across all articles. The five largest clusters are marked in red, green, dark blue, yellow, and light blue. Keywords that have a very strong connection with other keywords include Cluster 1 keywords in red which have large keywords including article, student, and learning. With these various keywords, it can be said that Cluster 1 focuses on the role of students in the use of AI. This is in line with the results of a study stating that AI technology has revolutionized the student learning process by enhancing their learning experience and satisfaction [23].

Cluster 2, which is marked in green, has large keywords including students, higher education, teaching, education computing, and e-learning. This cluster shows that the use of AI has supported the effectiveness of digital teaching, including in online learning [24]. Cluster 3, marked in dark blue, has large keywords including ChatGPT and generative artificial intelligence. This cluster shows the trend of using ChatGPT and generative AI in higher education.

Cluster 4, marked in yellow, has large keywords including artificial intelligence, higher education, and education. The emergence of these main keywords in this cluster indicates that this cluster focuses on the core of

the discussion regarding AI in higher education. This cluster includes the discussion of AI as one of the rapidly developing educational technologies [25]. Cluster 6, marked in light blue, has large keywords including machine learning and learning systems. These keywords show that Cluster 6 focuses on the discussion of the technical application of AI in higher education with intelligent tutoring systems that can increase the efficiency and effectiveness of the learning process [26]. Some of these keywords from Clusters 1, 2, 3, 4, and 6 are the most discussed keywords in AI research in higher education.

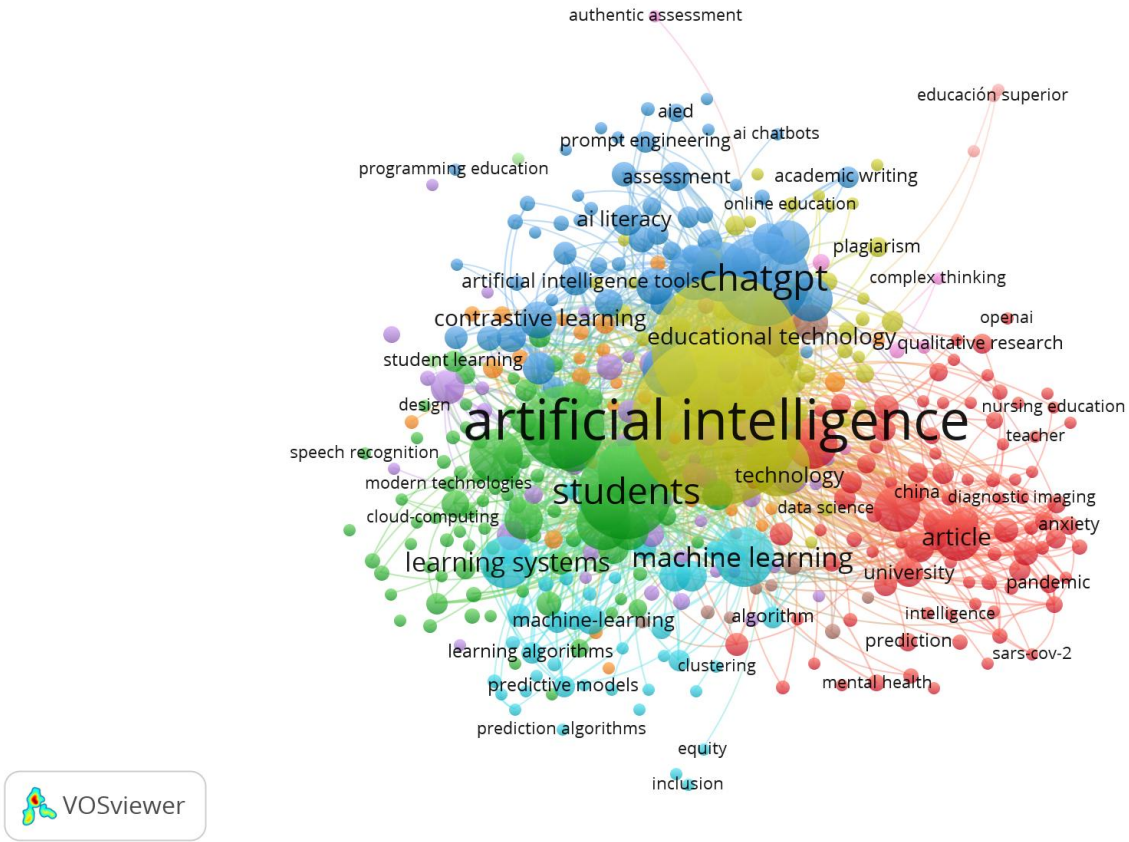

Fig. 7. Keyword relationship visualization based on co-occurrence.

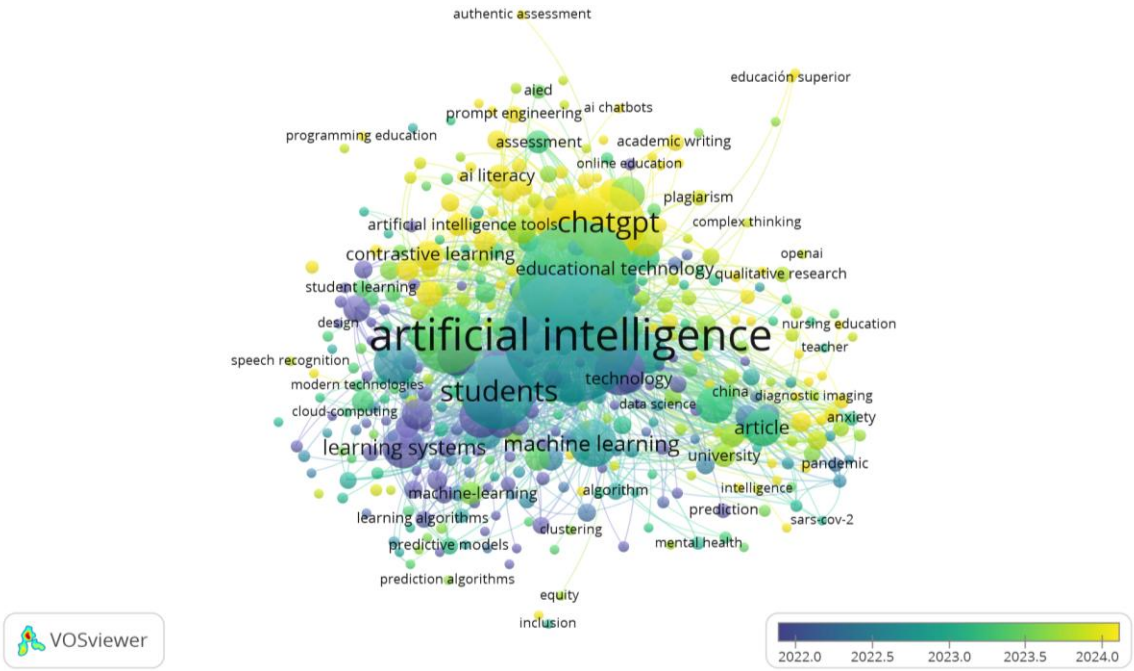

Fig. 8. Keyword overlay visualization based on co-occurrence.

Based on these results, it can also be seen that there are keywords that are still minimally discussed in AI research in higher education, including inclusion, equity, authentic assessment, digital education, and digital competencies. The result of these minimally discussed keywords can be a research topic opportunity that still needs to be conducted in the future.

Bibliometric analysis also presents results regarding research mapping based on the year of publication. This analysis can be used as a reference to understand the state of the art of research on AI in higher education. Fig. 8 shows the distribution of publication years marked by color. The lighter the color of the dots in the figure indicates that the research with the keyword was studied in more recent years, while the darker color shows that the research with the keyword has been studied in earlier years. 'learning systems', 'program outcomes', and 'learning outcomes' are some of the keywords researched around 2022, while 'chatgpt', 'AI literacy', and 'academic writing' are keywords studied around 2024.

The keywords that appeared in 2022 indicate that the use of AI in higher education focused on its utilization in learning systems to support learning outcomes. This is in line with research findings that provide an overview of various AI applications integrated into adaptive and personalized learning systems to support students [27]. Then, in 2024, there was a shift in research focus due to the development of generative AI. Thus, the keyword 'AI literacy' is considered important to support both students and lecturers in utilizing AI ethically and effectively [28].

IV. Conclusion

The bibliometric analysis of 1,725 journal articles on AI in higher education revealed several findings that can be used to inform research trends and developments in this field. The number of research publications on AI in higher education has continued to increase since 2018 and has increased significantly in 2024. This shows that AI has received close attention in recent years.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Tsaniya Sholihah was responsible for the conceptualization, data collection, data analysis, and drafting of the manuscript; Cepi Riyana contributed to reviewing and providing critical feedback on the manuscript; both authors had read and agreed to the published version of the manuscript.

Acknowledgment

Tsaniya Sholihah expresses gratitude to the Lembaga Pengelola Dana Pendidikan (LPDP), Ministry of Finance of the Republic of Indonesia, for the master's degree scholarship and funding support for the publication of this article.

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