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Mapping AI in Social Sciences: A Bibliometric Study of Its Influence in Higher Education

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Abstract

Purpose

This study investigates the paradigm shift in higher education by examining the role of artificial intelligence (AI) as a crucial tool within the social sciences discipline. The research aims to identify key trends, influential publications, and leading contributors, co-occurrences of keywords, bibliographic coupling, co-citation & co-authorship analysis in AI research in higher education.

Design/Methodology/Approach

A bibliometric analysis was conducted using a dataset of 762 published articles sourced from the Scopus database, covering the period from 2019 to 2023. The analysis focused exclusively on published articles, excluding queued to press, conference papers, and books to ensure the reliability and thorough originality of the findings.

Findings

The study reveals a significant increase in AI-related research within higher education during the analysed period. Key trends were identified, along with the most influential authors, institutions, and publications driving the field. The findings highlight the growing importance of AI in reshaping educational practices within the social sciences.

Limitations

The research is constrained by its exclusive reliance on the Scopus database, which may have potentially missing relevant articles from other sources. Also, the focus on published articles omits emerging research presented in conference papers or books, potentially narrowing the scope of the analysis.

Keywords: Artificial Intelligence, Higher Education, Social Science, Artificial Intelligence in Education, Bibliometric Analysis

1. Introduction

Artificial intelligence (AI) plays an important role in higher education and is profoundly influencing the academic and everyday lives of students (Chen et al., 2020). Platforms powered by AI are enabling educators to craft highly tailored learning environments, catering to the diverse needs of students while encouraging active engagement and critical thinking

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(Zhang & Aslan, 2021). Moreover, the use of AI in research has begun to unlock new avenues for exploration, offering unprecedented analytical power and data processing capabilities that are proving invaluable for researchers(Maphosa & Maphosa, 2023; Zemel et al., 2013).
A recent report suggests that this emerging sector is set to grow rapidly, with expectations of an impressive 42% compound annual growth rate over the next ten years.

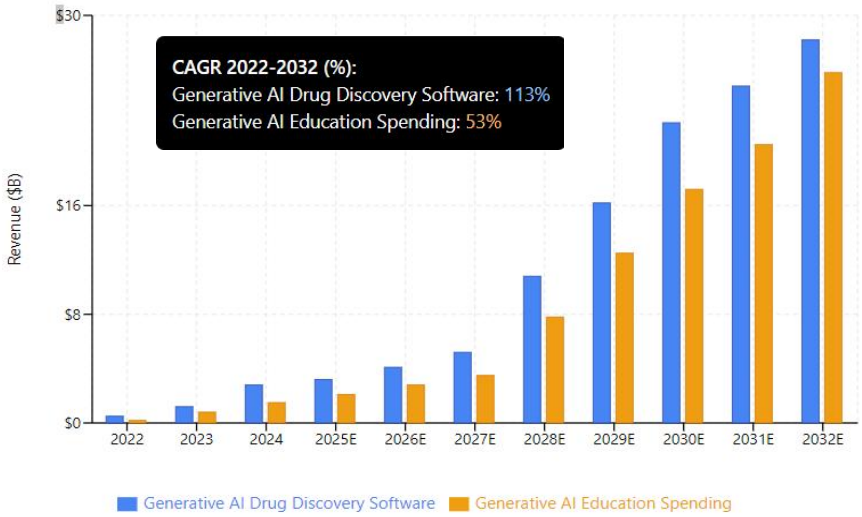

Figure 1.Revenue Projection across AI Education in Upcoming Years (Source: Bloomberg)
Soaring demand for GAI products could generate approx. $280 billion in additional software revenue, with the generative AI market potentially reaching $1.3 trillion by 2032 ("Generative AI to Become a $1.3 Trillion Market by 2032, Research Finds | Press | Bloomberg LP," 2023).

1.1 Artificial Intelligence & Higher Education

A recent survey by Oxford University Press showed that 76% of academic researchers around the world use some form of generative AI in their work (Heaton, 2024), and a survey by Elsevier reported that a substantial majority of researchers (95%) and clinicians (93%) anticipate that AI will be utilized for spreading misinformation. Furthermore, 86% of researchers and 85% of clinicians are concerned that AI will lead to significant mistakes, with a comparable proportion expressing worries about AI diminishing critical thinking abilities. Additionally, 79% of clinicians and 80% of researchers fear that AI will create societal disruptions. (*Insights 2024 | Attitudes toward AI | Elsevier*, 2024). AI in education has evolved from computers and web-based platforms to more advanced systems like cobots,

humanoid robots, and chatbots. These technologies enhance teacher effectiveness, leading to improved instructional quality. Additionally, AI personalizes learning materials to fit students' individual needs, enriching their overall learning experience (Chen et al., 2020). Farazouli et al. (2024) found in their results, that ChatGPT demonstrated a high passing rate, exceeding 66%, in addressing home examination questions across humanities, social sciences, and legal studies.

1.2 Artificial Intelligence, Malpractices & Ethical Challenges

After OpenAI's chatbot launched in November 2022, it was quickly criticized as a tool that made cheating on assignments easy. Los Angeles Unified School District and others worldwide soon blocked access. By January, school districts across the English-speaking world, including the US and Australia, had banned the software. MIT Technological Review (2023) suggests the fear of AI in originality of work and loosing intellectuals. Advanced generic AI tools such as ChatGPT pose a significant challenge as they are able to closely mimic students' work and are therefore difficult to distinguish from the students' own contributions. This raises concerns about untraceable plagiarism and cheating, prompting a re-evaluation of many established assessment methods (Farazouli et al., 2024).AI in education is not without its challenges. While AI offers numerous benefits, it is important to address potential concerns, such as ensuring academic integrity and mitigating potential biases in AI algorithms (Chen et al., 2020).

1.3 Artificial Intelligence, Limitations & Evaluation

AI learning is presently viewed as an educational aid in its initial phase, but as learning needs evolve, AI-driven education is expected to assume a more significant role. Currently, it offers courses of varying difficulty levels based on basic rule-based decisions and has yet to achieve its full potential in intelligent education (Chen et al., 2020). Farazouli et al. (2024) support that ChatGPT-generated texts are based on factors like nonsensical phrases, repetitive vague arguments, and an impersonal tone lacking personal opinions or emotional expression. The findings highlighted that while AI chatbots like ChatGPT offer potential benefits to the educational landscape, their introduction also presents challenges for maintaining academic integrity and necessitates a re-evaluation of traditional assessment methods.

Students who understand AI are better prepared to work with GenAI, recognizing its capabilities and risks, including ethical & moral concerns. This awareness promotes more responsible GenAI use. The study also points out that higher education should focus on improving students' digital and media skills, helping them handle future challenges and make informed choices when it comes to generative AI(Chiu, 2024). The study found a lack of consensus among university staff on the impact of AI in higher education and a great deal of ambiguity about best practices further concluded that potential impact on academic integrity to be overstated and also raised requirement of more professional development (Lee et al., 2024). Further, like all emerging technologies, a balance must be struck between potential benefits and possible drawbacks, requiring careful consideration and oversight. Students' top concerns about AI relate to originality, critical thinking, and ethics. The most common reasons students give for not using AI are: Lack of originality and innovation, Limited critical thinking skills, Over-reliance on technology, Misinformation and inaccurate information & Unintentional plagiarism (Malik et al., 2023). Memarian & Doleck (2023) proposed evaluating AI using Fairness, Accountability, Transparency, and Ethics (FATE) but found

inconclusive results, "*The scarcity of work done on accountability and transparency, the all-encompassing characteristics of ethics, and the blurry explanations of fairness and bias warrant more discussions and a clearer explanation and examination of all FATE terms*.", also specific concerns related to 'trust and privacy,' 'interactivity,' and 'information quality' were raised by (Saihi et al., 2024).

1.4 Artificial Intelligence in Higher Education – Bibliometric Analysis

Bibliometric techniques enable researchers to derive insights from aggregated bibliographic data created by other scholars, reflecting their perspectives through citations, collaborations, and publications. Analysing this data reveals the field's structure, social connections, and key topics (Zupic & Čater, 2015). Bibliometric methods serve primarily two functions: evaluating performance and mapping scientific domains (Cobo et al., 2011). Performance analysis looks at how much researchers and institutions are publishing, while science mapping explores how different areas of science are connected and how they develop over time(Zupic & Čater, 2015).

Chu et al. (2022) conducted a review of the 50 most cited articles on AI in higher education, finding that AI is primarily used to predict student outcomes, particularly dropout and retention rates, with a focus on engineering courses. Most studies employed quantitative methods and often used data from student log files. Knowledge elicitation through expert interviews was common, though mixed methods are increasingly used. The primary research focus was on learning behaviour, with limited exploration of AI's role in enhancing higher-order thinking, collaboration, or student self-efficacy. The authors suggested future research should expand AI's application to more disciplines than STEM.

López-Chila et al. (2024) conducted a bibliometric study of 870 articles from the Scopus database examining the growth and impact of AI research in higher education from 2017 to 2023 while Hinojo-Lucena et al. (2019) carried out a detailed bibliometric study covering the years 2007 to 2017, utilizing data from the WoS and Scopus databases. Their analysis uncovered a notable rise in proceedings papers as the prevailing publication type, with the United States emerging as the leading contributor. Kavitha et al. (2024) conducted their bibliometric analysis primarily using data from the Scopus database. The study focused on publications related to AI in higher education from 2000 to 2022. A total of 775 publications were analysed by them, covering a wide range of topics within the scope of AI in higher education The study observed a sharp increase in AI-related publications in higher education after 2015, with the most significant growth occurring during and after the COVID-19 pandemic. In their bibliometric analysis, Bircan and Salah (2022) focused on the trends and influential authors in AI research within higher education in the Social Science Discipline using the WOS and Scopus index between 2015-2020 of 11007 articles.

Although a notable no. of previous bibliometric analyses suggests insights into the ever-growing usage of AI in Higher Education across multidisciplinary fields i.e., Science and STEM, there are marked deficiencies in the exploration of AI's usage specifically within the social science domain of Higher Education in recent years. To that end, this review aims to chart the landscape of AI applications within the context through a bibliometric lens, focusing on contemporary insights and potential future research avenues in AI in education (AIEd) in

the Social Science discipline. Consequently, the study addresses the following research questions (RQs):
RQ1. What are the trends in publication related to AI in higher education within social sciences (number of papers published per year)?
RQ2. Where are the most influential publications on AI in higher education within social sciences found (journals, articles)?
RQ3. Who are the leading figures in advancing AI in the domain of higher education within social sciences (authors, countries, and institutions)?
RQ4. What insights can be drawn from previous studies on AI in higher education within social sciences (themes, topics, keywords)?
RQ5. What are the potential avenues for further research to expand our understanding of AI in higher education within social sciences?

2. Methods

2.1 Bibliometric Analysis

Bibliometrics has become a trend in academic research in recent years (Donthu et al., 2020). This research examined AI in higher education using bibliometric analysis methodology, a widely recognized scientific tool across various disciplines (Zhu et al., 2023). Bibliometric analysis effectively captures trends in article and journal productivity, reveals the interconnections between publications and authors, and maps collaboration patterns through visual representations (Donthu et al., 2021; Zupic & Čater, 2015).

2.2 Data Collection

Scopus was selected due to (1) its extensive bibliometric data for indexed publications, and (2) its rigorous coverage of publications that meet stringent indexing criteria, ensuring scientific and intellectual relevance. Scopus is widely recognized and often recommended for bibliometric evaluations (Donthu et al., 2021). The Time Frame Range has been selected for the last 5 years i.e., 2019-2023 since the span from 2019 to 2023, marked by the COVID-19 pandemic and AI-driven chatbots, has accelerated AI adoption and reshaped education, capturing the latest trends and groundbreaking developments similar to Genc & Kocak, (2024).

2.3 Data Pre-Processing

This procedure encompassed three successive stages: delineating the topic, parameters of scope, and eligibility criteria; evaluating the articles; and their subsequent inclusion, as illustrated in Figure 2. The initial search query aimed at identifying publications on AI and HE, utilizing the pertinent keywords specified in Figure 2. Strict inclusion and exclusion criteria were applied, with a focus on documents classified as "Article" in "English," appearing in academic "Journals" from 2019 to 2023. "artificial intelligence" and "higher education" are recognized descriptors in the ERIC (Education Resources Information Center) Thesaurus and are commonly used in Education Sciences.

2.4 Data Analysis

The study was performed as a series of bibliometric analyses using 762 articles retained from the bibliometric search conducted in Scopus. Only published articles were selected to ensure the robustness and integrity of the original work, providing a solid foundation for a comprehensive review. The data collected from the study were analysed using descriptive

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analysis techniques.Additionally, density maps for various variables were generated utilizing the Vosviewer (van Eck & Waltman, 2010) and R Studio Biblioshiny visual mapping program (Aria & Cuccurullo, 2017).

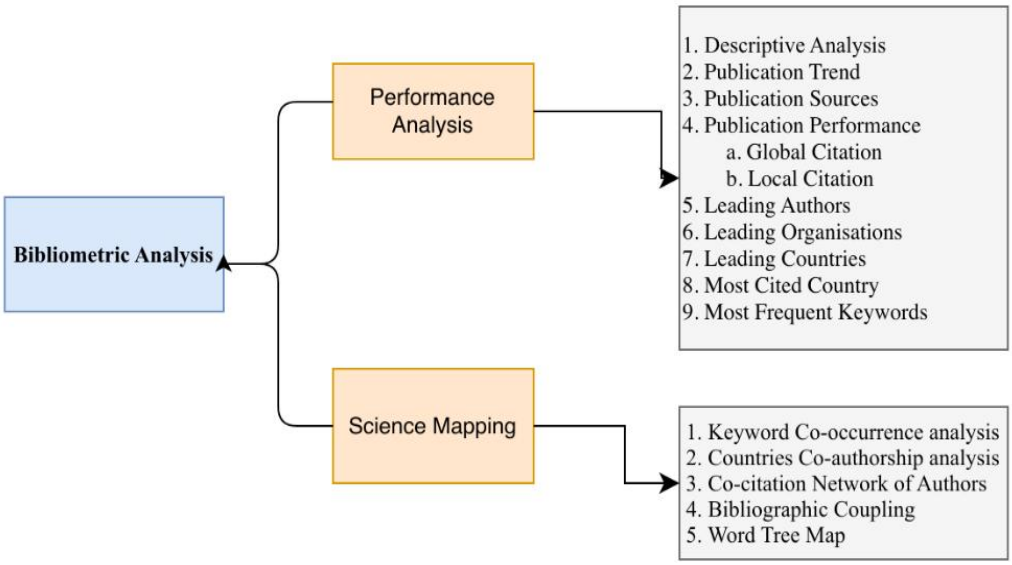
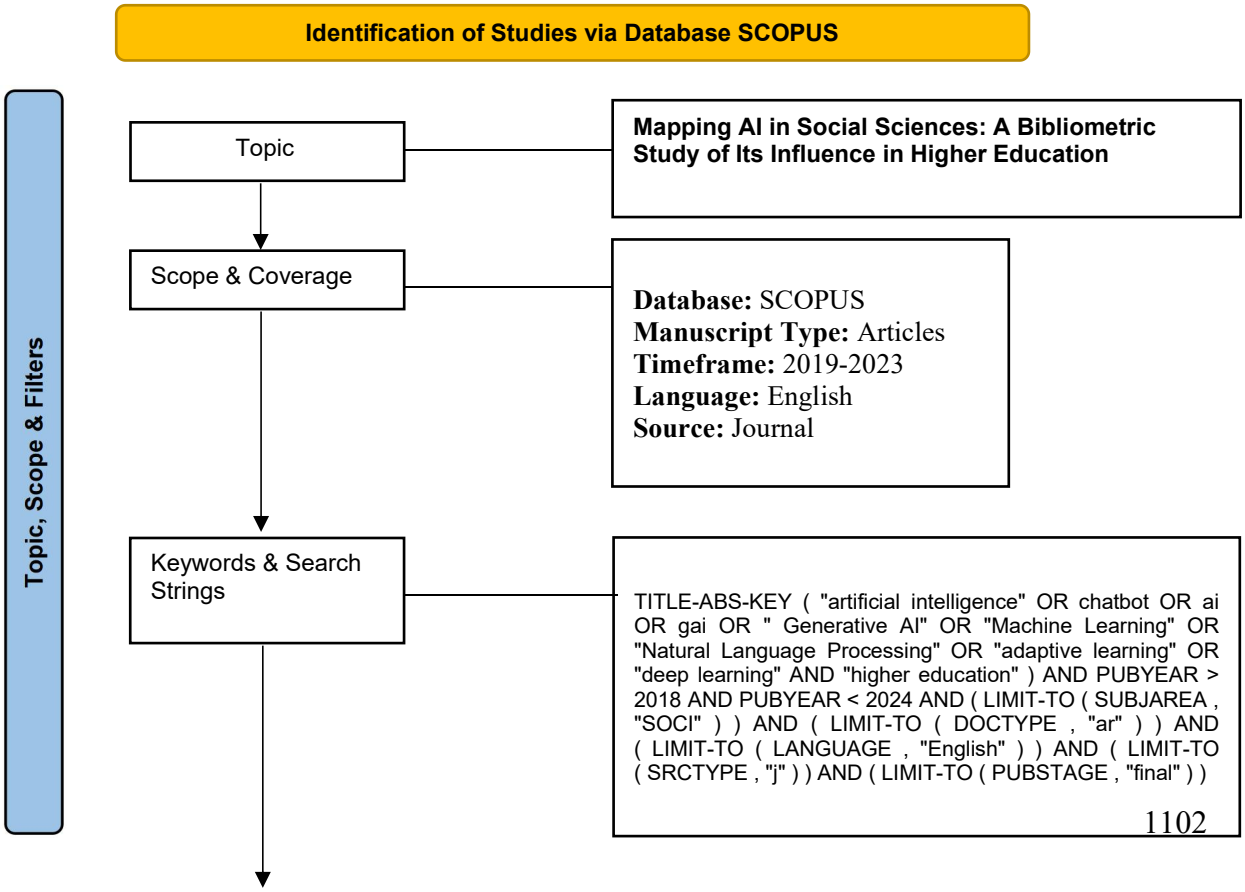


Figure 2. Analysis Strategy for Bibliometric analysis

Stage1-Stage 3 Screening and Selection of Data



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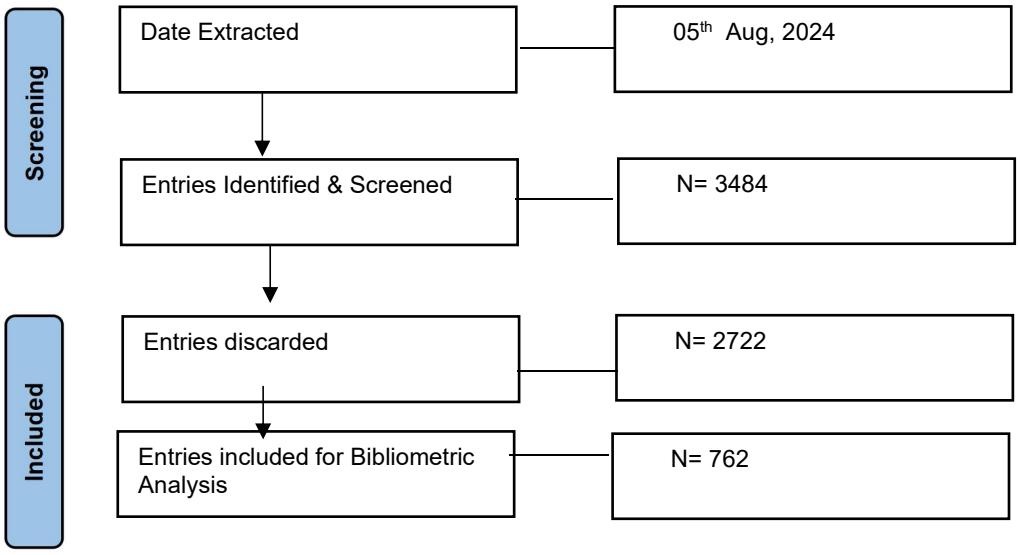

Figure 3. Search Strategy Flow Diagram adapted from Kavitha et al. (2024); Zakaria et al. (2021).

3. Results

3.1 Descriptive Analysis through R Package Software Biblioshiny

Table 1 Descriptive Report generated using Biblioshiny software

Main Information	Description	Results
Timeframe		2019:2023
Sources (Journals, Books, etc)	List of different journals	330
Manuscripts	Total no. of studies	762
Yearly Expansion Rate %	% Growth in no. of studies per yr.	57.06
Mean age of publications		2.11
Avg. citations per study	Total count of citations (36837) ÷ Total count of manuscripts (762)	17.47
References	Total no. of references	36837
MANUSCRIPT CONTENTS		
Keywords Plus (ID)	Total count of repeated phrases algorithmically detected in the titles of an article's references.	1376
Descriptive Elements	Total no. of keywords used by authors	2410
AUTHORS		
Authors	Total count of authors	2270
Authors of single-authored	No. of single authors per document	121
COLLABORATIVE		

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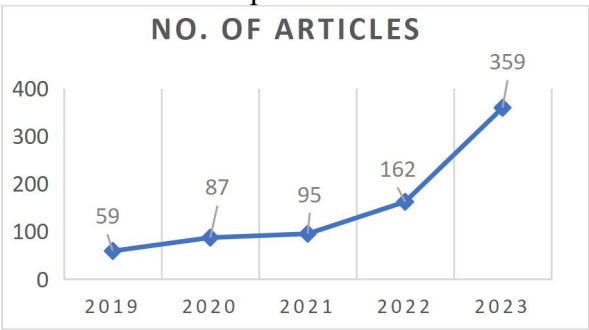
WORKS		
Articles with single author	No. of manuscripts with a single author collaborated	135
Co-Authors per article	Author counts (2270) ÷ Total no. of manuscripts (762)	3.21
Co-authorship across globe %	Different countries' author collaboration percentage	18.11
MANUSCRIPT TYPES		
Articles		762

3.2 Publication Trend of Scientific Productions (RQ1)

Table 2 No. of articles published in the period 2019-2023 with Graph.

Year	No. of Articles
2019	59
2020	87
2021	95
2022	162
2023	359



3.3 Publication Sources/Journal Quality Analysis (RQ2)

Table 3 Most Frequent Publication Journal

Source	h index	Q-Value	TC	NP	PY_start
SUSTAINABILITY (SWITZERLAND)	169	Q2	997	48	2019
EDUCATION AND INFORMATION TECHNOLOGIES (United States)	76	Q1	890	29	2020
COMPUTERS AND EDUCATION: ARTIFICIAL INTELLIGENCE (Netherlands)	29	Q1	505	22	2021
INTERNATIONAL JOURNAL OF EDUCATIONAL TECHNOLOGY IN HIGHER EDUCATION (Netherlands)	61	Q1	1062	19	2020
EDUCATION SCIENCES (Switzerland)	53	Q2	523	27	2019
INTERNATIONAL JOURNAL OF EMERGING TECHNOLOGIES IN LEARNING (Austria)	46	Q2	395	28	2019
JOURNAL OF APPLIED LEARNING AND TEACHING (Singapore)	13	Q2	1314	15	2022
JOURNAL OF UNIVERSITY TEACHING AND LEARNING PRACTICE (Australia)	22	Q2	522	9	2023
FRONTIERS IN EDUCATION (Switzerland)	40	Q2	63	13	2020

INDUSTRY AND HIGHER EDUCATION (US)	32	Q2	67	7	2021

Note: Ranking info collected from https://www.scimagojr.com

3.4 Publication Performance (RQ2)

Table 4 Top 10 Global Cited Published Articles

Sl. no.	Title of the Articles	Author	Total Citations	TC per Year	Normalized TC
1.	*"ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?"*	Rudolph J.; Tan S.; Tan S.	492	246.00	31.97
2.	*"War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education"*	Rudolph J.; Tan S.; Tan S.	262	131.00	17.02
3.	*"Adoption of artificial intelligence in higher education: a quantitative analysis using structural equation modelling"*	Chatterjee S.; Bhattacharjee K.K.	212	42.40	10.22
4.	*"Academic Integrity considerations of AI Large Language Models in the post-pandemic era: ChatGPT and beyond"*	Perkins M.	203	101.50	13.19
5.	*"Educational data mining: prediction of students' academic performance using machine learning algorithms"*	Yağcı M.	194	64.67	13.83
6.	*"Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020"*	Ouyang F.; Zheng L.; Jiao P.	183	61.00	13.04
7.	*"Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI)"*	Crawford J.; Cowling M.; Allen K.-A.	179	89.50	11.63
8.	*"A comprehensive AI policy education framework for university teaching and learning"*	Chan C.K.Y.	173	86.50	11.24
9.	*"ChatGPT in higher education: Considerations for academic integrity and student learning"*	Sullivan M.; Kelly A.; McLaughlan P.	173	86.50	11.24
10.	*"Artificial intelligence in higher education: A bibliometric study on its impact in the scientific literature"*	Hinojo-Lucena F.-J.; Aznar-Díaz I.; Cáceres-Reche M.-P.; Romero-Rodríguez J.-M.	160	26.67	5.20

Table 5 Top 10 Most Local Cited Articles

Sl. no.	Document Title	Author	Year	Local Citations	Global Citations	LC/GC Ratio (%)
1.	*"ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?"*	Rudolph et al.	2023	15	492	3.05
2.	*"Utilizing early engagement and machine learning to predict student outcomes"*	Gray et al.	2019	9	147	6.12
3.	*"ChatGPT in higher education: Considerations for academic integrity and student learning"*	Sullivan M et al.	2023	8	173	4.62
4.	*"War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education"*	Rudolph et al.	2023	8	262	3.05
5.	*"Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020"*	Ouyang et al.	2022	8	183	4.37
6.	*"The role of ChatGPT in higher education: Benefits, challenges, and future research directions"*	Rasul et al.	2023	7	113	6.19
7.	*"A two-phase machine learning approach for predicting student outcomes"*	Iatrellis et al.	2021	7	54	12.96
8.	*"Adoption of artificial intelligence in higher education: a quantitative analysis using structural equation modelling"*	Chatterjee et al.	2020	7	212	3.30
9.	*"What ChatGPT means for universities: Perceptions of scholars and students"*	Firat M	2023	6	111	5.41
10	*"My Teacher Is a Machine: Understanding Students' Perceptions of AI Teaching Assistants in Online Education"*	Kim et al.	2020	5	102	4.90

3.5 Top Leading Authors with Scientific Productions in SCOPUS (RQ3)

Table 6 Leading Authors with most Publications

Sl. no.	Authors	Articles	Sl. No.	Authors	Articles
1.	SALAS-RUEDA, RICARDO-ADÁN	11	6.	BANERES, DAVID	4

2.	CHAN, CECILIA KA YUK	6	7.	BERGAMIN, PER	4
3.	ILIĆ, MILENA P.	5	8.	COWLING, MICHAEL	4
4.	OUYANG, FAN	5	9.	CRAWFORD, JOSEPH	4
5.	SALLOUM, SAID A.	5	10.	FOMUNYAM, KEHDINGA GEORGE	4

Source(s): Author's own compilation using *Biblioshiny*

Table 7 Top 10 Authors with Highest Citation Scores (indices calculated from local source)

Name of Authors	h index	g index	m index	TC	NP
ILIĆ MILENA P.	5	5	1.25	287	5
CHAN CECILIA KA YUK	4	6	0.8	358	6
COWLING MICHAEL	4	4	2	207	4
CRAWFORD JOSEPH	4	4	2	219	4
KULETO VALENTIN	4	4	1	254	4
OUYANG FAN	4	5	1.333	284	5
RUDOLPH JÜRGEN	4	4	2	786	4
SALLOUM SAID A.	4	5	1	363	5
TAN SHANNON	4	4	2	786	4
AL KURDI BARWEEN	3	3	0.75	207	3

Source(s): Author's own compilation using *Biblioshiny*

3.6 Most Relevant and Leading Affiliations/Organisations (RQ3)

Table 8 Leading institutions affiliated with different nations producing most articles

Affiliation	Country	Articles
THE HONG KONG POLYTECHNIC UNIVERSITY	Hong Kong	20
ZHEJIANG UNIVERSITY	China	20
UNIVERSITAT DE VALÈNCIA	Spain	14
UNIVERSITAT OBERTA DE CATALUNYA	Spain	14
UNIVERSITY OF SOUTH AUSTRALIA	Australia	14
SCHOOL OF ENGINEERING AND SCIENCES	Mexico	11
SWISS DISTANCE UNIVERSITY OF APPLIED SCIENCES	Switzerland	11
THE UNIVERSITY OF HONG KONG	Hong Kong	11
THE UNIVERSITY OF JORDAN	Jordan	11
UNIVERSITY OF LEEDS	England	11

Source(s): Author's own compilation using *Biblioshiny*

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3.7 Leading Countries in the Scientific Productions and Local Citations

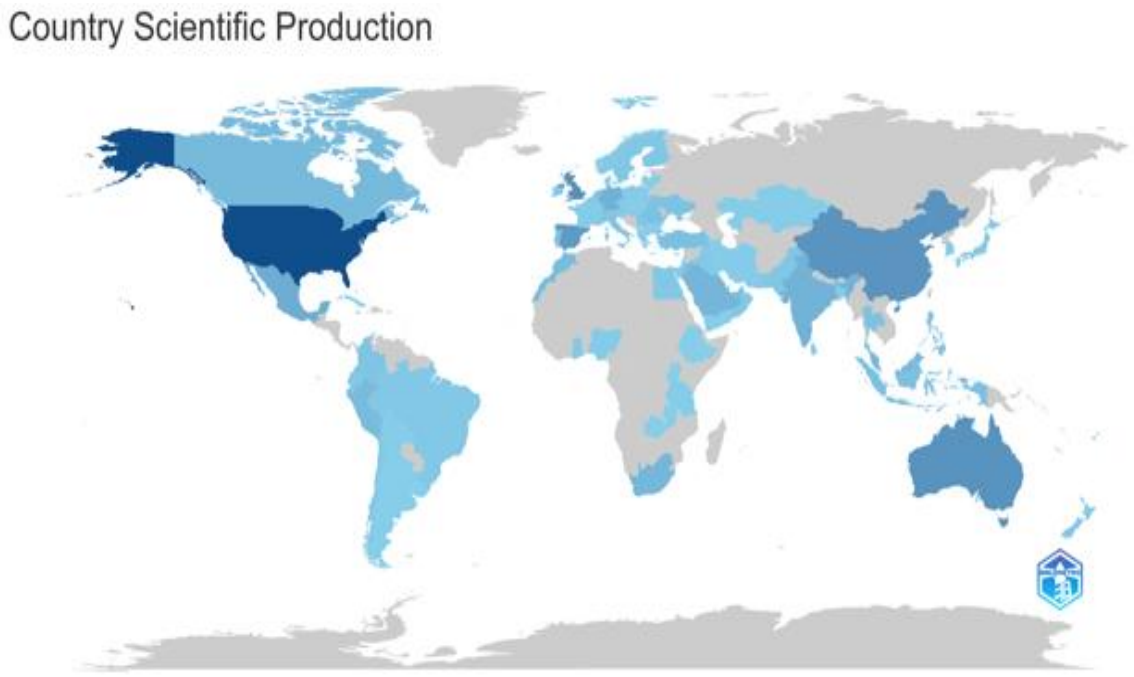

Figure 4. Density Map of the Countries with highest no. of Scientific Productions
Source(s): *Author's own compilation using Biblioshiny*

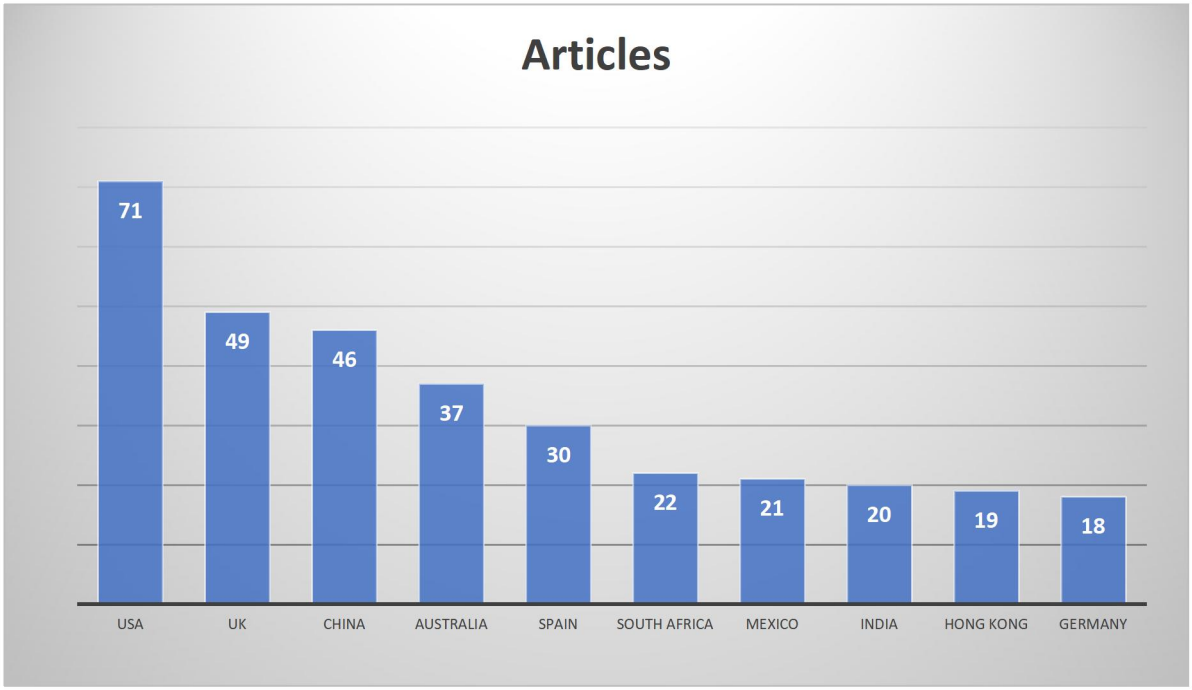

Figure 5. Graph of the Countries with highest no. of Scientific Productions
Source(s): *Author's own compilation using Biblioshiny*

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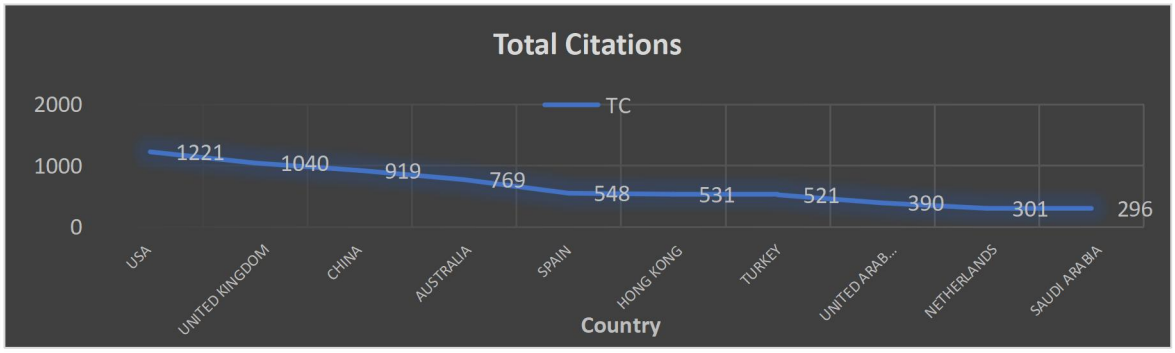

Figure 6. Top 10 Most Cited Countries

3.8 Co-occurrences of Authors' Keywords (RQ4)

Co-occurrences of authors' keywords refer to the frequency with which specific keywords appear together within the same set of publications. Density around Cluster 1's *artificial intelligence, higher education, machine learning and Cluster 2's learning system, education computing, students* keywords suggest growing interest and current trends of research in the above context.

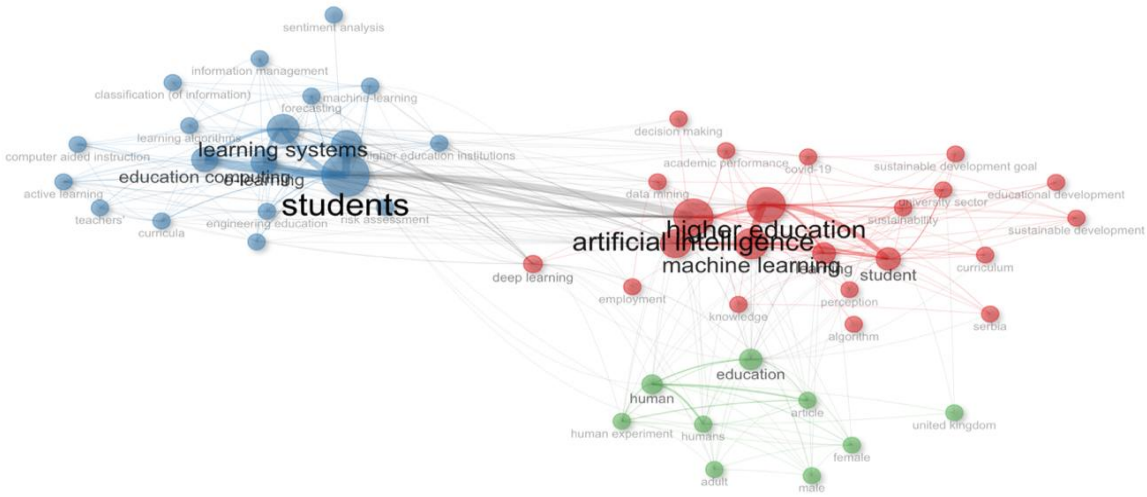

Figure 7. Most Co-occurred Authors' keywords
Source(s): VOSviewer

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3.9 Co-authorship Analysis based on Countries:

Among the 94 countries analysed, 51 countries met the threshold of minimum 5 documents produced by the country with at least 20 citations per country for network links. However, certain countries, including Zambia, Slovenia, Morocco, Fiji, Bulgaria, Lithuania, Poland, the Czech Republic, Kazakhstan, Iraq, Lebanon, Auckland, Somalia, and Ethiopia, exhibited no international co-authorship connections. USA followed by UK and Australia were prominent in result. This finding aligns with the observations of Selwyn et al. (2020) who noted that disparities in research focus and institutional support often hinder international collaboration in social science research on AI in education. Prominently, the United States (USA), followed by the United Kingdom (UK) and Australia, emerged as central hubs in the co-authorship network

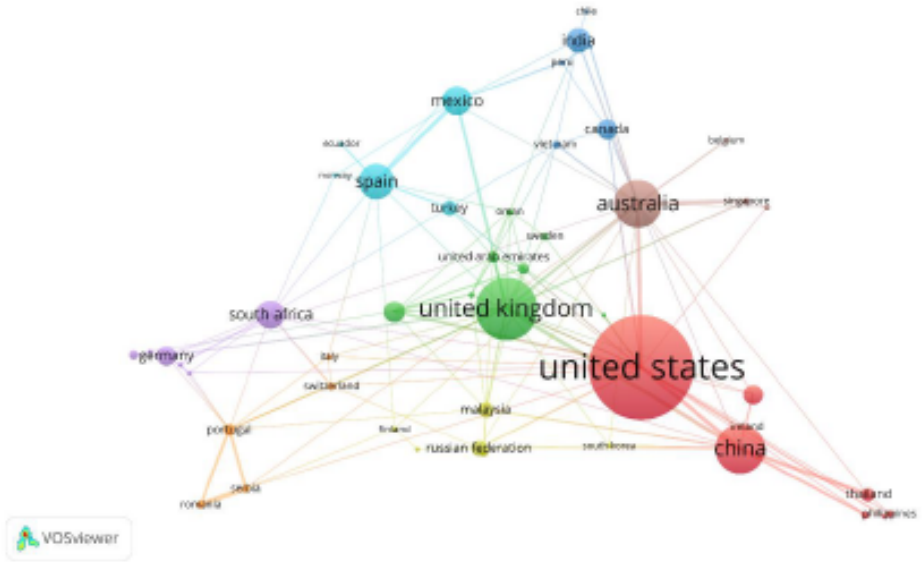

Figure 8. Co-authorship network Illustration using VOSviewer
Source(s): *Author's own compilation using VOSviewer*

Table 9 List of top 10 Countries with highest co-authorship with other countries

Country	Documents	Citations	Total link strength
United States	122	1939	42
United Kingdom	73	1382	37
Australia	56	1272	31
China	58	939	28
Portugal	14	274	17
Saudi Arabia	25	457	17
Spain	42	883	17
Mexico	34	421	14
Serbia	10	343	13

reflecting their dominant role in fostering international research collaborations in this field. This result is consistent with the findings of Zawacki-Richter et al. (2019), who highlighted the leading positions of these countries in AI-related research in higher education due to their advanced technological infrastructure and strong academic networks. Furthermore, the absence of international co-authorship ties among some countries resonates with the work of Luckin et al. (2016), who emphasized that limited access to AI resources and expertise often

restricts cross-border collaboration in social science research on AI in education. These insights underscore the uneven distribution of collaborative research efforts in the field of AI in higher education within the social sciences, as also noted by Williamson et al. (2020) in their analysis of global trends in AI and education research.

3.10 Co-Citation Network of Authors

At the forefront, Gasevic, D. (139 citations, 365 link strength) emerges as the most influential author, followed by Tan, S. (105 citations, 341 link strength) and Sarstedt, M. (88 citations, 239 link strength), reflecting their foundational contributions and central roles in shaping the discourse. The strong presence of Rudolph, J. (70 citations, 311 link strength) and Bond,M. (69 citations, 218 link strength) highlights their collaborative influence, aligning with Selwyn et al. (2020), who emphasized interdisciplinary collaboration in advancing AI in education. Similarly, Zawacki-Richter, O. (68 citations, 196 link strength) and Ringle, C.M. (63 citations, 227 link strength) reflect the interconnectedness of scholars bridging theory and practice, as noted by Williamson et al. (2021).

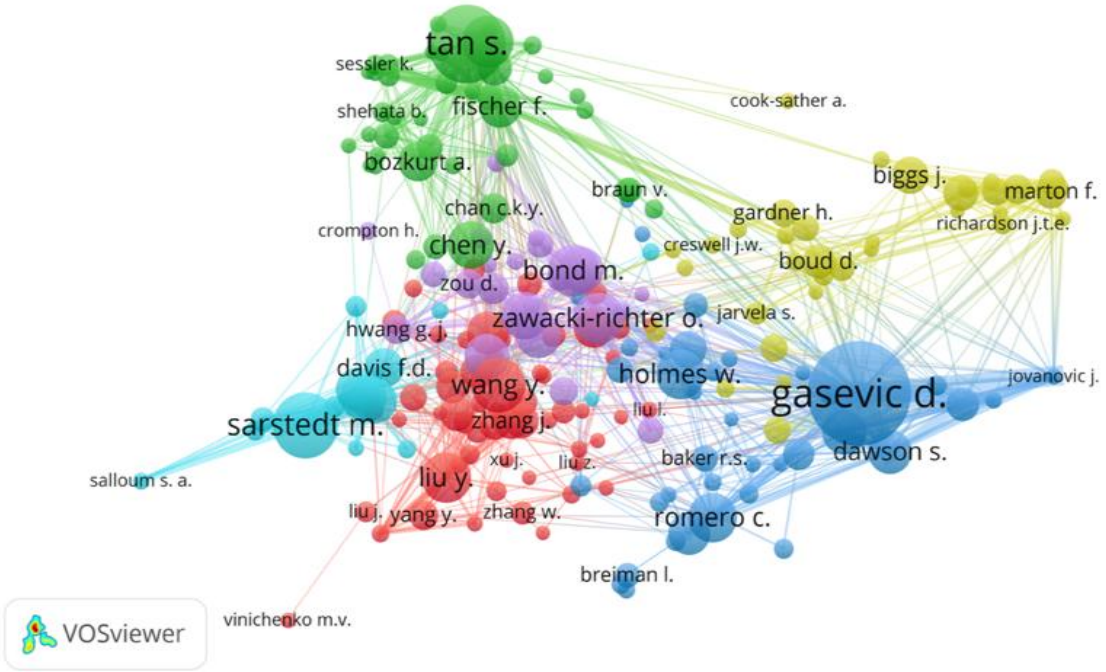

Figure 9. Co-citation Network Illustration using VOSviewer

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Table 10 List of top 10 authors cited together more often

Author	Citations	Total Link Strength
Dragan Gasevic	139	365
Shannon Tan	105	341
Marko Sarstedt	88	239
Jürgen Rudolph	70	311
Melissa Bond	69	218
Olaf Zawacki-Richter	68	196
Christian M. Ringle	63	227
Haoran Xie	63	145
Shane Dawson	59	257
Frank Fischer	57	69

Source(s): Author's own compilation using *VOSviewer*

3.11 Bibliographic Coupling (based on documents)

This approach aligns with the methodology emphasized by Kessler, 1963, who first introduced bibliographic coupling as a means to uncover relationships between documents based on their shared citations. Figure 10 shows that, out of 762 documents, with 5 or more citations count, 412 documents exhibited network relationship, in which Rudolph (2023b), Chatterjee (2020), and Yağcı (2022) were prominent works of respective authors which shared their bibliography most in their produced articles.

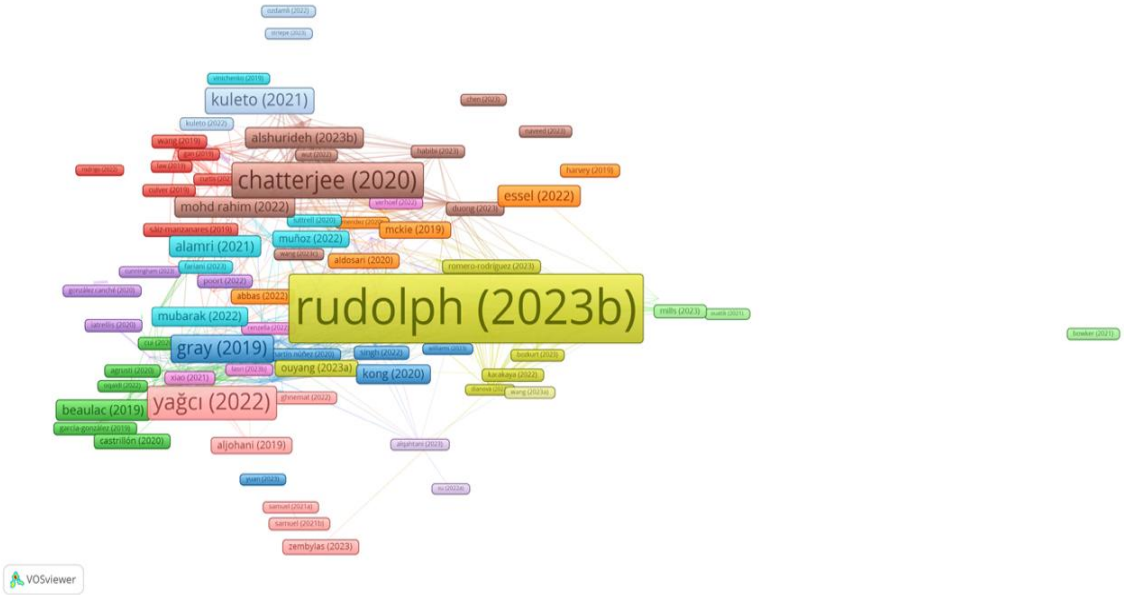

Figure 10. Bibliographic Coupling Illustration generated using VOSviewer Software

3.12 Word Tree Map: Most Frequent Keywords (used by the authors)

It underscores the most commonly recurring terms in the research on AI within the domain of higher education. From the Figure 11, The top keywords include "*student*" (77 occurrences), "*artificial intelligence*" (72), "*higher education*" (65), "*machine learning*" (56), and "*learning systems*" (45) indicating the central themes and areas of focus in the literature

during the period from 2019 to 2023. The results are congruent with previous studies like of Chen et al. (2020) employed word tree maps in their bibliometric review of AI in education,identifying "machine learning," "learning analytics," and "personalized learning" as central themes.

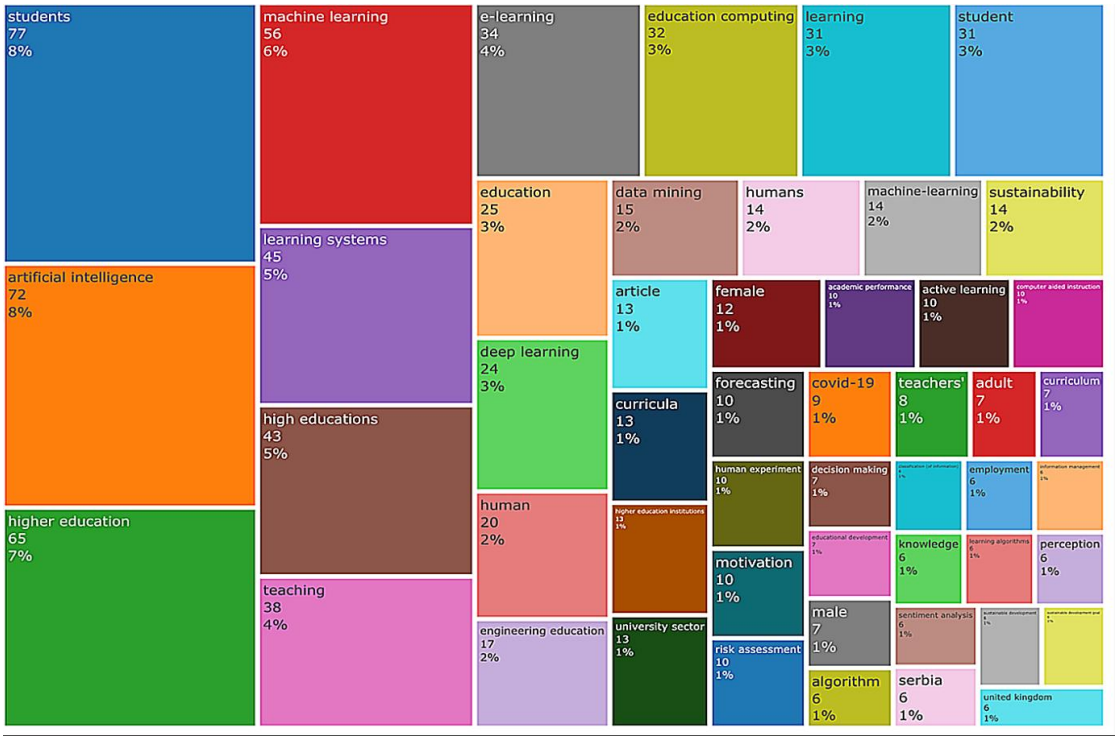

Figure 11. Word Tree Map of most used words (*Generated using Biblioshiny*)

3.13 Topic Building Cluster Analysis

In this study, we conducted a co-citation analysis of 36,481 cited references to explore the intricating structure of the research domain. Using VOSviewer, a threshold of a minimum of four citations per cited reference was applied, resulting in the selection of 130 references that met the criterion. Among these, 126 references were interconnected, forming a robust citation network depicted in Figure 12. The clustering algorithm identified six distinct clusters, each representing a thematically coherent research area. These clusters indicate the presence of interrelated subfields within the broader research domain, allowing for a deeper understanding of the key conceptual foundations.

3.13.1 Learning Strategies and Analytical Techniques – Cluster 1

This cluster focuses on learning strategies and analytical techniques, highlighting key research contributions. The study "Random Forests" (2001) has been cited 8 times, emphasizing its impact on predictive modelling in education. Xing & Du (2019) explores adaptive learning framework Massive open online courses (MOOCs) and Traditional Education System comparison with optimizing dropout prediction model in novel learning system. (6 citations). Bird et al. (2009) and Tomasevic et al. (2020) examine data-driven decision-making including supervised data mining techniques to predict learning performances (6 citations each). Additionally, Long et al. (2011) contributes to the field of learning analytics (6 citations). These works collectively advance knowledge in educational data mining and AI-driven learning techniques.

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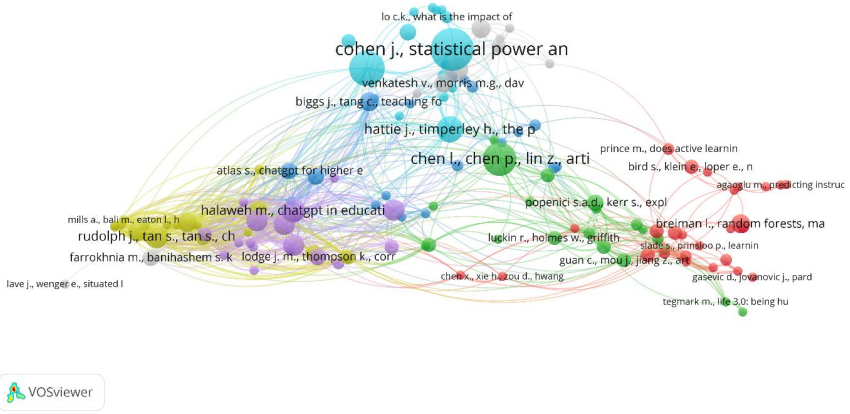

Figure 12. Co-citation Analysis of Cited References

3.13.2 Artificial Intelligence Tools in Higher Education -Cluster 2

This cluster focuses on AI-driven tools in higher education. Chen et al. (2020) provides a foundational perspective on AI-powered assessment tools (14 citations). Popenici & Kerr (2017) and Luckin et al. (2016) analyse AI-based tutoring systems, their contributions and limitations (7 and 6 citations, respectively). Guan et al. (2020) investigates AI-enhanced curriculum development (6 citations), while Zawacki-Richter et al. (2019) explores AI chatbots in student engagement (6 citations). These studies underscore the transformative potential of AI tools in enhancing higher education methodologies.

3.13.3 Traditional vs Contemporary Teaching in the age of AI -Cluster 3

This cluster examines the shift from traditional to AI-enhanced teaching methods. Biggs & Tang (2011) analyses how AI-driven personalization reshapes instructional design (8 citations). "ChatGPT User Experience: Implications for Education" (2022) and "ChatGPT for Higher Education and Professional Development" (2023) explore AI-assisted learning environments (7 citations each). "Artificial Intelligence as an Effective Classroom Assistant" (2016) and Roll & Wylie (2016) discuss AI's role in improving classroom engagement (5 citations each). This cluster highlights the evolving landscape of AI-supported education.

3.13.4 ChatGPT in Higher Education and Existing Literature Review – Cluster 4

This cluster focuses on ChatGPT's role in academic settings. Rudolph et al. (2023) provides an extensive review of ChatGPT's educational applications (10 citations). Crawford et al. (2023) evaluates AI-generated content for instructional use (8 citations). Zawacki-Richter et al. (2019) and Baidoo-Anu & Ansah (2023) investigate ethical concerns surrounding ChatGPT's impact on academic integrity (7 citations each). These studies highlight the growing influence of conversational AI in teaching, learning, and research.

3.13.5 Large Language Models (LLM) in Education and Post-Pandemic Era relevance – Cluster 5

This cluster explores the impact of LLMs like ChatGPT on education post-COVID-19. *"ChatGPT in Education: Strategies for Responsible Implementation"* (2023) offers best practices for AI adoption (10 citations). Rudolph et al. (2023) and Kasneci et al. (2023) discuss AI's role in remote learning (9 citations). *"ChatGPT: The End of Online Exam Integrity?"* (2022) raises concerns about academic honesty (9 citations), while *"AI Large Language Models in the Post-Pandemic Era"* (2023) addresses the long-term implications of

AI in education (9 citations). These studies underscore the disruptive yet beneficial role of AI in post-pandemic learning.

313.6 Psychology and Cognitive Theory in Pedagogy -Cluster 6

This cluster examines AI's intersection with psychology and cognitive learning theories. "*Statistical Power Analysis for the Behavioral Sciences*" (1988) provides a methodological foundation for studying AI's cognitive effects (18 citations). The foundational work on thematic analysis in psychology by Braun and Clarke (2006) provides a methodological framework for examining qualitative aspects of learning, while Hattie et al. (2007) established the critical role of feedback in classroom settings for effective student development. These seminal studies offer valuable lenses through which to evaluate artificial intelligence's emerging role in educational environments. By applying these frameworks, researchers can systematically analyse how AI-driven educational tools compare to traditional teaching methods, particularly in their ability to provide personalized feedback and adapt to individual learning patterns (15 and 11 citations, respectively). Freire P.'s "*Pedagogy of the Oppressed*" (1970) critiques traditional education as a "banking model", where students passively receive knowledge, advocating instead for a dialogical approach that encourages critical thinking and empowerment. The study emphasizes on radicalization that education should be a tool for social transformation, enabling the oppressed to challenge and change unjust systems through active participation and reflection effectively relevant in modern context of AI intervention in education (6 citations). These studies contribute to the understanding of AI's role in psychological and cognitive implications in learning.

4. Discussion

This study aimed to explore the integration of artificial intelligence (AI) in higher education by addressing five key research questions (RQs). The findings are discussed below, with relevant literature supporting or contradicting our results.

Our analysis indicates a substantial increase in AI-related publications within higher education, particularly in the social sciences. Between 2019 and 2023, there was a 500% growth in research output, reflecting a growing academic interest in AI applications. This trend aligns with prior studies highlighting the expanding role of AI in educational contexts (Zawacki-Richter et al., 2019). However, some studies argue that despite this growth, AI research in the social sciences remains underdeveloped compared to STEM fields (Chu et al., 2022). In terms of geographic distribution of scholarly influence, the findings reveal a consistent pattern of leadership among key nations in this research domain. The United States, United Kingdom, China, Australia, and Spain emerged as the five most productive and influential countries based on publication output and citation metrics. This hierarchical arrangement aligns remarkably with the bibliometric analysis conducted by Talan (2021), suggesting a stable concentration of research activity and impact within these national academic communities. Where USA, UK, and China lead in AI research in higher education, with 71, 49, and 46 articles respectively, reflecting their prominent roles. Countries like Australia, Spain, and India also show growing contributions, indicating a broad global interest and increasing research activity in this field. Moreover, trending topics from 2019's male, adult, and human experiments have shifted to artificial intelligence, higher education in 2022, and deep learning in 2023. The journal with the highest no. of publications, SUSTAINABILITY (SWITZERLAND) holds Q2 ranking with an h-index of 169 followed by EDUCATION AND INFORMATION TECHNOLOGIES from the US with a Q1 ranking

and h-index of 76 shows their prominence and influence in AI and education research in Social Science.

The bibliometric analysis reveals that leading journals publishing AI-related research in social sciences include inter-disciplinary *Sustainability (Switzerland)*, *Education and Information Technologies*, and *Computers and Education: Artificial Intelligence*. These journals have high citation impact, reinforcing their influence on the discourse surrounding AI in higher education. This trend is consistent with findings from previous bibliometric studies (Kavitha et al., 2024; López-Chila et al., 2024).

Co-citation and bibliometric coupling analyses identified key scholars contributing to AI research in higher education, including Gasevic, Tan, Sarstedt, and Rudolph. Their work primarily focuses on predictive analytics, adaptive learning, and academic integrity. This finding is consistent with previous research e.g., Selwyn et al. (2020) that recognizes these scholars as central to AI education research. However, some authors, such as Williamson et al. (2020), argue that AI research is overly concentrated in a few geographic regions, limiting diverse perspectives. Through Co-citation analysis of authors, Gasevic. D emerged as the author who shared the most citations with other authors with a citation count of 139 and a link strength of 365, these findings align with the previous result produced by Kavitha et al. (2024).

Key themes emerging from AI research include personalized learning, ethical considerations, and AI-driven assessment methods. The increasing reliance on generative AI tools like ChatGPT raises concerns regarding academic integrity, bias, and misinformation (Farazouli et al., 2024). Scholars such as Memarian & Doleck (2023) advocate for the Fairness, Accountability, Transparency, and Ethics (FATE) framework to address these challenges. However, other researchers, Lee et al. (2024) argue that fears surrounding AI's impact on education are often overstated.

5. Conclusion

It has been observed that during the last 5 years, Literature has seen a surge in studies on Artificial Intelligence. From the study, it is revealed that between 2019 and 2023, the number of publications on AI in higher education grew by over 500%, reflecting a significant shift in academic focus. While the period from 2019 to 2021 saw steady growth, the publication count surged by 70.5% in 2022 and more than doubled in 2023, indicating that AI in higher education has rapidly evolved from a niche area to a major research focus, driven by technological advancements and widespread adoption in educational institutions in Post-Pandemic Era. Social sciences, characterized by qualitative analysis, human behaviour studies, policy evaluation, and societal impact research, are increasingly leveraging AI for text mining, sentiment analysis, network modelling, and predictive analytics (Tomasevic et al., 2020). AI-driven tools enhance data collection and analysis in fields such as sociology, political science, psychology, and economics, enabling scholars to process large datasets, identify trends, and refine theoretical frameworks with greater precision. In education, AI supports adaptive learning, personalized curriculum design, and automated qualitative coding, improving both student engagement and faculty research productivity evident through 2019 post-pandemic surge in MOOCs and ML based fuzzy logic system adaptability, more

nuanced interpretations of human interactions in Social Science research domain (Perkins, 2023).

Established from past & present studies, potential avenues for future research are favouring towards long-term effects of AI in higher education, ethical issues, and reshaping pedagogy. Future research should investigate the long-term impact of AI-driven education models, ethical challenges, and institutional adoption dynamics. There is also a need for cross-disciplinary research integrating AI into humanities and social sciences education. Expanding collaboration across diverse regions can help address the current geographical concentration of AI research as also noted by Williamson et al. (2020) in their findings. Furthermore, promoting AI literacy among educators and students is critical for responsible AI adoption in academic settings, which is congruent to the view of Chiu (2024).

Furthermore, exploring its integration across multiple disciplines (Kavitha et al., 2023), understanding the dynamics of institutional adoption (Rudolph et al., 2023), promoting collaboration, enhancing AI proficiency among educators, instructors, and students, and devising robust policies that guide its responsible use (Halaweh, 2023). However, ethical dilemmas and disparities in global research contributions must be addressed to facilitate the responsible and equitable implementation of AI in educational settings.

6. Limitations

This study has several limitations. It reviews published research on AI in higher education from 2019 to 2023, specifically within the social sciences and related disciplines, using data primarily from the Scopus database as of August 5th, 2024, and focusing solely on English-language journals. Consequently, this analysis excludes more recent publications and non-English journals, which may result in variations in the findings in general. Additionally, the study does not include conference papers, books, or book chapters, which may hold other insights and prospects for Artificial Intelligence and Higher Education.

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