Review Article

A Descriptive Bibliometric Study of Artificial Intelligence in Education in India

Bharti Sharma[1] and Suvin V M[2]
[1]Professor and [2]Research Scholar
[1, 2]Department of Teacher Training and Non-Formal Education (IASE),
Jamia Millia Islamia, New Delhi
[2]suvinvm07@gmail.com (Corresponding Author)

Manuscript Submission Date: November 10, 2025
Manuscript Acceptance Date: December 30, 2025

Abstract

Artificial intelligence drastically changes the educational field, increasing the opportunity for self-learning and challenging the existing education system. This bibliometric study explores research focused on AI and education published from 2014 to 2024 in the Indian context. The analysis of 119 Scopus indexed articles were carried out examining the trajectory of distribution of publication and citation, the top-cited research articles, the top authors, the top institutions, the leading journals in research on AI in education in India during the last decade and the research gap that exist within AI in education in India with the help of Biblioshiny (RStudio) and VOS viewer software. The findings revealed that the themes discussed mostly by the researchers in connection with AI are ChatGPT, higher education, learning and education. The study identified the need for more research in school education, inclusive education and special education.

Keywords: Artificial Intelligence, AI, Education, India, Bibliometric Study, Biblioshiny, VOS viewer.

Introduction

Education aims at developing the potential in each child and ensure their holistic development and equip them to face the challenges and opportunities confidently. This technological advanced time and society demand education appropriate to face these challenges (Asif and Panakaje, 2022). Technological advancement is rapidly happening in the world (Su and Zhong, 2022) and is replacing humans from unskilled jobs with machines (AbuMusab, 2024; Hotte et al., 2023) by stressing on the need to redesign the existing educational practices (Carvalho et al., 2022; Ministry of Human Resource Development, 2020). By recognising the significance of AI in the soon future, countries are framing guidelines and setting the platform to integrate and teach AI in schools (Erumit et al., 2024) and hence the terrain of education is dynamic and witnessing a fast change which never happened before (Agarwal et al., 2025; Ahmed et al., 2025; Ghalia et al., 2024; Shahzad et al., 2024; Barbhuiya, 2023). The personalised learning experience of AI (Chanda et al., 2025; Sugunan and Thiyagu, 2025; Gupta and Jaiswal, 2024; Naggar et al., 2024; Rahiman and Kodikal, 2024; Ouyang and Jiao,2021) generated interest among students to use AI in classroom learning (Ghalia et al., 2024). Artificial intelligence opens doors to children to the world of learning, gets personalized feedback and assistance (Darvishi et al., 2024; Tapalova and Zhiyenbayeva, 2022) on their academic activities like assignments, projects, etc., and receives diverse ideas and

solutions for their queries (Singh and Azteca, 2022). This will enhance the learning experience of learners and their performance (Bressane et al., 2024; Onesi-Ozigagun et al., 2024; Hooda et al., 2022; Srinivasa et al., 2022). The concern is that if children are not verifying the reliability of the AI generated contents (Veldhuis et al., 2025), then they are in over-dependence or over-reliance on AI (Hyde et al., 2024; Zhai et al., 2024). Over-reliance on AI also connected to the user's preference towards cognitive shortcuts for fast solutions (Zhai et at., 2024). Another concern is about the dehumanization of education (Ghalia et al., 2024) and teachers worried about their roles in the future. To resolve this ambiguity and to harness and develop the strength of both teachers and AI (Kanvaria and Ritika, 2024; Holmes & Tuomi, 2022; Sorell, 2022; Grover and Naik, 2021) for more effective teaching learning process, a collaborative action is needed (Hajam and Purohit, 2024; Ifenthaler et al., 2024).

In education, AI has a key role and it has many benefits (Dash and Bharathi, 2025; Kapoor and Bakhshi, 2025; Nehru et al., 2025; Shahzad et al., 2024), but the rise of ethical problems, including misinformation, algorithmic biases, plagiarism, privacy violations, transparency deficits, and the dehumanization of education, is potentially degrading crucial cognitive abilities (Sugunan and Thiyagu, 2025; Amoasi, 2024; Ghalia et al., 2024; Ifenthaler et al., 2024; Lopez et al., 2024; Naggar et al., 2024; Rehman et al., 2024; Yadav and Srivastava, 2024; Zhai et at., 2024; Memarian and Doleck, 2023). The need of digital infrastructure and skilled educators are also challenging the integration of AI in the field of education in India (Gupta and Saranya, 2024; Lopez et al., 2024). The uneven access to AI benefits in developing countries raises concerns about equity and potential impacts. So, it is important to create an inclusive society and learning environment by ensuring necessary support system in those countries (Mannuru et al., 2023).

NEP 2020 emphasised the inclusion of artificial intelligence in the curriculum and pedagogy for enhancing teaching and learning in India (Ministry of Human Resource Development, 2020). There are multiple initiatives by Government of India including National Strategy on AI by NITI Aayog (NITI Aayog, 2018), the "AI for all" programme launched by Ministry of Education and various government-led projects in various sectors (Majid & Lakshmi, 2022). The CBSE in India has integrated AI into its curriculum initially in 2019 as an optional subject in class 9 and they have released an AI integration manual (Erumit et al., 2024; Karan, 2024). Similarly in 2024, University Grant Commission (UGC) released guidelines for the introduction of skill-based courses in the higher educational sector for enhancing the competencies of students in emerging fields like AI (UGC, 2024). At the same time, debates are going on concerning the possibilities and challenges of integration of AI in education (Ahmed et al., 2024; Alexandrowicz, 2024; Higgs and Stornaiuolo, 2024; Chan and Hu, 2023; Mouta et al., 2023) and the research on this area is crucial currently. The bibliometric studies conducted in this field discussed AI along with the digital education ecosystem (Chung and Cam, 2025), education (Afzaal et al., 2024; Durak et al., 2024; Guo et al., 2024; Kavitha and Joshith, 2024; Subroto et al., 2024; Akhmadieva et al., 2023; Dao et al., 2023; Metli, 2023; Pu et al., 2021; Talan, 2021; Baek and Doleck, 2020), quality education (Bahcelerli and Sucuogu, 2024), educational research (Delen et al., 2024), higher education (Lopez-Chila et al., 2024; Maphosa and Maphosa, 2023; Hinojo-Lucena et al., 2019), personalised learning (Li and Wong, 2023), language teaching and learning (Zhang & Umeanowai, 2025;

Huiling et al., 2024; Kartal and Yesilyurt, 2024; Jaleniauskiene et al., 2023), teaching (Ivanova et al., 2024), student learning (Yun et al., 2024), teaching and administration (Ullrich et al., 2022), implementation of ChatGPT in STEM education (Prahani et al., 2025) and development of ChatGPT in education (Bhaskar and Tiwari, 2025; Samala et al., 2024; Shang, 2024; Zheltukhina et al., 2024; Pradana et al., 2023), trends of smart education (Dehbi et al., 2025), smart learning (Chen et al., 2021), ChatGPT use in higher education (Ma, 2025), AI chatbots in educational context (Lin and Yu, 2023), virtual reality in sports and training (Soorinarayanan et al., 2025), educational artificial intelligence (Song and Wang, 2020) and many more. The current literature shows a skewness toward STEM, language education, and medical sciences. There is a significant lack of research on AI in the Humanities and Social Sciences. The studies conducted on AI identified China and US as the most influential contributors. The bibliometric study conducted in India by Kavitha and Joshith (2024) discusses about the transformation of AI in education through the studies conducted all over the world. Thus, there is a gap in understanding how AI can be integrated in the Educational filed in the context of NEP 2020. So, this paper analyses the research works conducted on AI and education in Indian context particularly from 2014 to 2024.

Research Questions

Q1. What is the trajectory of distribution of publication and citation in research on artificial intelligence and education in India from 2014 to 2024?

Q2. What are the most cited research publications on artificial intelligence and education in India from 2014 to 2024?

Q3. Who are the top authors in research on artificial intelligence and education in India between 2014 and 2024?

Q4. Which are the top institutions in research on artificial intelligence and education in India from 2014 to 2024?

Q5. What are the most prominent journals publishing artificial intelligence and educational research in India from 2014 to 2024?

Q6. What is the research gap that exists in the field of AI and education in India?

Methodology

The study uses bibliometric analysis, a quantitative approach (Andersen, 2021) that measures patterns of a large set of publications (Manoj, et al., 2023; Verma and Gustafsson, 2020). Bibliometric analysis helps the researchers to examine emerging trends, publication and journal performance, and collaboration networks (Passas, 2024; Baker et al., 2020). Bibliometric analysis employs two techniques: main techniques and enrichment techniques (Donthu et al., 2021). Main techniques include performance analysis that quantifies research productivity and impact through metrics like total publications, citation counts and h index (Cobo et al., 2010) and science mapping, which visualises research connections through citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis (Donthu et al., 2021). Enrichment techniques deepen this analysis through network analysis and visualisation tools such as Biblioshiny and VOS viewer (Donthu et al., 2021). Biblioshiny and VOS viewers support researchers in transforming large volumes of textual information into comprehensive visual networks that can reveal meaningful connections and trends (Bukar et al.,

2023; Rashid, 2023; Eck and Waltman, 2010). The paper used the data from the Scopus database and refined based on the period of publication (2014-2024), subject area (social science), keywords (artificial intelligence, education, and machine learning), type of document (article), language of publication (English), and country (India). The details of the retrieval of data including identification, screening and inclusion are given in figure 1, Prisma flow chart. Finally, 119 articles were retrieved from a total of 37,258 articles. For the analysis of data Biblioshiny (RStudio), VOS viewer, and MS Excel were used and visualisation of the data exported in CSV format.

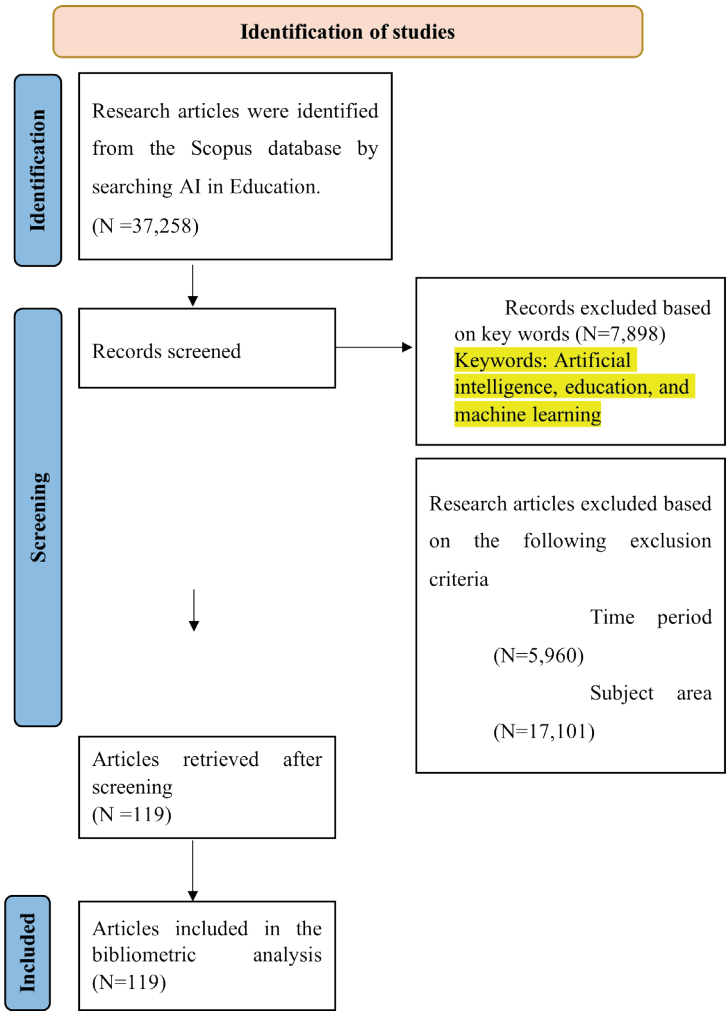

Fig. 1: Data retrieval using PRISMA flow chart

Source: Author compilation

Results and Discussions

Description of the Retrieved Data

Table 1 shows a comprehensive summary of bibliometric data retrieved from the Scopus database, from 2014 to 2024. The data consists of 119 articles sourced from 94 journals and books, contributed by a diverse group of 564 authors. Notably, 11 of these articles are

single authored. There is an average of 56.08 citations per document, indicating significant scholarly attention and influence. The table also reveals 380 indexing keywords (ID) and 453 author-defined keywords (DE), reflecting the diverse research topics in the data retrieved.

Table 1:Retrieved data from the Scopus database

Description	Results
Period	2014-2024
Sources (Journals, Books, etc)	94
Articles	119
Average citations per doc	56.08
Keywords Plus (ID)	380
Author's Keywords (DE)	453
Authors	564
Single-authored docs	11

Trajectory of distribution of publication and citation over the past 10 years

RQ 1 is addressed in Figure 2, and it indicates the growth of publications and citations on AI and Education in India annually during the last decade (2014 to 2024). The data indicates a significant pattern in research output and citation patterns. It is clear from the figure that there was a gradual increase in publications from 2020 to 2023 and a dramatic increase in 2024 with 70 publications. This supports the NEP's argument that AI is rapidly changing the global knowledge landscape (NEP, 2020). Notably, there is a decrease in the number of citations. This is common in academic research as the newer publications have less time to accumulate citations compared to older publications (Belter, 2015). The significant increase in publications in 2023 and 2024 suggests a growing research interest in AI and Education in India.

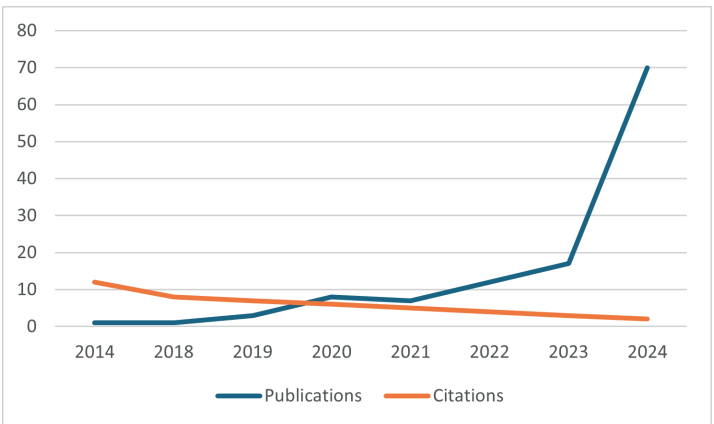

Fig. 2: Trajectory of distribution of publication and citation over the past 10 years

The most-cited research publications on artificial intelligence in education in India

Table 2 shows the details of most-cited research publications on AI in education in India from 2014 to 2024 and thus, addresses RQ2. According to the number of citations, 10 articles are listed as the most-cited research publications from 119 articles retrieved from the Scopus database. Research articles which came in the first top three positions are review papers and they discuss the technological transformation by recognizing both opportunities and challenges. It is notable that all the most-cited 10 articles are published after 2020 which can be the result of COVID-19 Pandemic and the emphasis of integration of AI in NEP 2020. This confirms the findings of Afzaal et al. (2024) and Kavitha and Joshith (2024) that COVID-19 pandemic can be a reason for the extensive importance of AI.

Table 2:Details of the Most-cited Research Publications

Author(s)	Year	Keyword	DOI	Citations
Dwivedi, et al.	2021	AI, Artificial intelligence, Cognitive computing, Expert systems, Machine learning, Research agenda	10.1016/j.ijinfomgt.2019.08.002	1907
Dwivedi, et al.	2023	ChatGPT, Conversational agent, Generative AI, Generative artificial intelligence, Large language models	10.1016/j.ijinfomgt.2023.102642	1827
Dwivedi, et al.	2020	COVID-19, Digital life, Digital transformation, Digital world, Information management, Information systems, Information technology	10.1016/j.ijinfomgt.2020.102211	740
Chatterjee and Bhattacharjee	2020	AI, Attitude, Behavioural intention, Education, India	10.1007/s10639-020-10159-7	310
Bhutoria, A	2022	Artificial intelligence, Big data, China, India, Personalized education, USA	10.1016/j.caeai.2022.100068	242

Author(s)	Year	Keyword	DOI	Citations
Herath and Mittal	2022	Artificial intelligence (AI), Digital cities, Intelligent interaction, Internet of Things (IoT), Smart cities	10.1016/j.jjimei.2022.100076	181
Sharma, et al.	2020	Artificial intelligence, Environmental sustainability, Governance, ICT, Policy-making, Public Administration	10.1016/j.sftr.2019.100004	151
Nigam, et al.	2021	AI, AIPS, Artificial Intelligence, Exams, Online learning, Online proctoring, Proctoring system	10.1007/s10639-021-10597-x	123
Mannuru, et al.	2023	Artificial intelligence, Developing countries, Fourth industrial revolution, Generative AI, Technological change	10.1177/02666669231200628	96
Sharma, et al.	2022	AI enabled systems, Artificial intelligence, Emerging economies, Implementing challenges, Public manufacturing sector	10.1016/j.giq.2021.101624	78

Top authors, institutions in the research on artificial intelligence and education in India

RQ 3 focuses on the top authors in research on artificial intelligence and education in India from 2014-2024 and the details are given in Table 3. Joshith and Kavitha from Central University of Kerala are the top authors among the first ten authors. Duan, Dwivedi, Edward, Hughes, and Nripendra are authors from Institutions outside India. Table 4 also indicates the contributions from institutions outside India. Swansea University, United Kingdom is the top institution among the ten institutions. Three out of the ten institutions are from outside India contributing to the

research on AI and education, which indicates the research collaboration in this field. Four institutions among the seven institutions from India, are from the field of Science, Technology and Medical Sciences.

Table 3:Most Contributed Authors in Research on Artificial Intelligence and Education in India

Authors	No. of Articles
Joshith, V.P.	4
Kavitha, K.	4
Duan, Yanqing	3
Dwivedi, Yogesh K.	3
Edwards, John S.	3
Hughes, Laurie	3
Kumar, Prasantha N.S.	3
Moulieswaran, N.	3
Raman, Ramakrishnan	3
Rana, Nripendra P.	3

Table 4:Top ten contributing institutions in Research on Artificial Intelligence and Education

Affiliation	Articles
Swansea University	17
Central University of Kerala	12
Pushpagiri Medical College	9
University of North Texas	9
Chitkara University	8
Kerala University of Health Sciences	7
Symbiosis International (Deemed University)	7
University of Bradford	6
CSIR—Central Building Research Institute	5
National Institute of Industrial Engineering (NITIE)	5

Leading Journals in Research on Artificial Intelligence and Education in India

Table 5 addresses RQ 5 and show the leading journals in research on AI and education according to the number of articles published. The top journals suggest a growing research landscape that spans across multiple disciplines. Interestingly, the list includes journals from diverse fields such as health education, management education

and sustainability. It indicates that wide integration of artificial intelligence in diverse fields of education. While bibliometric mapping shows the domination of international publishers among the top ten journals, there is one journal published in India named Journal of Education and Health Promotion. This suggests the need for institutional support to increase the number of journals withinternational indexing standards in this field.

Table 5:Leading Journals in Research on Artificial Intelligence and Education in India

Sources	Articles
Education and Information Technologies	5
Cogent Education	4
Journal of E-Learning and Knowledge Society	4
Journal of Education and Health Promotion	4
International Journal of Information Management	3
International Journal of Management Education	3
Sustainability (Switzerland)	3
Jmir Medical Education	2
Journal of Computers in Education	2
Journal of Ecohumanism	2

Research gaps exist in AI and education in India

To address RQ 6, co-occurrence of key words and word cloud have been analysed. The co-occurrence of keywords was visualised using VOS viewer. Out of 752 keywords, 23 keywords met the threshold, and the minimum occurrence was given as 5. The number of occurrences of keywords is visualized as size of nodes, connections as lines and the different colours as the different clusters. Figure 3 shows the network of co-occurrence of keywords. Clustering serves us as a valuable enrichment technique in bibliometric analysis, which shows how key themes form and change over time (Zupic and Cater, 2015).

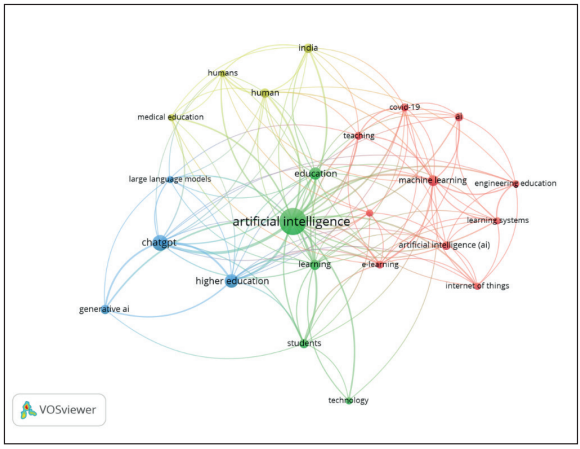

Fig. 3:Network of Key-work co-occurrence

Cluster 1

Cluster 1 includes keywords AI, Covid 19, e-learning, engineering education, internet of things, learning systems, machine learning, teaching and virtual reality. It highlights the technology enhanced learning. The keyword 'Covid 19' indicates more researchers studied the crucial role of technologies during the pandemic. This aligns with the previous findings and underline the role of Covid 19 pandemic in the rapid growth of AI in all fields.

Cluster 2

Artificial intelligence, education, learning, students, and technology were the keywords included in Cluster 2. The node labelled artificial intelligence is the biggest among all. The nodes 'education', 'artificial intelligence' and 'learning' are closer in the cluster indicating the strong relationship between them. It implies not only the research interests in the area but also the crucial role of AI in Education that cannot be ignored.

Cluster 3

Cluster 3 encompasses 4 keywords which are ChatGPT, Generative AI, higher education and large language models. It shows the recent trend of AI research, especially on ChatGPT, and higher education. The research should expand and continue to explore the new emerging AI platforms. It is also evident from the overlay visualisation given in Figure 4. The yellow colour denotes the cluster with a high number of occurrences.

Cluster 4

Cluster 4 includes human, humans India and medical education. This cluster shows a distinct focus on medical education.

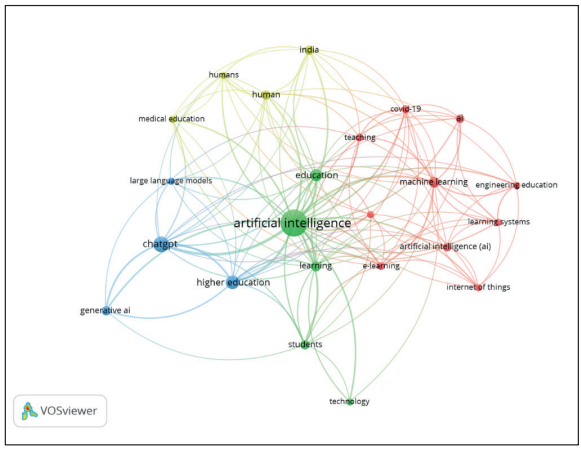

Fig. 4: Overlay Visualisation of Key-word Co-occurrence

Conclusion

This bibliometric study analysed 119 articles on AI and education in India, retrieved from Scopus database from 2014 to 2024. It is evident that even in the time of wide use technology and AI in education sector in India, less research studies have conducted in this period. The dramatic increase in publications in 2023 and 2024 indicates the growing recognition and importance of AI in education. NEP (2020) also highlighted the significant role of AI in all fields in near future. The study analysed top-cited articles, relevant authors, journals, and institutions in this field. Relevant authors, journals, and institutions were analysed based on the number

of publications. Seven articles out of the top ten articles are review papers. The findings reveal the need for more empirical research and collaborations among institutions in India for the efficient use of AI in education. The major trends existing in contemporary research in this field are focused on ChatGPT, Higher Education, generative AI, and large language models. It also highlights the need for research studies in school education, special education and inclusive education in India.

Acknowledgement

We are grateful to the staff at the Dr. Zakir Husain Central Library, Jamia Millia Islamia for their support and services, and for providing access to the invaluable resources of the library.

References

AbuMusab, S. (2024). Generative AI and human labor: Who is replaceable? *AI & Society, 39*, 3051-3053. https://doi.org/10.1007/s00146-023-01773-3

Afzaal, M., Shanshan, X., Yan, D., & Younas, M. (2024). Mapping artificial intelligence integration in education: A decade of innovation and impact (2013–2023) - A bibliometric analysis. *IEEE Access, 12*, 113275-113299. https://doi.org/10.1109/ACCESS.2024.3443313

Agarwal, V., Verma, P., & Ferrigno, G. (2025). Education 5.0 challenges and sustainable development goals in emerging economies: A mixed-method approach. *Technology in Society, 81*. https://doi.org/10.1016/j.techsoc.2025.102814

Ahmed, A. B., King, B. D., Hiran, K. K., Dadhich, M., & Malcalm, E. (2025). Half a decade of artificial intelligence in education in Africa: Trends, opportunities, challenges and future directions. *Journal of Engineering Education Transformations, 38* (3), 81-100. 10.16920/jeet/2024/v38i3/24246

Ahmed, Z., Shanto, S. S.,Rime, M. H. K., Morol, M. K., Fahad, N., & Hossen, M. J. (2024). The generative AI landscape in education: Mapping the terrain of opportunities, challenges, and student perception. *IEEE Access, 12*,147023 - 147050 https://doi.org/10.1109/ACCESS.2024.3461874

Akhmadieva, R. S., Udina, N. N., Kosheleva, Y. P., Zhdanov, S. P., Timofeeva, M. O., & Budkevich, R. L. (2023). Artificial intelligence in science education: A bibliometric review. *Contemporary Educational Technology, 15*(4). https://eric.ed.gov/?id=EJ1406974

Alexandrowicz, V. (2024). Artificial intelligence integration in teacher education: Navigating benefits, challenges, and transformative pedagogy. *Journal of Education and Learning, 13*(6), 346-364. https://doi.org/10.5539/jel.v13n6p346

Amoasi, F. (2024). "Too much of anything is bad" evaluating the potential impact of generative artificial intelligence on teaching and learning, protection of right to privacy and copyright in Ghana. Kwame Nkrumah University of Science and Technology. https://dx.doi.org/10.2139/ssrn.5064465

Andersen, N. (2019). Mapping the expatriate literature: A bibliometric review of the field from 1998 to 2017 and identification of current research fronts. *The International Journal of Human Resource Management, 32*(22), 4687–4724. https://doi.org/10.1080/09585192.2019.1661267

Asif, N. V. A., & Panakaje, N. (2022). Paradigm shift - the role of educational technology and internet in Indian education system. *International Journal of Case Studies in Business, IT, and Education (IJCSBE), 6*(2), 930-944. https://doi.org/10.5281/zenodo.7508889

Baek, C., & Doleck, T. (2020). A bibliometric analysis of the papers published in the Journal of Artificial Intelligence in Education from 2015-2019. *International Journal of Learning Analytics and Artificial Intelligence for Education (iJAI), 2*(1), 67–84. https://doi.org/10.3991/ijai.v2i1.14481

Bahcelerli, N. M., & Sucuoglu, E. (2024). Artificial intelligence in education quality: Bibliometric analysis. *Pakistan Journal of Life and Social Sciences, 22*(2), 2543-2548. https://doi.org/10.57239/PJLSS-2024-22.2.00185

Baker, H. K., Kumar, S. and Pandey, N. (2020). A bibliometric analysis of managerial finance: A retrospective, *Managerial Finance*, 46(11), 1495-1517. https://doi.org/10.1108/MF-06-2019-0277

Barbhuiya, R. K. (2023). Introduction to artificial intelligence: Current developments, concerns and possibilities for education. *Indian Journal of Educational Technology*, 5(2), 266–277. https://journals.ncert.gov.in/IJET/article/view/585

Belter, C.W. (2015). Bibliometric indicators: Opportunities and limits. Journal of the Medical Library Association, 103 (4), 219-221. https://doi.org/10.3163/1536-5050.103.4.014

Bhaskar, P., & Tiwari, C. K. (2025). Charming or chilling? A comprehensive review of ChatGPT's in education sector. *International Journal of Information and Learning Technology*. 10.1108/IJILT-05-2024-0097

Bressane, A., Zwirn, D., Essiptchouk, A, Saraiva, A. C. V., Carvalho, F. L. C., Formiga, J. K. S., Medeiros, L. C. C., & Negri, R, G. (2024). Understanding the role of study strategies and learning disabilities on student academic performance to enhance educational approaches: A proposal using artificial intelligence. *Computer and Education: Artificial Intelligence, 6*. https://doi.org/10.1016/j.caeai.2023.100196

Bukar, U. A., Sayeed, M. S, Razak., S. F. A, Yogarayan, S., Amodu, O. A., Mahmood, R. A. R. (2023). A method for analyzing text using VOSviewer. MethodsX, 11. https://doi.org/10.1016/j.mex.2023.102339

Carvalho, L., Martinez-Maldonado, R., Tsai, Y. S., Markauskaite, L., & Laat, M. D. (2022). How can we design for learning in an AI world? *Computer and Education: Artificial Intelligence,* 3. https://doi.org/10.1016/j.caeai.2022.100053

Chan, C. K. Y., & Hu, W. (2023). Students' voices on generative AI: Perceptions, benefits, and challenges in higher education. *International Journal of Educational Technology in Higher Education, 20*. https://doi.org/10.1186/s41239-023-00411-8

Chanda, R. C., Vafaei-Zadeh, A., Hanifah, H., & Ramayah, T. (2025). Artificial intelligence teaching assistant adoption in university education: Key drivers through the ability, motivation and opportunity framework. *Education and Information Technologies.* https://doi.org/10.1007/s10639-025-13360-8

Chen, X., Zou, D., Xie, H., & Wang, F. L. (2021). Past, present, and future of smart learning: A topic-based bibliometric analysis. *International Journal of Educational Technology in Higher Education, 18*(2). https://doi.org/10.1186/s41239-020-00239-6

Chung, N. H. T., & Cam, T. A. (2025). Identifying the most impactful research fronts in the digital education ecosystem: Formulation, metrics, and insights. *European Journal of Educational Research, 14*(2), 349-364. https://doi.org/10.12973/eu-jer.14.2.349

Cobo, M. J., Lopez-Herrera, A.G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets theory field. *Journal of Informetrics, 5*(1), 146-166. https://sci2s.ugr.es/sites/default/files/ficherosPublicaciones/1321_mjcobo-joi-2010.pdf

Dao. L. T., Tran, T., Le, H. V., Nguyen, G. N., & Trinh, T. P. T. (2023). A bibliometric analysis of research on education 4.0 during the 2017–2021 period. *Education and Information Technologies, 28,* 2437-2453. https://doi.org/10.1007/s10639-022-11211-4

Darvishi, A., Khosravi, H., Sadiq, S., Gasevic, D., & Siemens, G. (2024). Impact of AI assistance on student agency. *Computers & Education, 210*. https://doi.org/10.1016/j.compedu.2023.104967

Dash, S. A., & Bharathi, S. V. (2025). AI shishya: Enhancing Vedic pedagogy with artificial intelligence in education 4.0. *Journal of Educators Online, 22* (1). https://doi.org/10.9743/JEO.2025.22.1.4

Dehbi, A., Bakhouyi, A., Khaddar, A. M., & Talea, M. (2025). Education and smart technologies: Towards a new pedagogical paradigm. *International Journal of Evaluation and Research in Education (IJERE)*, 14(1), 297-309. http://doi.org/10.11591/ijere.v14i1.30470

Delen, I., Sen, N., Ozudogru, F., & Biasutti, M. (2024). Understanding the growth of artificial intelligence in educational research through bibliometric analysis. *Sustainability, 16*(16). https://doi.org/10.3390/su16166724

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research, 133*, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.070

Durak, G., Cankaya, S., Ozdemir, D., & Can, S. (2024). Artificial intelligence in education: A bibliometric study on its role in transforming teaching and learning. I*nternational Review of Research in Open and Distributed Learning, 25*(3), 219-244. https://doi.org/10.19173/irrodl.v25i3.7757

Eck, N. J.V., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*, 523–538. https://doi.org/10.1007/s11192-009-0146-3

Erumit, A. K., Cebeci, U., Ozmen, S., & Kalyoncu, F. (2024). Comparative analysis of the studies of countries on AI teaching. *Journal of Computer Education, 3*(1), 25-63. https://www.journalofcomputereducation.info/ojs/index.php/jce/article/view/21

Ghalia, N., Isami, E., Bsoul, M., Aabed, S., Haeb, R. S., Mustafa, M. (2024). Impact of artificial intelligence in education: Insights from students and faculty members at Yarmouk University. *Journal of Ecohumanism, 3*(8), 1278-1289. https://doi.org/10.62754/joe.v3i8.4807

Grover, S., & Naik, P. R. (2021). Understanding the role of teachers at the advent of digital age. *Indian Journal of Educational Technology*, 3(1), 99–107. https://journals.ncert.gov.in/IJET/article/view/496

Guo, S., Zheng, Y., & Zhai, X. (2024). Artificial intelligence in education research during 2013–2023: A review based on bibliometric analysis. *Education and Information Technologies, 29*, 16387-16409. https://doi.org/10.1007/s10639-024-12491-8

Gupta, S. K., & Saranya, T. S. (2024). Navigating the digital frontier: The unique challenges and opportunities of education in India. *Pedagogy and Education Management Review,4* (18). https://doi.org/10.36690/2733-2039-2024-4-24

Gupta, S., & Jaiswal, R. (2024). How can we improve AI competencies for tomorrow's leaders: Insights from multi-stakeholders' interaction. *International Journal of Management Education, 22* (3). https://doi.org/10.1016/j.ijme.2024.101070

Hajam, K. B., & Purohit, R. (2024). The ethics of artificial intelligence: A critical examination of moral responsibility and autonomy. I*ndian Journal of Educational Technology*, 6(2), 398–407. https://journals.ncert.gov.in/IJET/article/view/513

Higgs, J. M., & Stornaiuolo, A. (2024). Being human in the age of generative AI: Young people's ethical concerns about writing and living with machines. *Reading Research Quarterly, 59* (4), 632-650. https://doi.org/10.1002/rrq.552

Hinojo-Lucena, F. J., Aznar-Diaz, I., Caceres-Reche, M. P., & Romero-Rodriguez, J. M. (2019). Artificial intelligence in higher education: A bibliometric study on its impact in the scientific literature. *Education Sciences, 9*(1). https://doi.org/10.3390/educsci9010051

Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European*

Journal of Education, 57, 542-570. https://doi.org/10.1111/ejed.12533

Hooda, M., Rana, C., Dahiya, O., Riswan, A., Hossain, M. S. (2022). Artificial intelligence for assessment and feedback to enhance student success in higher education. *Mathematical Problems in Engineering*. https://doi.org/10.1155/2022/5215722

Hotte, K., Somers, M., & Theodorakopoulos, A. (2023). Technology and jobs: A systematic literature review. *Technological Forecasting and Social Change, 194.* https://doi.org/10.1016/j.techfore.2023.122750

Huiling, M., Ismail, L., & Weijing, H. (2024). A bibliometric analysis of artificial intelligence in language teaching and learning (1990–2023): Evolution, trends and future directions. *Education and Information Technology, 29*, 25211-25235. https://doi.org/10.1007/s10639-024-12848-z

Hyde, S. J., Busby, A., & Bonner, R. L. (2024). Tools or fools: Are we educating managers or creating tool-development robots? *Journal of Management Education, 48*(4), 708-734. https://doi.org/10.1177/10525629241230357

Ifenthaler, D., Majumdar, R., Gorissen, P., Judge, M., Mishra, S., Raffaghelli, J., & Shimada, A. (2024). Artificial intelligence in education: Implications for policymakers, researchers, and practitioners. *Technology, Knowledge and Learning, 29*, 1693-1710. https://doi.org/10.1007/s10758-024-09747-0

Ivanova, M., Grosseck, G., & Holotescu, C. (2024). Unveiling insights: A bibliometric analysis of artificial intelligence in teaching. *Informatics, 11*(1). https://doi.org/10.3390/informatics11010010

Jaleniauskiene, E., Lisaite, D., & Daniuseviciute-Brazaite, L. (2023). Artificial intelligence in language education: A bibliometric analysis. *Sustainable Mutilingualism, 23*(1). https://doi.org/10.2478/sm-2023-0017

Kanvaria, V. K., & Ritika. (2024). Exploring the integration of artificial intelligence in lesson planning for pre-service teachers. *Indian Journal of Educational Technology*, *6*(2), 340–345. https://journals.ncert.gov.in/IJET/article/view/455

Kapoor, V., & Bakhshi, A. K. (2025). Artificial intelligence and the future of education. *Indian Journal of Educational Technology*, 7(1), 389–397. https://journals.ncert.gov.in/IJET/article/view/837

Karan, B. (2024). Integration of artificial intelligence by Central Board of Secondary Education in India: Towards innovative teaching and learning practices. *Teaching, Pedagogy and Education, 33*(4). https://doi.org/10.1080/1475939X.2024.2337924

Kartal, G., & Yesilyurt, Y. E. (2024). A bibliometric analysis of artificial intelligence in L2 teaching and applied linguistics between 1995 and 2022. *ReCALL, 36*(3), 359-375. https://doi.org/10.1017/S0958344024000077

Kavitha, K., & Joshith, V. P. (2024). The transformative trajectory of artificial intelligence in education: The two decades of bibliometric retrospect. *Journal of Educational Technology Systems, 52*(3). https://doi.org/10.1177/00472395241231815

Li, K. C., & Wong, B. T. M. (2023). Artificial intelligence in personalised learning: A bibliometric analysis. *Interactive Technology and Smart Education,20*(3). https://doi.org/10.1108/ITSE-01-2023-0007

Lin, Y., & Yu, Z. (2024). A bibliometric analysis of artificial intelligence chatbots in educational contexts. *Interactive Technology and Smart Education, 21*(2), 189–213. https://doi.org/10.1108/ITSE-12-2022-0165

Lopez, S., Sarada, V., Praveen, R.V. S., Pandey, A., Khuntia, M., & Haralayya, B. (2024). Artificial intelligence challenges and role for sustainable education in India: Problems

and prospects. *Library Progress International, 44*(3), 18261-18271. https://dx.doi.org/10.2139/ssrn.5031316

Lopez-Chila, R., Llerena-Izquierdo, J., Sumba-Nacipucha, N., & Cueva-Estrada, J. (2024). Artificial intelligence in higher education: An analysis of existing bibliometrics. *Education Sciences, 14*(1). https://doi.org/10.3390/educsci14010047

Ma, T. (2025). Systematically visualizing ChatGPT used in higher education: Publication trend, disciplinary domains, research themes, adoption and acceptance. *Computers and Education: Artificial Intelligence, 8*. https://doi.org/10.1016/j.caeai.2024.100336

Majid, I. & Lakshmi, V. Y. (2022). An analysis of artificial intelligence initiatives and programmes in India. In A. Rana., A.K. Rana., S. Dhawan., S. Sharma., & A. E. Elngar (Eds.), Convergence of Deep Learning and Artificial Intelligence in Internet of Things. (1st ed, pp. 281-292). CRC Press. https://doi.org/10.1201/9781003355960-19

Mannuru, N. R., Sakib, S., Teel, A. Z., Wand, T., Lund, B. D., Tijani, S., Pohboon, C. O., Agbaji, D., Alhassan, J., Galley, J., Kousari, R., Ogbadu-Oladapo, L., Saurav, S. K., Srivastava, A., Tummuru, S. P., Uppala, S., & Vaidya, P. (2023). Artificial intelligence in developing countries: The impact of generative artificial intelligence (AI) technologies for development. *Information Development*. https://doi.org/10.1177/02666669231200628

Manoj, K. L., George, R. J., & Anisha, P. S. (2023). Bibliometric analysis research for medical research. Indian Psychological Medicine, 45(3). https://doi.org/10.1177/02537176221103617

Maphosa, V., & Maphosa, M. (2023). Artificial intelligence in higher education: A bibliometric analysis and topic modeling approach. *Applied Artificial Intelligence, 37*(1). https://doi.org/10.1080/08839514.2023.2261730

Memarian, B., & Doleck, T. (2023). ChatGPT in education: Methods, potentials, and limitations. *Computers in Human Behavior: Artificial Humans, 1*(2). https://doi.org/10.1016/j.chbah.2023.100022

Metli, A. (2023). Articles on education and artificial intelligence: A bibliometric analysis. *Journal of Social Sciences and Education,* 279-312. https://doi.org/10.53047/josse.1352197

Ministry of Human Resources and Development. (2020). *National Education Policy 2020*. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English.pdf

Mouta, A., Pinto-Llorente, A. M., & Torrecilla-Sanchez, E. M. (2023). Uncovering blind spots in education ethics: Insights from a systematic literature review on artificial intelligence in education. *International Journal of Artificial Intelligence in Education, 3*4, 1166-1205. https://doi.org/10.1007/s40593-023-00384-9

Naggar, A. E., Gaad, E., & Inocencio, S. A. M. (2024). Enhancing inclusive education in the UAE: Integrating AI for diverse learning needs. *Research in Developmental Disabilities, 147*. https://doi.org/10.1016/j.ridd.2024.104685

Nehru, R. S. S., Paredes, S., Roy, S. C., Cuong, T. Q., & Huong, B. T. T. (2025). Implementing the revised Bloom's taxonomy (2001) in AI-digital and online learning environments: A strategic approach. *Indian Journal of Educational Technology*, 7(1), 173–189. https://journals.ncert.gov.in/IJET/article/view/854

NITI Aayog. (2018). *National strategy for artificial intelligence*. https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

Onesi-Ozigagun, O., Ololade, Y. J., Eyo-Udo, N. L., Ogundipe, D. O. (2024). Revolutionizing education through AI: A comprehensive review of enhancing learning experiences. *International Journal of Applied Research in Social Sciences, 6*(4), 589-607. https://doi.org/10.51594/ijarss.v6i4.1011

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computer and Education: Artificial Intelligence, 2*. https://doi.org/10.1016/j.caeai.2021.100020

Passas, I. (2024). Bibliometric Analysis: The Main Steps. *Encyclopedia.* 4. 1014-1025. https://doi.org/10.3390/encyclopedia4020065

Pradana, M., Elisa, H. P., & Syarifuddin, S. (2023). Discussing ChatGPT in education: A literature review and bibliometric analysis. *Cogent Education, 10*(2). https://doi.org/10.1080/2331186X.2023.2243134

Prahani, B. K., Nisa, K., Suliyanah, Deta, U. A. (2025). Evaluation of ChatGPT research in STEAM education. *International Journal of Evaluation and Research in Education* (*IJERE)*,*14*(1), 598-611. http://doi.org/10.11591/ijere.v14i1.30423

Pu, S., Ahmad, M. N., Khambari, M. N. M., & Yap, N. K. (2021). Identification and analysis of core topics in educational artificial intelligence research: A bibliometric analysis. *Cypriot Journal of Educational Science. 16*(3), 995-1009 https://doi.org/10.18844/cjes.v16i3.5782

Rahiman, H. U., & Kodikal, R. (2024). Revolutionizing education: Artificial intelligence empowered learning in higher education. *Cogent Education, 11*(1). https://doi.org/10.1080/2331186X.2023.2293431

Rashid, M. F. A. (2023). How to conduct a bibliometric analysis using R packages: A Comprehensive Guidelines. *Journal of Tourism, Hospitality & Culinary Arts, 15*(1), 24-39. https://www.researchgate.net/publication/372134180

Rehman, A. U., Behera, R. K., Islam, M. S., Abbasi, F. A., & Imtiaz, A. (2024). Assessing the usage of ChatGPT on life satisfaction among higher education students: The moderating role of subjective health. *Technology in Society, 78*. https://doi.org/10.1016/j.techsoc.2024.102655

Samala, A. D., Sokolova, E. V., Grassini, S., & Rawas, S. (2024). ChatGPT: A bibliometric analysis and visualization of emerging educational trends, challenges, and applications. *International Journal of Evaluation and Research in Education (IJERE), 13*(4), 2374-2387. http://doi.org/10.11591/ijere.v13i4.28119

Shahzad, M. F., Xu, S., Lim, M. W., Yang, X., & Khan, Q. R. (2024). Artificial intelligence and social media on academic performance and mental well-being: Student perceptions of positive impact in the age of smart learning. *Helion, 10*. https://doi.org/10.1016/j.heliyon.2024.e29523

Shang, L. (2024). Bibliometric analysis of potential themes and trend development of ChatGPT in the field of education. *Advances in Educational Technology and Psychology, 8*(3). http://dx.doi.org/10.23977/aetp.2024.080308

Singh, S. V., & Hiran, K. K. (2022). The impact of AI on teaching and learning in higher education technology. *Journal of Higher Education Theory and Practice, 22*(13). https://doi.org/10.33423/jhetp.v22i13.5514

Song, P., & Wang, X. (2020). A bibliometric analysis of worldwide educational artificial intelligence research development in recent twenty years. *Asia Pacific Education Review, 21*, 473-486. https://doi.org/10.1007/s12564-020-09640-2

Soorinarayanan, S., Aziz, S. A., Elumalai, G., Chanthiran, M., Khan, T.K. A., & Ruskova, D. (2025). Beyond the court: How virtual reality is changing the game for athletes. *Journal of Advanced Research in Applied Sciences and Engineering Technology, 48*(1), 77-88. https://doi.org10.37934/araset.48.1.7788

Sorell, T. (2022). Cobots, "co-operation" and the replacement of human skill. *Ethics and Information Technology, 24*. https://doi.org/10.1007/s10676-022-09667-6

Srinivasa, K. G., Kurni, M., & Saritha, K. (2022). Harnessing the power of AI to education. *Learning, Teaching, and Assessment Methods for Contemporary Learners,* 311-342. https://doi.org/10.1007/978-981-19-6734-4_13

Su, J., & Zhong, Y. (2022). Artificial intelligence (AI) in early childhood education: Curriculum design and future directions. *Computers and Education: Artificial Intelligence, 3*. https://doi.org/10.1016/j.caeai.2022.100072

Subroto, P. W., Malik, M., Raditya, A., & Saputra, N. N. (2024). A bibliometric analysis on artificial intelligence in mathematics education. *JRAMathEdu (Journal of Research and Advances in Mathematics Education), 9*(1), 1–15. https://doi.org/10.23917/jramathedu.v9i1.2429

Sugunan, P. S., & Thiyagu, K. (2025). Navigating the role of ChatGPT in education from the perspectives of PhD scholars. *Indian Journal of Educational Technology*, 7(1), 213–224. https://journals.ncert.gov.in/IJET/article/view/861

Talan, T. (2021). Artificial Intelligence in Education: A Bibliometric Study. *International Journal of Research in Education and Science, 7*(3), 822-837. https://doi.org/10.46328/ijres.2409

Tapalova, O., & Zhiyenbayeva, N. (2022). Artificial intelligence in education: AIEd for personalised learning pathways. *The Electronic Journal of e-Learning, 20*(5), 639-653. https://eric.ed.gov/?id=EJ1373006

Ullrich, A., Vladova, G., Eigelshoven, F., & Renz, A. (2022). Data mining of scientific research on artificial intelligence in teaching and administration in higher education institutions: A bibliometrics analysis and recommendation for future research. *Discover Artificial Intelligence, 2*. https://doi.org/10.1007/s44163-022-00031-7

University Grant Commission. (2024). Guideline for the introduction of skill-based courses and micro-credentials in higher educational institutions and SOP for implementation. 3261004_Draft-Guidelines-for-Introduction-of-Skill-based-courses-and-MCs-in-HEIs-and-SOP-for-Implementation.pdf

Veldhuis, A., Lo, P. Y., Kenny, S., & Antle, A. N. (2025). Critical artificial intelligence literacy: A scoping review and framework. *International Journal of Child-Computer Interaction, 4*3. https://doi.org/10.1016/j.ijcci.2024.100708

Yadav, P., & Srivastava, A. (2024). ChatGPT and social science research in higher education. Indian Journal of Educational Technology, 6(2), 273–281. https://journals.ncert.gov.in/IJET/article/view/446

Yun, G., Lee, K. M., & Choi, H. H. (2024). Empowering student learning through artificial intelligence: A bibliometric analysis. *Journal of Educational Computing Research, 62* (8). https://doi.org/10.1177/07356331241278636

Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environment, 11*(28). https://doi.org/10.1186/s40561-024-00316-7

Zhang, X., & Umeanowai, K. O. (2025). Exploring the transformative influence of artificial intelligence in EFL context: A comprehensive bibliometric analysis. *Education and Information Technologies, 30*, 3183-3198. https://doi.org/10.1007/s10639-024-12937-z

Zheltukhina, M. R., Sergeeva, O. V., Masalimova, A. R., Budkevich, R. L., Kosarenko, N. N., & Nesterov, G. V. (2024). A bibliometric analysis of publications on ChatGPT in education: Research patterns and topics. *Online Journals of Communication and Media Technologies, 14*(1). https://doi.org/10.30935/ojcmt/14103

Zupic, I., & Cater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods, 18*(3), 429-472. https://doi.org/10.1177/1094428114562629