Research Article

Ethical Dimensions of Artificial Intelligence in Educational Technology and Policy: A Global Bibliometric Analysis (2020–2025)

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Background: Artificial Intelligence (AI) has shown a vast likelihood of integration in education, which has brought in personalization and efficiency changes to education. Yet it also brings up the important issues of privacy, equity and transparency. More recent studies stress the fact that these issues needed to be analyzed in an objective and ethical manner. The objective of the study is to establish and focus on the global trends in AI ethics as applied to the educational policy and technology. It discusses how analysts are trying to tackle the spheres of ethics and where they fail. *Methodology:* The employed bibliometric approach studied 342 peer-reviewed articles included in Scopus in 2020-2025. The use of VOSviewer software was done in analysis of citation patterns, keyword trends and author collaboration networks. It concentrated on ethics-related, governance-related, and standards-related AI literature on education. *Findings:* The identified essential ethical issues are privacy of data, integrity in academia, and justice in AI application. Less popular of the topics, e.g., algorithmic bias, blockchain technologies, child-centered ethics reflect large gaps in research. The academic output and collaboration were led by United States, United Kingdom and China. The discussion is asymmetrical in space and disciplinary lines despite the increasing interest in the construct worldwide. *Conclusion:* The current study underlines the necessity of education-related research on AI ethics that is more policy- and interdisciplinary-focused. It demands the deeper integration of technological change and ethical policy structures to maintain a sustainable equality in educational innovational advancement.

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1. Introduction

Artificial intelligence (AI) entered the education system increasingly every day. This number was estimated to had experienced 47.5% growth from 2017 to 2021[1][2] (Crompton & Song, 2021). With emerging technologies such as AI based on data analysis, intelligent tutoring, and learning systems, teaching methods were undergoing radical changes. Post-2018 studies had revealed that AI can reduce study time before exams by 15-20% and improve learning outcomes by 25-30%[3]. From 2018 to 2022 AI adoption in the US was estimated to had increased by 48%[4]; however, the majority of teachers had no awareness of the long-term implications of AI in schools[5].

On the other hand, concerns about data privacy, algorithmic bias, fairness, and transparency, especially in colleges and universities were main causes for the confusion relate to AI ethics and governance[6][7][8][9]. Also, it was hard to create one set of regulations that fits all situations since different places had different ethical norms and regulations[10][11]. This problem is addressed by models such as the FRAPPE framework (Frame, Pixel, Place, Event) and socio-developmental models for ethical aids, yet education systems take a different path to implementation[12][13].

Bibliometric analysis presents a powerful method aiming to track research trends, detect knowledge gaps, and examine the international debate on AI in education[14][15] (van Eck, 2005). It provides a finely focused scrutiny of the scholarly literature, theme development, and cooperation networks based on huge databases such as Scopus[16][17] (Gavira-Marin et al., 2018). However, these approaches were rarely used to investigate matters of governance and ethics, which was something that ought to change (Setyowati, 2020). The present study strives to remedy this by providing a rigorous bibliometric analysis of the linkage of AI, ethics, and education policy recently.

The study thus very ambitiously planed to analyze in an interdisciplinary way many difficult political, educational technology, and AI-related decisions and identify the main ethical principles and dilemmas in this emerging area. The research located leading authors and nations engaged in the debates with a special focus on scholarly work from 2020-2025, and mapped published work in terms of publication trends. Attention would be given to collaboration mapping and identified the research that needs to be done to inform further academic and policy responses in this fast-moving domain. To do that, the following questions would be asked:

1. What was the volume and disciplinary distribution of research on ethical AI in education from 2020–2025 in Scopus?
2. What were the principal ethical issues and conceptual themes that were being considered in the AI and educational technology research papers?
3. What were the collaboration patterns and knowledge networks associated with global research in ethical AI within education?
4. Who were the key authors and intellectual groups in this domain?
5. What were the ethical blind spots or under-researched areas that merit attention for future research?

2. Literature Review

Academic interest in AI for education had increased in recent years, especially since 2018[18][16] (Durak et al., 2024). AI driven technologies enriched education so that better educational services can be provided at more reasonable prices and in more accessible ways. Subsequently, these services created better performances for students in school[19][20]. On the other hand, there were some important ethical issues concerning AI issues of data privacy and algorithmic bias[21][22].

Automated evaluation, facial recognition, and adaptive learning technologies can unknowingly promote discriminatory treatment based on gender and race[23] (Akgun & Greenhow, 2021). A pressing need was proven for improved education about AI and systems that were positioned differently in terms of gender and culture[6][24][25]. The ethical issues surrounding AI in education can be grouped under four headings that overlap: Ethics and Principles, Explainability and Transparency, AI in Education, and Bias and Fairness[26].

Regulations on education affecting AI governance were then lawfully recognized in roughly 10% of establishments[27]. The national policies in most countries give little attention to the most pressing ethical questions and give greater weight to bureaucratic and technical issues[28]. To support this, some governance models such as the AI Ecological Education Policy Framework had been proposed to ensure the ethical and fair use of AI[29] (Ren Bin Lee Dixon, 2022). The objectives were to respect human dignity, do no harm, respect individuals' rights, uphold privacy, and promote responsible use[30].

Organizations such as the Ada Lovelace Institute (2019), AI Now Institute (2017), DeepMind Ethics and Society[31], Future of Life Institute (2013), and the Institute for Ethical Artificial Intelligence and Machine Learning (2018) inherit the task of developing ethical guidelines for AI. The The General Data Protection

Regulation in the European Union was among the first ethical frameworks aiming to secure personal data and avoid its abuse[32].

This policy framework focused on being accountable for educational innovation, encourages open discussions, and was based on teaching principles, but there were still significant gaps due to the large number of studies being done. Most AI research concentrates on the technical or instructional side while barely focusing on regulations or ethics. When ethics were even considered, there was fragmentation with no in-depth research on it[33][6]. This paper analyzes 2020 world literature on AI-in-education and policy ethical issues, addressing gaps in studies on ethics across different regions.

3. Method

According to prior research, the preparation of a bibliometric review typically **followed** five key steps:1. Selecting the search terms 2. Conducting the first search 3. Refining the search term 4. Collecting the descriptive data and 5. Performing network and bibliometric analysis[34]. Besides that, Table 1 showed the search strategy for the Scopus database used in the present study.

Element	Details
Search Query	(TITLE-ABS-KEY("artificial intelligence") AND TITLE-ABS-KEY(ethic* OR "ethical issues" OR "ethical implications" OR "ethics in education") AND TITLE-ABS-KEY("educational technology" OR "digital learning" OR "technology in education" OR "AI in education" OR "intelligent tutoring systems" OR "learning analytics") AND TITLE-ABS-KEY("policy" OR "education policy" OR "AI policy")
Subject Areas	Social Sciences, Computer Science, Engineering, Arts and Humanities, Decision Sciences, Multidisciplinary
Document Types	Articles
Time Span	2015–2025
Language	English
Database	Scopus
Number	342 documents

Table 1. Search Strategy for Scopus Database

3.1. Data Collection and Analysis

In May 2025, 342 documents were collected from the Scopus database (www.scopus.com), as it was rich with peer-reviewed articles and was excellent in citation tracking[15][35]. Scopus was among the largest academic databases in the world and was well known for supporting the undertaking of complex bibliometric analyses because of quality data and searching features[16].

Data were downloaded in both.ris and.csv formats for the purpose of the analysis and utilized VOSviewer the most reputed software application which had capacity to map links, run advanced analyses, and visually display research patterns[36] (Van Eck & Waltman, 2010). Two main tools had been used to process

and analyze data. VOSviewer 1.6.20 had been used to draw bibliometric network visualization maps of co-authorship, keyword co-occurrence, and bibliographic coupling for different units of analysis. Microsoft Excel was used for cleaning data and making statistical calculations.

There were some parameters in place for the study just to make sure about the quality and relevance of the data. Peer-reviewed journal articles from 2020 to 2025 were selected also; only articles that were indexed in Scopus, which had been strictly peer-reviewed and had applied publishing ethics, were considered, thus preserving the integrity of the dataset. It should be noted that the articles had to refer either to laws, policies, or ethical issues with the use of artificial intelligence in education so as to be relevant to this research work. Meanwhile, only those articles published in English were considered and belonged to the subject areas such as Decision Sciences, Arts and Humanities, Computer Science, and Social Sciences. Conference proceedings, book chapters, editorials, and other non-peer-reviewed work were not considered, nor were articles not related to AI ethics, teaching, or policy. Items published outside the specified time limit or concerning a non-AI related topic were also excluded.

3.2. Limitations

While Scopus spreads itself over a broad array of topics, it certainly does not had data from special repositories or other databases like Web of Science. Putting such restrictions on journal articles published in English would perhaps result in missing research truly worthy being carried out in any other language or at presentation level.

4. Results

RQ1: What was the volume and disciplinary distribution of research on ethical AI in education from 2020–2025 in Scopus?

This study examined the Scopus database to research ethical AI and education. After this study filtered 825 papers for analysis, they were only able to analyze 342 research papers in May 2025. Figure 1 showed there had been an increasing number of articles from 2023 to their peak in 2024, which provided early evidence of increasing interest in examining the relationship between AI and education through applications. The authors of this research could only reflect on the benefits and ethical concerns in the use of AI in schools.

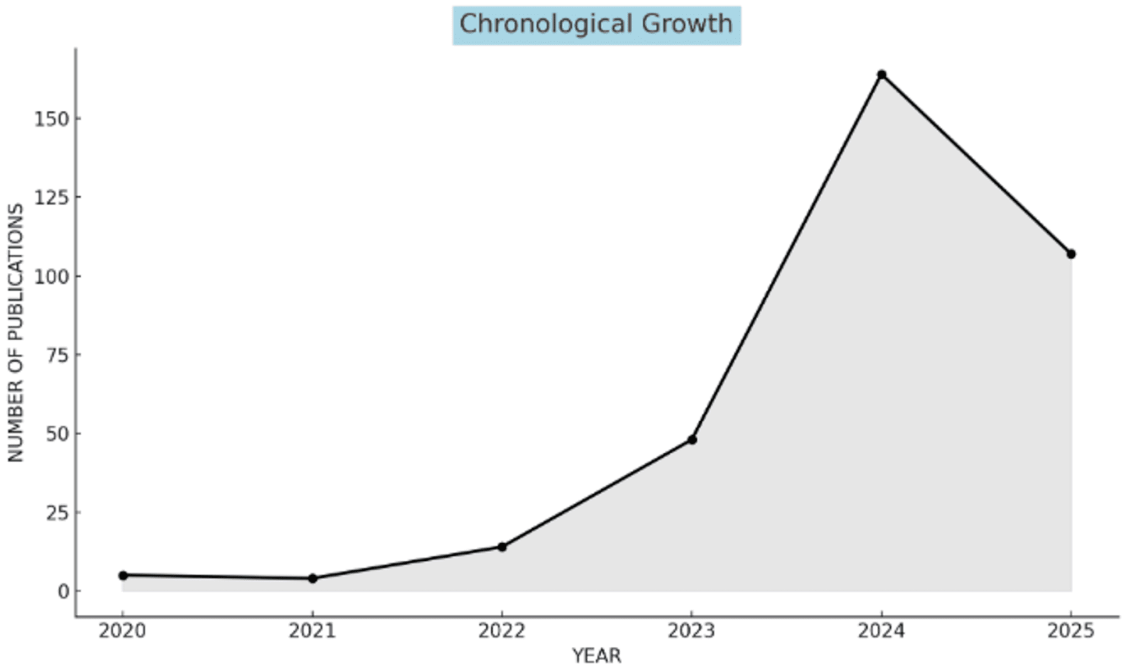

Figure 1. The number of papers and publications in relation to the ethical aspects of AI in education.

Table 2 showed that the majority of the studies reviewed (57%) stemmed from Social Sciences. Therefore, this discipline predominantly investigated human-centered or conceptual contexts. Following this was Computer Science (33.92%), which investigates the technological dimension of AI. There were also minor percentages of literature from Arts and Humanities (7.02%) and Decision Sciences (1.75%) indicating that variations of disciplines were investigating ethics and decision-making as well.

Subject Area	Count	Percentage
Social Sciences	196	57.31\%
Computer Science	116	33.92\%
Arts and Humanities	24	7.02\%
Decision Sciences	6	1.75\%

Table 2. Distribution of Publications by Subject Area

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RQ2: What were the principal ethical issues and conceptual themes that were being considered in the AI and educational technology research papers?

The scholars discussing AI in education indicated that it involved key ethical and intellectual issues, a likely consideration as a function of numerous keywords appearing together in keyword co-occurrence analyses (Figure 2). The co-occurrence keyword analysis enabled us, to develop specific keywords clusters, and to understand how ethical issues were defined and addressed across researcher contexts.

The yellow cluster highlighted the significance of AI for education, i.e., student perspectives that included academic integrity, and personalized learning. It refered to issues such as assessment, attendance, and explored how ChatGPT, for example, had fundamentally changed the level and quality of academic authorship, and had generated fresh queries regarding how generative AI software affected testing practices and learning processes. Within the yellow cluster and across the keyword data, the conversations had been focused specifically on the impacts that AI articles might have on academic integrity and learning outcomes, (i.e., elementary, secondary, and university).

The green cluster indicated the care that needed to be taken with technological meant so that security could be assured, and the privacy of our information was fulfilled. It demonstrated and details words such as privacy, transparent, trust, data, and technology. The issues related to privacy, transparency, and trust with educational technology also brings to the fore, the concern for data gathering of students, the processing of that student data, and subsequently the security of those data.

The red cluster refered to the area of governance where AI was involved in policies, and ethical rules of engagement. It did not take long to see words such as policy, ethical issues, and responsible use, for example, meaning researchers were looking at how schools can engage with AI for learning and what consequence of use technology had. This cluster expressed a huge level of importance for justice, fairness, and accountability, because it informed future AI in learning.

The blue cluster indicated the priority of putting the human aspects of responsible AI, integrity, and principles of use of AI as paramount. It expressed ethical supervision, transparency, and human judgement in a more automated, less human learning environment. While some terms directed toward colleges or medical colleges, the being in the issue was providing ethical judgement, and human oversight, in AI based learning.

These clusters pointed to a multifaceted ethical problem rife with challenges at the system, institution, and individual levels. Table 3 examineed five key ethical questions regarding AI in education, and

differences between AI based teaching approaches, psychology, policy, and technological influences.

Ethical Theme	Key Related Keywords
Data Privacy & Security	Data privacy, privacy, federated learning, differential privacy, security
AI Ethics & Responsibility	AI ethics, ethical considerations, philosophical aspects, systematic review
Academic Integrity	Academic integrity, ChatGPT, generative AI, student perceptions
Human Trust & Acceptance	Trust, motivation, attitude, human, psychology
Sustainability & Innovation	Sustainability, innovation

Table 3. Key Ethical Themes and Associated Keywords in AI and Education Research (2020–2025)

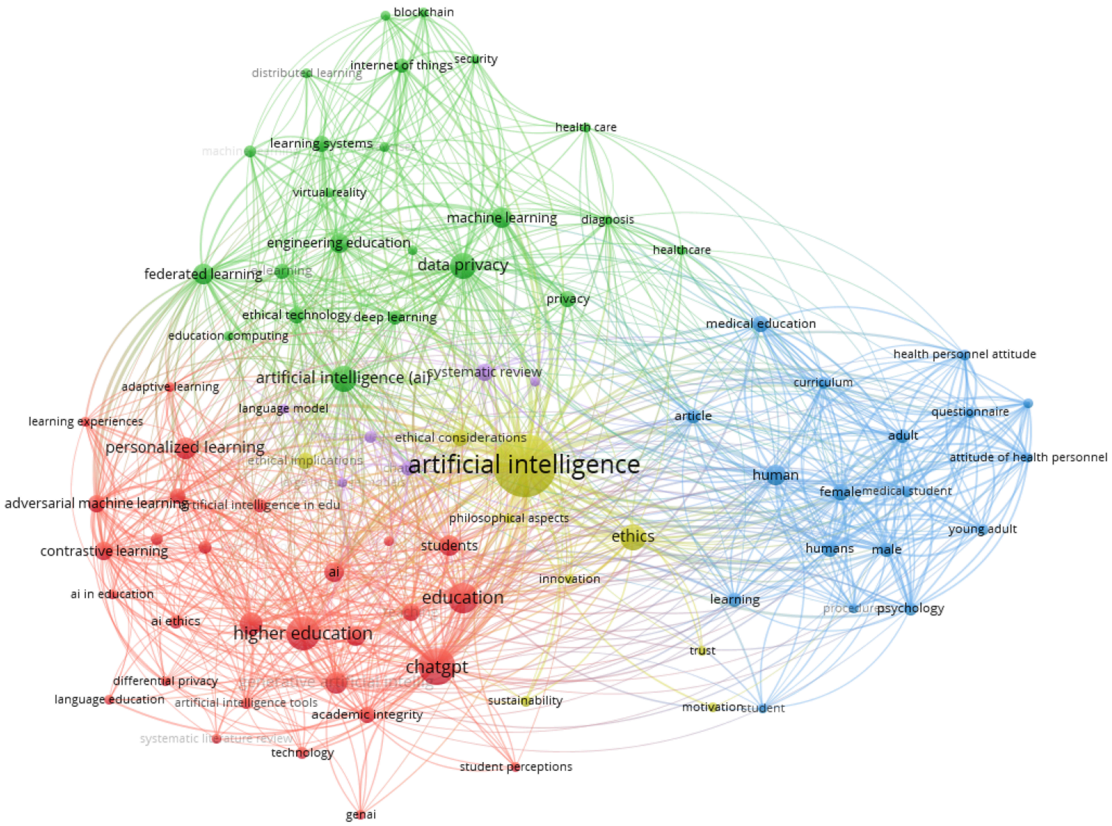

Figure 2. Co-occurrence All keywords for Most frequently used keyword

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RQ3: What were the collaboration patterns and knowledge networks associated with global research in ethical AI within education?

The bibliometric analysis revealed distinct geographical clusters amid the collaborations within the global educational ethical AI research. Intellectually interlinked countries were represented through visual network graphs (Figures 3 and 4). Figure 3 had the intellectual interlinks of the countries with the United States at the center. The green cluster included Portugal, Canada, Australia, India, and the UAE, who displayed shared interests in novel education ideas as well as in AI policy and practice, which underlineed some common interest in what was new or of public interest. The red cluster contained the UK, Germany, Spain, the Philippines, Hong Kong, and South Africa, who sought to explore governing, regulations, and ethical principles for higher education and close ties between the countries. The blue cluster, which included China, Saudi Arabia, Malaysia, and Pakistan, presumably indicateed a collective interest in Government-directed education policies or AI-based management systems, or both.

Even if these countries were not explicitly acting as co-operators, they implied that countries confronting similar issues were likely thinking similar thoughts and possibly confronting similar moral and ethical issues. But considering that the Southeast Asian and African countries attended without truly being in the major academic circles, the compartmentalization suggests a certain distance from them. This raised the importance of considering international moral and ethical frameworks that were aware of different education systems, cultures, and social contexts.

Figure 4 showed a co-authorship analysis of who the different countries partnered with to carry out ethical AI in education. The USA as a partner was prevalent with countries like China, India, the UK, the UAE, and Australia to a degree. These partnerships reflected how much trust and influence the USA had regarding the world dialogue surrounding this issue. The UK and Germany were mutually connected as they connected to each other, both the UK and Germany partnered with an array of partners from across Europe and Asia and transformed collective partnership "hubs." The UAE and India were developing tight bonds both bilaterally and multilaterally as their voice would become more significant in global discussions on AI ethics and education policy. The map indicated the areas where organizations were collaborating, with connections probably based on both common social and political aims and likely geographic proximity. Saudi Arabia, Malaysia and Pakistan were an example where they appeared to be connected in a network, indicating they likely had a regional agenda for AI ethics, in line with their domestic policy efforts. While nations like Pakistan, the Philippines, and South Africa had limited connections to the global research network; this continued limitation and level of involvement indicated

the remaining asymmetries in global academic collaboration. These still allow for potentially ignoring substantive local ethical issues like digital equity, language, or culturally appropriate AI systems. This issue of collaboration continued to result in ethical challenges.

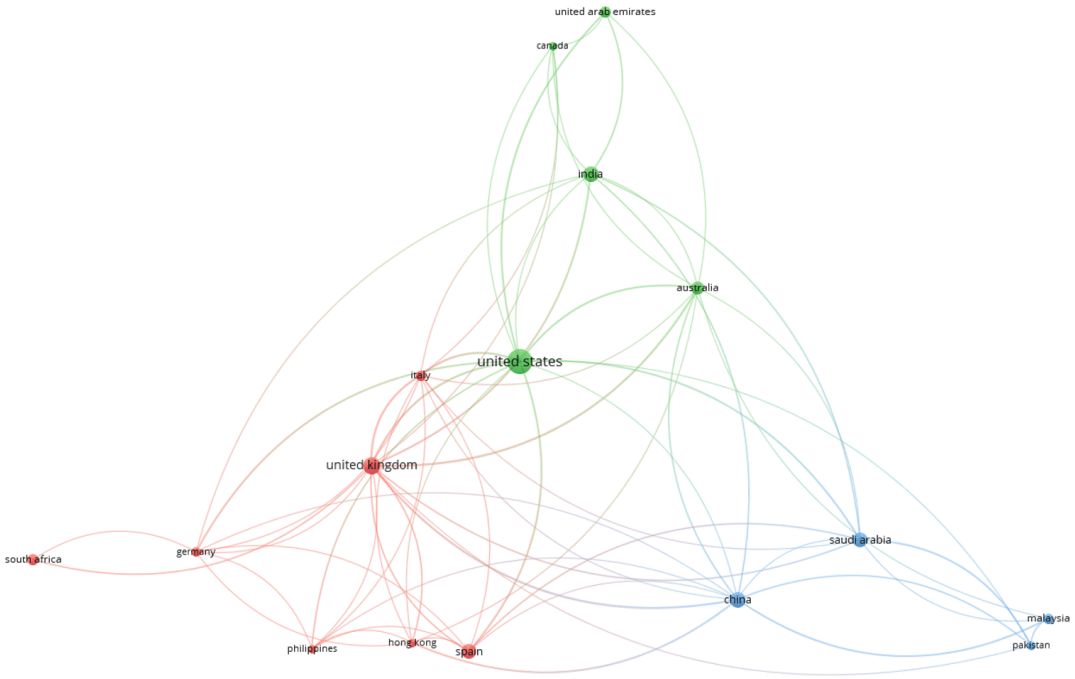

Figure 3. Bibliographic coupling analysis of Countries analysis related to the ethical dimensions of AI in educational

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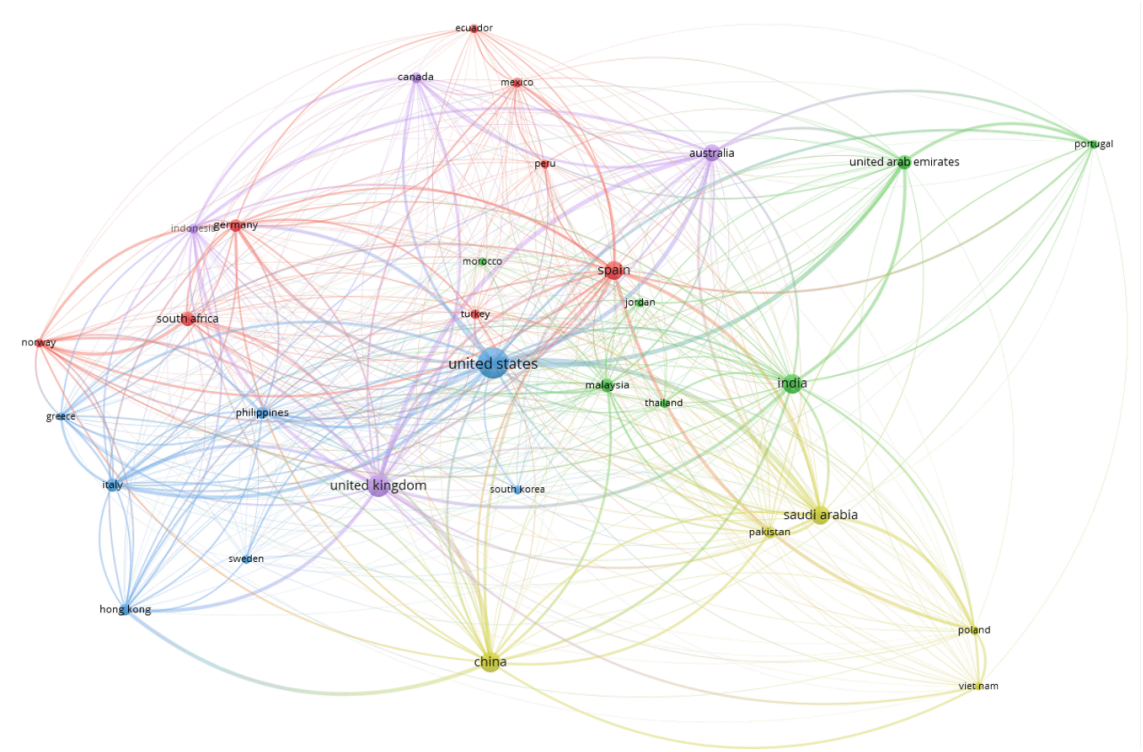

Figure 4. Co-authorship analysis of Countries analysis related to the ethical dimensions of AI in educational

RQ4: Who were the key authors and intellectual groups in this domain?

The review used co-authorship, co-citation, and bibliographic coupling determined the main academics in ethical AI and education. Essentially, these indicators revealed who researchers frequently authored alongside and who referenced each other with related ideas. In Figure 5 were clear groups working strategically close together in this co-authorship network, perhaps a single cluster as in the cases of the authorship cluster including Guillén-Gámez, Shahan, and Mohamed, and also the cluster with Jakhongirov, Gu, and Obrenovic. These groups indicated that very strong research ecosystems were building up in relation to AI learning systems, ethics of assessment, and data management in education, which suggested a hope for much more collaboration within each of these cluster groups.

Even though they were rarely working together, the co-citation analysis (Figure 6) revealed which scholar was cited in a similar context. Distinctive names in the literature (e.g. Virvou, M. and Filipe, S.G.A.) filled the center of the larger field, and there were justifications that their research represented distinct areas, notably important contributions to various conversations related to ethical AI. Finally, the bibliographic coupling analysis showed (Figure 7) who were citing common sources even when not working together or citing each other. It identified a common interest in areas like independent student status, minimization

of bias, and openness. These characteristics suggested that even though the researchers may be in far-ranging geographic contexts, they were coalescing also around a common body of ideas that might help cohere the field more broadly.

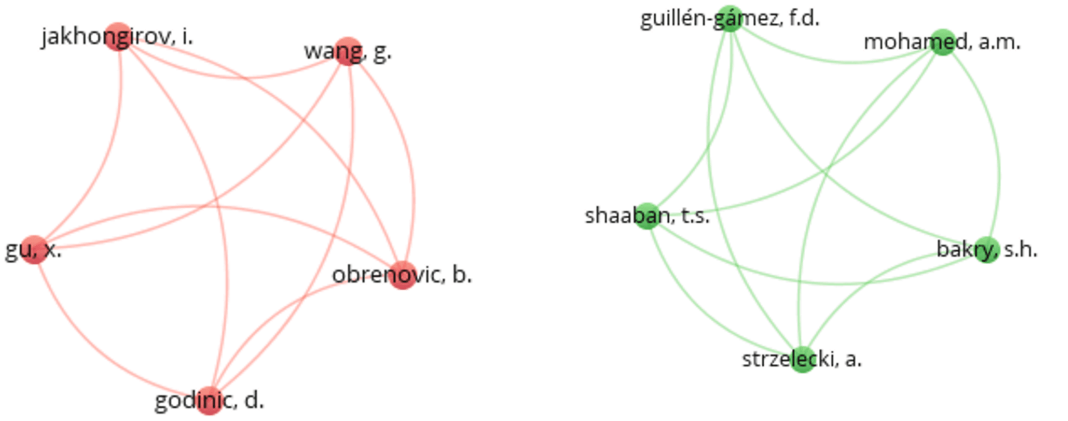

Figure 5. Co-authorship analysis of Authors related to the ethical dimensions of AI in educational

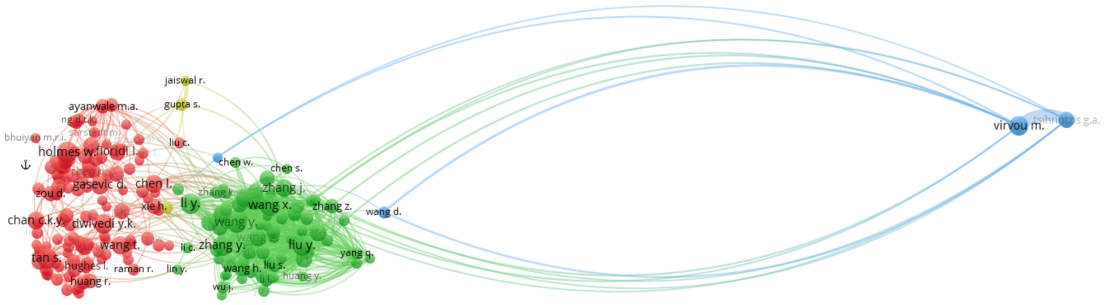

Figure 6. Co-citation analysis of Authors related to the ethical dimensions of AI in educational

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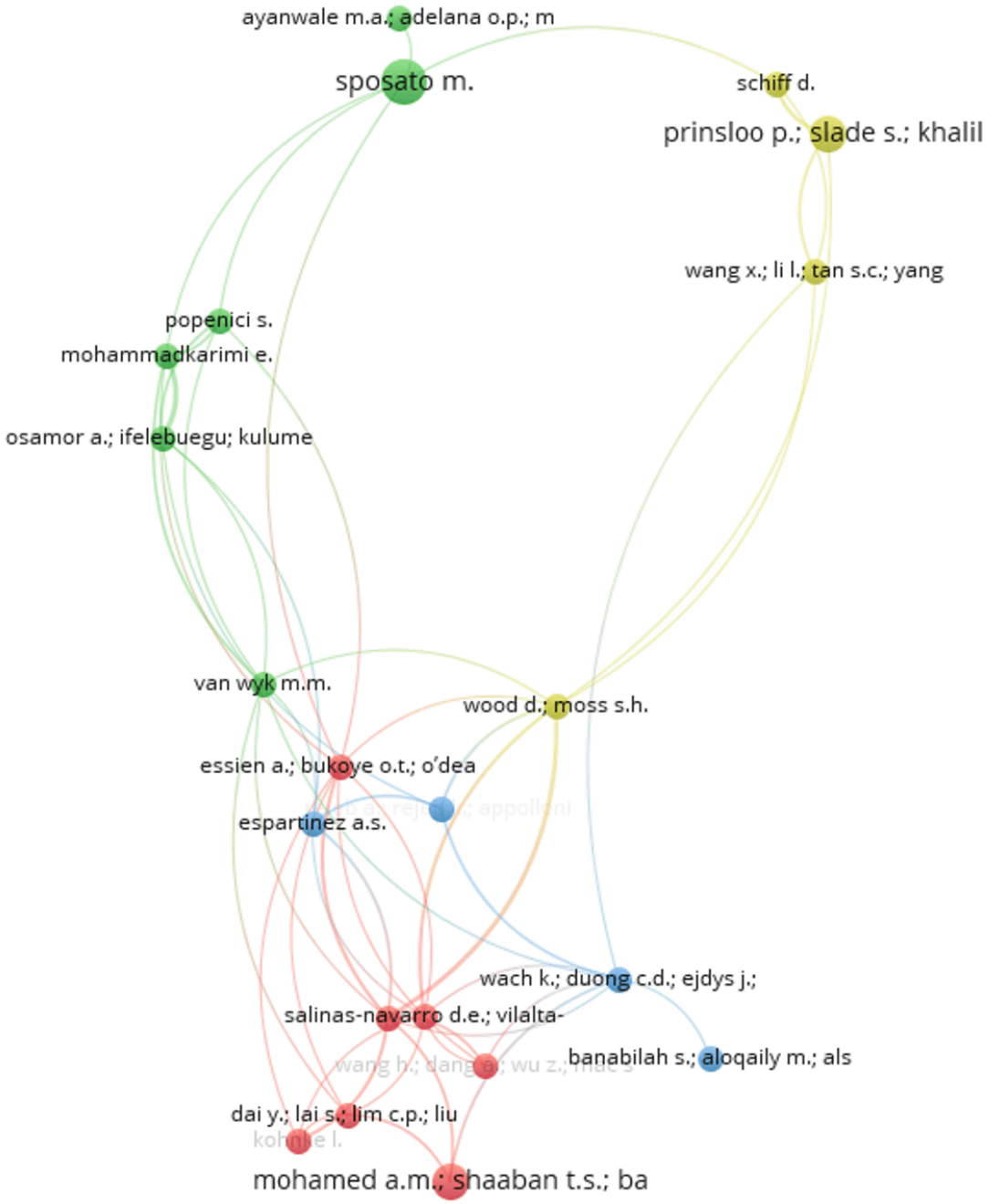

Figure 7. Bibliographic Coupling analysis of Authors related to the ethical dimensions of AI in educational

RQ5: What were the ethical blind spots or under-researched areas that merit attention for future research?

There were a variety of AI and education ethical issues revealed in the co-occurrence map in Figure 8, many of which were not being much talked about. concerns related to Data Privacy, Algorithmic Fairness,

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Academic Integrity, and Transparency had been studied, but there were a lot of significant ethical concerns that were overlooked and needed to be investigated more seriously.

The red cluster considered how generative AI technologies (e.g. ChatGPT) were changing how teachers perform teaching, how students demonstrated learning, and how students engaged in learning. It also highlighted increasing interest in the role of AI technologies in classroom interactions and lesson design in terms of vocabulary that described the roles of teacher, critical thinking, skills, and evaluation. Even though the ethical dilemmas that come with these developments were often referenced, they rarely led to meaningful debate.

The green group detailed the anatomy of AI systems with a focus on data, privacy, technology, and ethics dimensions. While challenges regarding performance, security, and transparency were considered understood, issues related to algorithmic accountability and data governance had not moved beyond infancy. Furthermore, actors in education had little knowledge about safe handling of data in general, especially with children and blockchain applications.

Blue was all about academic integrity, creating rules, compliance, and using resources appropriately, and mainly discussed rules, regulations, and accountability. However, far too much literature failed to engage the question of whether these compliance rules would translate to other cultural and legal systems, especially in resource constrained nations.

In contrast, the yellow group studied attitudes, participants, surveys, and opinions of the people and showed that much of the research we saw today was based on opinion. While the opinions were useful, they were normally not underpinned by a theory or evidence that it would work in other contexts. The purple theme consisted of topics such as algorithmic bias, principles, systematic literature reviews, and bibliometric analyses and was related to theoretical studies and systematic inquiries.

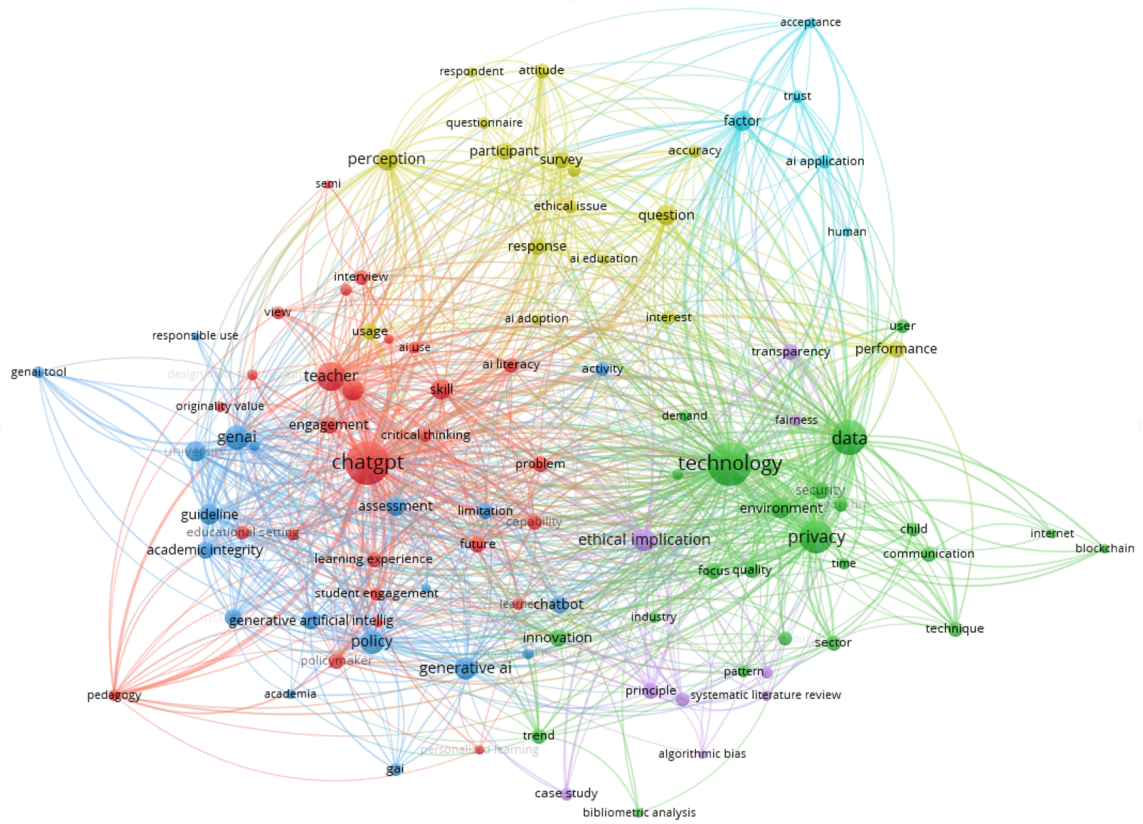

Figure 8. Co-occurrence mapping of terms related to future ethical gaps

5. Discussion

Throughout the review period of 2020 to 2025, there was worldwide attention on the ethical questions associated with artificial intelligence (AI) in education. From the research it was clear AI technologies, such as generative models, adaptive systems, and intelligent tutors, were disrutping education and learning, while also raising some significant ethical dilemmas. In the literature studies that examined data ethics in education, social issues, such as data privacy, algorithmic fairness, and academic integrity, were frequently highlighted[33][6]. For example, the keyword co-occurrence analysis (RQ2) indicated researchers were focused on a set of recurring themes: the influence of AI tools on instruction (for example, ChatGPT), issues of governance and policy, what technology required for data ethics, and perceptions of the technology by stakeholder groups.

The clustering also demonstrated the United States appeared to be minimally engaged in these international research groups. This was troubling in terms of equity, as it suggested that the Global North

was setting in place policies and ethical frameworks that do not adequately represent a wider variety of educational systems. In detailing the research on the primary contributors, there were numerous research groups and influential experts, all with key contributions in the field. The close communities of authors showed change in the discipline, but there was still a need to work across fields and geography to generate broader perspectives and move on neglected questions. Finally, the term mapping highlighted some gaps in ethics.

While there had been significant discussions around fairness and privacy, there had been limited engagement on children's rights to data, the long-term impact of AI in early childhood learning, or the ethical issues of blockchain in managing student data. Even when algorithmic bias was acknowledged, it tended to be described as a catch-all answer without deeper exploration.This highlighted the need for targeted, empirical, and context-sensitive studies that not only explored new technologies but also assess their implications for equity, trust, and student well-being. Only by grounding AI ethics in diverse educational realities could researchers and policymakers ensure responsible integration of AI technologies in learning environments.

6. Conclusion

This research underscoreed the pressing need to introduce ethics into the application of AI in education. While there was a growing global effort toward ethical AI, the analysis showed that most of the current literature largely focuseed on addressing typical issues, such as, privacy and fairness, and failed to recognize the more complex ethical challenges that were context-dependant. Moving forward, it was essential that the sector adopt a wider and more interdisciplinary approach that identifies cultural, economic, and regional differences in research and decisions. This meant establishing children-friendly guidelines, using data from the local context when addressing algorithmic bias and investigating the lived impacts of new technologies. Interdisciplinary and transnational collaborations were increasingly shaped the ethical AI research ecosystem.

Statements and Declarations

Conflicts of Interest

The authors declare that there are no conflicts of interest relevant to this research.

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Author Contributions

Elmira Rismani conceptualized the study, designed the bibliometric research framework, conducted the data collection and analysis using VOSviewer, and drafted the initial manuscript. Fatma Köprülü provided supervision throughout the research process, offered methodological guidance, and contributed critical feedback on the structure and scholarly rigor of the content. Both authors reviewed, edited, and approved the final version of the manuscript and accept full responsibility for the integrity and accuracy of the reported work.

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