Research Article

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

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Background: With its promise of efficiency, personalization, and creative teaching techniques, artificial intelligence (AI) is becoming a more prevalent component of education. However, this integration raises significant ethical concerns about equity, transparency, and data privacy. Recent studies suggest that these problems need to be examined methodically and impartially. *Goal:* The proposed work identifies underreported and understudied areas while mapping the trends in global AI ethics in education policy and technology. It examines how researchers address ethical dilemmas and finds any gaps that could be applied to future practice and policy. *Methodology:* Using a bibliometric approach, we analyzed 342 peer-reviewed articles from 2020 to 2025 that were stored in Scopus. Using VOSviewer, the current study looked at author collaboration networks, citation patterns, and keyword co-occurrence in literature pertaining to ethics, governance, and standards in AI in education. *Findings:* Among the main ethical issues are data privacy, academic integrity, and equity in the application of AI. Additionally, there are research gaps in understudied fields such as child-centered AI ethics, blockchain technologies, and algorithmic bias. China, the United Kingdom, and the United States control academic output and collaboration chains. Despite widespread interest, research is unevenly distributed across fields and geographical areas. *Conclusion:* The study shows that there is still a dearth of interdisciplinary and policy-focused research on AI ethics in education. Strong ethical frameworks should be combined with technological innovation to ensure the equitable and long-term advancement of educational practices.

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1. Introduction

Artificial intelligence (AI) is entering the education system increasingly every day. This number was estimated to have experienced 47.5% growth from 2017 to 2021[1][2][3]. With emerging technologies such as AI based on data analysis, intelligent tutoring, and learning systems, teaching methods are undergoing radical changes. Post-2018 studies have revealed that AI can reduce study time before exams by 15-20% and improve learning outcomes by 25-30%[4]. From 2018 to 2022, AI adoption in the US was estimated to have increased by 48%[5]; however, the majority of teachers have no awareness of the long-term implications of AI in schools[6].

On the other hand, concerns about data privacy, algorithmic bias, fairness, and transparency, especially in colleges and universities, are the main causes of confusion related to AI ethics and governance[7][8][9][10]. Also, it is hard to create one set of regulations that fits all situations since different places have different ethical norms and regulations[11][12]. 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[13][14].

Bibliometric analysis presents a powerful method for tracking research trends, detecting knowledge gaps, and examining the international debate on AI in education[15][16][17]. It provides a finely focused scrutiny of the scholarly literature, theme development, and cooperation networks based on large databases such as Scopus[18][19]. However, these approaches are rarely used to investigate matters of governance and ethics, which is something that ought to change[20]. 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 was thus ambitiously planned to analyze, in an interdisciplinary way, many difficult political, educational technology, and AI-related decisions and to 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 to 2025, and mapped published work in terms of publication trends. Attention will be given to collaboration mapping and identifying the research that needs to be done to inform further academic and policy responses in this fast-moving domain. The analysis focuses on answering the following questions:

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

2. Literature Review

AI has been of more interest in education since 2018[21][22][18]. AI technologies enhance education by providing effectiveness, ease of access, and individualization[23]. Despite these advantages, scientists mention increased fears of algorithmic bias, privacy, and fairness[24][25]. Facial recognition software, adaptive learning, or automated testing can all unwittingly reinforce socioeconomic status, gender, or racial bias[26][27].

If education is concerned, AI interest has been growing dramatically since 2018[21][22][18]. The benefits of AI technologies in education include providing efficiency, access, and personalization[23]. Despite all these advantages, scientists observe the increasing problem of algorithmic prejudice, confidentiality, and equity[24][25]. Automated grading, facial recognition software, and adaptive learning can be used unintentionally to reinforce socioeconomic status, gender, or racial bias[26][27]. Data justice frameworks have focused on fairness in various learning environments but more recently have sought to address the structural injustices and cultural diversity of AI systems[28]. Collectively, the theories offer practical and unexplored tools for AI ethics studies in education.

Certain rules of policy and codes of morality required to unify the theoretical framework are education-based. Another recommendation on the ethics of artificial intelligence[29] by UNESCO focuses on human-centered AI by insisting on fairness, inclusivity, accountability, and transparency in schools. Simultaneously, the OECD AI Principles (2019)[30] provide the ethical principles of AI application in education, including explainability, equity, and respect for the rights of students. Integrating these structures will give us the assurance that they are not only philosophy-driven but also in compliance with internationally recognized education needs and policy objectives that bridge the gap between theory and practice.

2.1. Critical Evaluation of Current Literature

Although there is an increasing amount of research on AI in education, most of the available literature remains descriptive and uncritical. Algorithmic bias formulations are generally used to diagnose the issue without addressing its structural and cultural origin. In spite of the tendency of compliance reactions such as GDPR to focus on privacy concerns, less attention is paid to the long-term rights of children, as well as the limits of such models in the context of most legal systems. Although Western modes dominate, international collaboration is usually viewed as a welcome development, and as a result, the Global South is represented with fewer of its positions[7].

The above gaps can be filled by adding technology, perspectives of different cultures and regions, and the rights of the child. For instance: Children's Rights and Long-Term Impact: Even though legal instruments like COPPA and the GDPR aim to protect children, research on the ethical use of AI and its potential effects on children is critically minimal[29]. Regional and Cultural Perspectives: Unlike the Global South, which seems to be more concerned with social equity, inclusion, and community welfare, Western regions are predominantly individualistic and rights-oriented in their perspectives[12]. Technical Insights: Monitoring attendance and engagement by facial recognition, as well as the use of blockchain technology for credentialing and learning verification, are advanced techniques yet to be fully explored, especially when the issues are more than just risks and ethics[31].

Stakeholder Perceptions—Take learners, parents, teachers, and policymakers as stakeholders. Their perceptions about AI and its use, privacy issues, and fairness aspects are quite different. In some studies, parents are concerned about consent and surveillance policies, students about being watched, and teachers about their workload and the reliability of AI[32][23]. Legal and Regulatory Discrepancies—GDPR, COPPA, and other local legislation differ in their jurisdiction, applicability, and cultural sensitivity. Hence, a set of standards should be discussed given the contextual conditions[33].

Ethical Concern	Key Insights from Literature	Gaps / Contentions
Data Privacy & Security	GDPR protects personal data[34].	Limited focus on children's rights and cross-jurisdictional issues
Algorithmic Bias & Fairness	Bias in adaptive learning systems identified[26].	Few solutions beyond technical fixes; little cultural analysis
Academic Integrity	ChatGPT raises new challenges for authorship and cheating[32].	Understudied in non-Western educational systems
Children's Rights & Long-term Impact	Rarely discussed beyond privacy; case law limited	Almost absent in empirical studies; no child-centered AI ethics frameworks
Emerging Technologies (Blockchain, Facial Recognition)	Mentioned in policy debates[35].	Lacks detailed case studies or critical risk analysis
Stakeholder Perspectives	Teachers' attitudes explored[23].	Limited research on parents and students
Legal & Regulatory Frameworks	GDPR and some national frameworks were considered[10].	Weak comparison across regions; limited Global South representation

Table 1. Summary of Ethical Concerns in the Literature

3. Method

According to prior research, the preparation of a bibliometric review typically follows 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[36]. In addition, Table 2 shows the search strategy for the Scopus database used in the present study. The search query contained terms related to artificial intelligence, education, and ethical considerations, along with synonyms for "ethics," like responsibility, accountability, fairness, and governance. To guarantee reproducibility, the final query is fully recorded in the Methods section.

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	2020–2025
Language	English
Database	Scopus
Number	342 documents

Table 2. 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 is rich with peer-reviewed articles and is excellent in citation tracking[17][37]. Scopus is among the largest academic databases in the world and is well known for supporting the undertaking of complex bibliometric analyses because of its quality data and searching features[18]. Data were downloaded in both .ris and .csv formats for the purpose of the analysis, and VOSviewer, the most reputed software application, which has the capacity to map links, run advanced analyses, and visually display research patterns, was utilized[38][16]. Two main tools were used to process and analyze data. VOSviewer 1.6.20 was 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 to ensure the quality and relevance of the data. Peer-reviewed journal articles from 2020 to 2025 were selected to capture the rapid growth of AI applications in educational contexts, including generative AI tools and adaptive learning systems. Only articles indexed in Scopus, strictly peer-reviewed, and adhering to publishing ethics were included, thus preserving the integrity of the dataset. It should be noted that the articles had to refer to laws, policies, or ethical issues with the use of artificial intelligence in education to be relevant to this research work.

Meanwhile, only those articles published in English were considered and that belonged to 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. Keyword searches included terms related to "artificial intelligence," "education," "ethics," "privacy," "bias," and "stakeholders." Inclusion criteria focused on peer-reviewed empirical and theoretical studies, while editorials, opinion pieces, and non-peer-reviewed reports were excluded. The study acknowledges potential bias arising from these selection criteria and emphasizes that the findings are indicative rather than exhaustive.

3.2. Limitations

There are various limitations to this study. First, depending too much on the Scopus database could result in linguistic and regional bias, which would underrepresent studies conducted in non–English-speaking nations. Second, the inclusion of pertinent publications may be impacted by discrepancies in field classification. Third, citation and term co-occurrence studies only take into account the papers that are part of the dataset, which may leave out new research. Lastly, insufficient data for 2025 could distort apparent publishing trends.

4. Results

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

This study looked at research on AI ethics in education using the Scopus database. As of May 2025, 342 of the original 825 papers had been chosen for analysis. From 2020 to 2024, the number of publications increased, as seen in Figure 1. The apparent reduction should be viewed cautiously, as the data for 2025 are incomplete and do not reflect a real decline in research productivity. All things considered, the literature shows increased interest in AI applications in education and draws attention to both possible advantages and moral dilemmas.
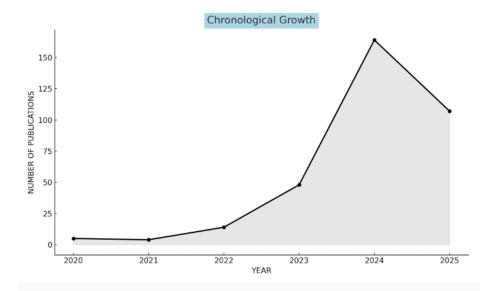

Figure 1. Publications per Year (2020–2025)

Table 3 shows that the majority of the studies reviewed (57%) stemmed from the 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 3. Distribution of Publications by Subject Area

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 keyword 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 referred to issues such as assessment and attendance and explored how ChatGPT, for example, has fundamentally changed the level and quality of academic authorship and has generated fresh queries regarding how generative AI software affects testing practices and learning processes. Within the yellow cluster and across the keyword data, the conversations have focused specifically on the impacts that AI might have on academic integrity and learning outcomes (i.e., elementary, secondary, and university).

The green cluster highlights themes of technological governance, emphasizing the need for robust security measures to ensure data privacy and information security. It demonstrated and detailed words such as privacy, transparent, trust, data, and technology. The issues related to privacy, transparency, and trust with educational technology also bring to the fore the concern for the gathering of student data, the processing of that student data, and subsequently the security of that data.

The red cluster referred to the area of governance where AI is 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 consequences the use of technology has. This cluster expressed a huge level of importance for justice, fairness, and accountability, because it informs 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 judgment in a more automated, less human learning environment. While some terms are specific to higher or medical education, the core issue within this cluster is the importance of maintaining ethical judgment and human oversight in AI-based learning environments.

These clusters pointed to a multifaceted ethical problem rife with challenges at the system, institutional, and individual levels. Table 4 examined five key ethical questions regarding AI in education and differences among 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 4. Key Ethical Themes and Associated Keywords in AI and Education Research (2020–2025)
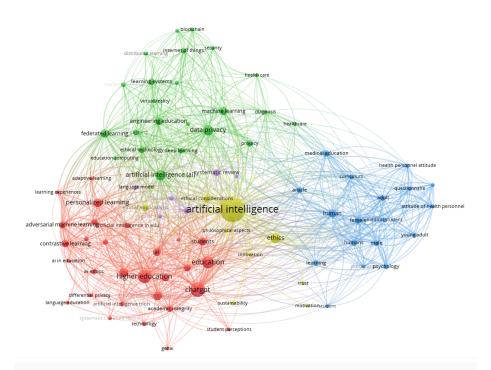

Figure 2. Network visualization of the most frequently used keywords in AI ethics and education research (2020–2025). Node size indicates keyword frequency; edge thickness represents co-occurrence strength. Colors denote thematic clusters: yellow (student-focused AI applications), green (privacy and trust), red (governance and policy), and blue (human oversight and ethical supervision). Only the top keywords are displayed for clarity.

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

The partnerships that referred to international AI ethical research in education were categorically arranged geographically, based on the bibliometric analysis. The green group included Portugal, Canada, Australia, India, and the United Arab Emirates and emphasized the commonalities of innovative teaching methods, AI policies, and applications. Those that were concerned with governance, rules, and moral principles in higher education formed the red group, which included the UK, Germany, Spain, the Philippines, Hong Kong, and South Africa. A blue group with China, Saudi Arabia, Malaysia, and Pakistan was a manifestation of the fact that these countries share a common interest in AI management systems and educational programs organized by the government.

Similar ethical and policy issues seem to affect countries of the same category even without direct cooperation, implying that there exists a shared perspective on AI–related education. The

interconnectedness of the Southeast Asian and African countries with major academic networks, however, also underscores the necessity of international frameworks that consider the differences in educational systems, cultural backgrounds, and social circumstances.

International science is emphasized through co-authorship patterns. The US has developed into a leading center of international AI ethics research in education through close partnerships with countries such as China, India, the UK, the UAE, and Australia. Although the majority of the networking and conversation is led by American researchers, this domination can, consciously or unconsciously, influence the world's ethical issues, possibly excluding the views of the Global South. The Global South, through various new partnerships such as the UAE-India cooperation, is becoming increasingly heard.

Organizations operating regionally, including those in Pakistan, Malaysia, and Saudi Arabia, offer localized AI ethics agendas that are in addition to national policy goals. Nonetheless, the failure of countries such as South Africa, the Philippines, and Pakistan to participate points to the presence of ongoing inequalities that might go against regional ethical considerations such as access to language, digital equity, and culturally responsive AI.

Overall, these patterns demonstrate that while international collaboration fosters shared learning and knowledge dissemination, disparities in participation and network centrality can influence which ethical issues receive attention, emphasizing the importance of promoting inclusive, globally aware research networks in AI ethics education.

Country	Top Collaborating Partners	Publication Count	Notes / Observations
USA	China, India, UK, UAE, Australia	85	Central hub, strong global influence
UK	Germany, USA, Spain, Hong Kong	40	European-Asian collaboration hub
Germany	UK, France, Netherlands	35	Mutual hub with UK
India	UAE, USA	12	Emerging influence in Global South
UAE	India, USA	10	Developing bilateral and multilateral partnerships
China	USA, Pakistan	15	Government-directed AI initiatives
Saudi Arabia	Malaysia, Pakistan	8	Regional collaboration cluster
Pakistan	China, Malaysia	4	Limited engagement in global networks
Philippines	UK, Spain	3	Low network integration
South Africa	UK	2	Low network integration

Table 5. Global Country Collaborations in AI Ethics Education Research (2020–2025)

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

The review used co-authorship, co-citation, and bibliographic coupling to determine 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 3, there 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 4) revealed which scholars were 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 was justification that their research represented distinct areas, notably important contributions to various conversations related to ethical AI. Finally, the bibliographic coupling analysis (Figure 5) showed who was 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 also coalescing around a common body of ideas that might help cohere the field more broadly.
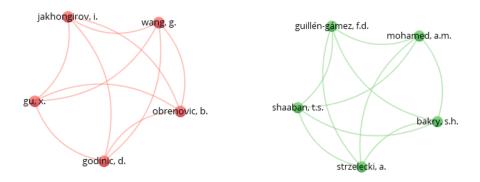

Figure 3. Co-authorship network of authors in ethical AI and education. The size of a node shows how many publications there are; edges represent links between co-authors. Clusters point out new research groups.
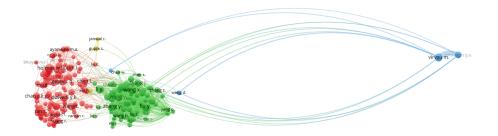

Figure 4. Co-citation network of authors in ethical AI and education. The size of each node represents how often it is cited; the edges show co-citation links, highlighting key scholars and centers of thought.
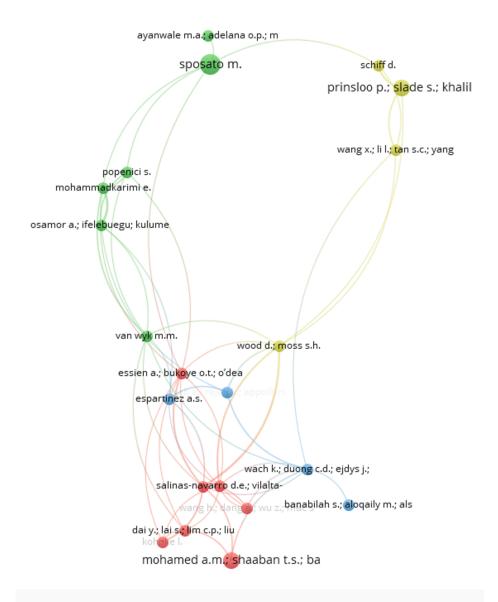
Figure 5. Bibliographic coupling network of authors in ethical AI and education. The size of each node shows the number of publications; the edges represent shared references, emphasizing the conceptual connection among researchers located in different regions.

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

A variety of ethical issues in AI and education were revealed in the co-occurrence map in Figure 6, many of which were not being widely discussed. Concerns related to data privacy, algorithmic fairness, academic integrity, and transparency had been studied, but many significant ethical concerns were overlooked and needed to be investigated more seriously.

The red cluster considered how generative AI technologies (e.g., ChatGPT) were changing how teachers performed 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 their infancy. Furthermore, actors in education had little knowledge about the safe handling of data in general, especially with children and blockchain applications.

The blue cluster was all about academic integrity, creating rules, compliance, and using resources appropriately, and mainly discussed rules, regulations, and accountability. However, far too much of the literature failed to engage with 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 people and showed that much of the research we see today is based on opinion. While the opinions were useful, they were normally not underpinned by a theory or evidence that they 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.
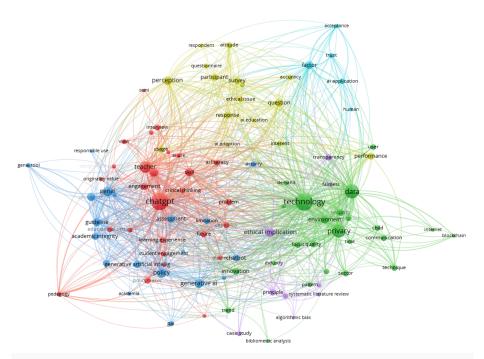

Figure 6. Co-occurrence map of terms highlighting under-researched ethical gaps in AI and education. Node size reflects keyword frequency, and edge thickness indicates co-occurrence strength. Clusters represent thematic groupings of ethical concerns, showing areas that require further empirical and theoretical attention.

5. Discussion

Between 2020 and 2025, ethical questions surrounding AI in education received global attention. AI technologies such as generative models, adaptive systems, and intelligent tutors disrupted traditional learning practices while raising significant ethical dilemmas. The literature frequently highlights issues of data privacy, algorithmic fairness, and academic integrity[32][7]. Keyword co-occurrence analyses revealed recurring themes: AI's influence on instruction (e.g., ChatGPT), governance and policy requirements, technical infrastructure for data ethics, and stakeholder perceptions.

In future studies, AI ethics need to be explicitly located within both classical and modern theories of ethics to enhance normative analysis. Deontological ethics, regardless of the outcome, will highlight the entitlement of children to privacy and just treatment[39]. Yan[40] says that consequentialism encourages a compromise between benefits such as

customization and costs such as misinformation or information exclusion. The primary aim of virtue ethics is to promote honesty, equity, and accountability among teachers and developers[41]. Bioethical principles—autonomy, beneficence, non-maleficence, and justice—provide a useful guide when making decisions in the classroom and in policy[42]. Data justice frameworks identify structural injustices and can guide the policy debate at the regional level[28].

There are still gaps: Children's Rights: Research seldom takes into account ethical frameworks targeting minors or examining the long-term effects on children. Cultural Contexts: Since most ethical norms tend to be developed in the West, Global South views are not adequately represented. Emerging Technologies: Despite the mention of blockchain and facial recognition during policy discussions, there is no in-depth, case-by-case analysis of the ethical, privacy, and equity risks. Stakeholder Perspectives: The absence of studies on the perspectives of students, parents, and administrators, as well as those of teachers, restricts the practical understanding of the subject. Policy Comparisons: A limited number of studies have been made comparing the implementation and cultural connotation of different regional frameworks.

To fill these gaps, we need studies that are based on strong evidence and that are sensitive to context. This research needs to investigate the ethical, social, and legal issues of AI in various educational settings. It is up to policymakers and educators to ensure the ethical use of AI technologies in education through a strong foundation of AI ethics based on numerous perspectives and real-world experiences.

6. Conclusion

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

Statements and Declarations

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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Declarations