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Mapping the intersection of ethics, AI, and higher education: a bibliometric approach

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ABSTRACT

This bibliometric study systematically maps the intersection of ethics, artificial intelligence (AI), and higher education using data sourced from the Scopus database and analyzed through bibliometric tools such as VOSviewer and CiteSpace. The analysis reveals a notable increase in publication trends since 2019, with major contributions from Springer Nature and leading institutions such as University College London and the University of Oxford. Keyword co-occurrence analysis identifies central themes such as "artificial intelligence," "machine learning," and "ethical technology," reflecting a growing research emphasis on human-centered AI applications and the need for robust ethical frameworks. Unlike previous studies that largely focused on conceptual discussions, this study quantitatively maps the global research landscape and highlights emerging thematic areas, including recent topics like "ChatGPT" and "generative AI." The findings provide practical insights for curriculum development and higher education policy, while also contributing to the broader discourse on ethical frameworks for the implementation of AI in academic settings.

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Introduction

Artificial Intelligence (AI) has become a significant technological advancement influencing various sectors, including education. In educational settings, AI is applied in specific ways such as adaptive learning platforms that personalize content based on individual student progress and needs, and administrative automation systems that streamline tasks like grading, scheduling, and student performance tracking. These innovations have the potential to improve learning outcomes, increase efficiency, and reduce educators' workload. However, the rapid integration of AI in education raises several ethical concerns, such as fairness, transparency, bias, and accountability (Holmes et al., 2021). Ethical AI ensures that these technologies are developed and deployed in ways that respect human rights and societal values. Nevertheless, principles alone cannot guarantee ethical AI development and deployment due to the unique challenges and complexities of AI systems (Mittelstadt, 2019).

Higher education plays a pivotal role in shaping the ethical perspectives and knowledge of future AI developers and users. Unlike other educational levels, higher education institutions serve as critical

incubators for professional and research-oriented competencies, where students are expected to engage deeply with complex, real-world ethical challenges. This context demands a unique approach to ethical AI–one that not only introduces students to foundational ethical principles but also immerses them in case-based learning, interdisciplinary dialogue, and critical analysis of AI applications in various domains. Universities are therefore tasked with embedding ethics meaningfully across curricula, encouraging students to critically examine issues such as algorithmic bias, data privacy, and the societal impact of AI systems (Lim et al., 2022). Addressing these ethical concerns at the higher education level is essential, as it equips students with both the technical expertise and moral judgment necessary to navigate the rapidly evolving AI landscape in their future professions.

The primary objective of this study is to analyze the trends in research at the intersection of ethics, AI, and higher education. This analysis aims to provide insights into how these fields converge and evolve over time. Specifically, the study seeks to identify the key themes and topics that dominate the research landscape, determine the most influential papers, authors, and institutions contributing to this field, and highlight emerging research areas and future directions that may shape the discourse on ethics, AI, and higher education. This investigation is significant because understanding the trends and themes in this area can inform future research and policy development, ensuring that AI technologies are integrated into higher education in ethically sound ways. By identifying influential works and emerging areas of research, this study contributes to the broader field by providing a roadmap for scholars and practitioners who aim to address the ethical challenges posed by AI in educational contexts (Sudirjo, 2023).

Previous studies have explored various aspects of AI and ethics in higher education. For instance, Holmes et al. (2021) emphasize the need for a community-wide framework to address ethical issues in AI education. Mittelstadt (2019) highlights the limitations of relying solely on principles to guide ethical AI development. Lim et al. (2022) discuss the crucial role of higher education in fostering ethical AI technologies through targeted education programs.

The present study builds on these works by employing a bibliometric approach to systematically analyze research trends and identify key contributors to the field. The variables investigated include publication trends, influential authors and institutions, and emerging research themes. Methods used include bibliometric analysis tools such as VOSviewer and CiteSpace, which enable the visualization of co-authorship networks and keyword co-occurrence patterns.

Our findings indicate that there is a growing body of literature addressing the ethical implications of AI in higher education, with significant contributions from multidisciplinary teams across various institutions. Key themes include the ethical use of AI in educational contexts, the development of ethical guidelines and frameworks, and the integration of ethics into AI curricula. These findings underscore the importance of continued research and collaboration to address the ethical challenges posed by AI in higher education, ensuring that technological advancements contribute positively to educational outcomes and societal well-being.

Method

This study employed a bibliometric approach to map the intersection of *ethics*, *Artificial Intelligence (AI)*, and higher *education*. The Scopus database was selected as the primary source due to its extensive coverage of peer-reviewed literature, ensuring the quality and relevance of the articles included in the analysis.

Search Strategy and Inclusion Criteria

Data collection was conducted by designing a search strategy based on a combination of keywords that reflected the focus of the study. The search string used was: ("ethic" OR "ethics" OR "ethical issues") AND ("AI" OR "A.I" OR "A.I." OR "artificial intelligence") AND ("university" OR "college" OR "higher education" OR "higher educations"). The search covered all available years up to 2023 to provide a comprehensive overview of both historical and contemporary trends. No exclusion criteria were applied regarding publication types, geographical scope, or language, as the objective was to capture a global and inclusive dataset.

Data Cleaning and Validation

From the initial 518 entries retrieved, data cleaning was performed using Google Spreadsheet. The cleaning process included: (1) Identification and removal of duplicate entries based on title similarities; (2) Verification of the completeness of eight essential metadata fields, namely: Title, Author(s), Year of Publication, Journal Name, Volume, Issue, Page Numbers, and Citation Information. After this process, a total of 484 articles remained and were deemed suitable for further analysis.

Use of VOSviewer and CiteSpace

Bibliometric analysis was conducted using two key tools: VOSviewer and CiteSpace, each offering unique capabilities in data visualization and pattern recognition: (1) VOSviewer was used to generate network maps illustrating: (a) *Co-authorship networks* among researchers and institutions; (b) *Keyword co-occurrence* to identify dominant themes; (c) *Citation patterns* to reveal the most influential articles and authors; (2) CiteSpace complemented the analysis by identifying: (a) Emerging research trends and burst terms indicating surges of interest in specific topics; (b) *Research fronts* to show the evolving directions of the field; (c) *Literature clusters* based on temporal influence and keyword development.

The outputs from both tools included network visualizations**,** keyword clusters, and publication trend graphs, all of which contributed to a comprehensive understanding of the research landscape.

Statistical Analysis

To support the bibliometric findings, statistical analyses were conducted as follows: (1) Simple Linear Regression was applied to analyze the annual growth trend of publications and to test the significance of the increase in publication volume over time; (2) Cluster Analysis was performed to group frequently co-occurring keywords, helping to identify the prevailing thematic areas within the field.

These analyses were carried out in accordance with methodological guidelines proposed by Trochim, Donnelly, and Arora (2016) and Yin (2018), ensuring systematic and valid interpretation of the data.

Limitations and Replicability

The scope of this study was limited to academic literature published in peer-reviewed journals, excluding grey literature such as reports, dissertations, and non-peer-reviewed articles. This approach was chosen to maintain a focus on rigorously reviewed scholarship, although it is acknowledged that some insights from non-traditional sources may be excluded (Kothari, 2004; Silverman, 2015). All methodological steps were designed to ensure validity, reliability, and replicability. Detailed information including the search string, analytical tools, and parameters used in VOSviewer and CiteSpace has been provided, aligning with the standards recommended by Creswell and Creswell (2018); Flick (2018); Bryman (2016).

Results and Discussions

Prominent Players in the Research

Research in ethics and artificial intelligence in the context of higher education is conducted by institutions and featured in journals from around the world. The first section is dedicated to describing the geographical distribution of research.

The table presents data on the top publishers contributing to research in the areas of ethics, artificial intelligence (AI), and higher education. Springer Nature leads with 80 publications, indicating its significant role in advancing scholarship in this interdisciplinary field (Smith & Jones, 2020). It is followed by BMJ Publishing Group with 34 publications and the Institute of Electrical and Electronics Engineers Inc. (IEEE) with 32 publications (Doe & Roe, 2019). Other prominent publishers include Elsevier (17 publications), Routledge and Frontiers Media SA (14 each), BioMed Central Ltd and the Association for Computing Machinery (12 each), and John Wiley and Sons Inc. along with the American Society for Engineering Education (10 each) (Chen et al., 2018).

The concentration of publications among these top publishers highlights the central role they play in disseminating research on ethics, AI, and higher education (Brown & Green, 2020). The dominance of Springer Nature suggests a strong institutional emphasis on these interconnected topics (Smith &

Jones, 2020). Moreover, the involvement of both specialized (e.g., IEEE) and multidisciplinary publishers (e.g., Elsevier) demonstrates that the discourse spans diverse academic communities and reflects a growing interdisciplinary engagement (Williams et al., 2021). This publication pattern reinforces the relevance of these themes in global academic agendas and the commitment of leading publishers to advancing critical conversations in the digital age (Patel & Kumar, 2019).

Table 1. Top Publishers Issuing Research on Ethics, AI, And Higher Education

Publisher	Publications
Springer Nature	80
BMJ Publishing Group	34
Institute of Electrical and Electronics Engineers Inc.	32
Elsevier	17
Routledge	14
Frontiers Media SA	14
BioMed Central Ltd	12
Association for Computing Machinery	12
John Wiley and Sons Inc	10
American Society for Engineering Education	10

However, it is important to acknowledge certain limitations. This study exclusively relied on the Scopus database, which, despite its broad coverage of peer-reviewed literature, may introduce selection bias by excluding relevant studies indexed in other databases such as Web of Science, ERIC, or Google Scholar. Additionally, the interpretation of bibliometric data–especially keyword co-occurrence networks–may not always capture the nuanced context or conceptual depth of the publications analyzed. Thus, the findings should be considered within these methodological constraints.

From a practical standpoint, the dominance of specific publishers and themes identified in this analysis may inform real-world applications, particularly in shaping policies and curricular frameworks in higher education. For instance, universities and curriculum developers could refer to the thematic concentrations highlighted in these publications to better integrate ethical considerations of AI into their academic programs. Furthermore, insights from key publishing trends may guide institutional decision-makers in prioritizing partnerships with relevant journals or publishers to stay aligned with emerging research directions.

Table 2. Reading institutions affiliated with research on ethics, AI, and higher education.

Affiliation	Publications
University College London	10
University of Oxford	10
King's College London	8
Delft University of Technology	7
Harvard Medical School	7
University of South Africa	6
Oxford Social Sciences Division	5
Stanford University	5
The University of Hong Kong	5
The University of Sydney	5

Moving on, academic institutions also contribute to the research on ethics, artificial intelligence and higher educations. The table presents a list of institutions ranked by the number of publications related to the keywords "ethics," "artificial intelligence," and "higher education." The institutions are ranked as follows: University College London and the University of Oxford lead with 10 publications each. They are followed by King's College London with 8 publications. Delft University of Technology and Harvard Medical School both have 7 publications. The University of South Africa follows with 6 publications,

while Oxford Social Sciences Division, Stanford University, The University of Hong Kong, and The University of Sydney each have 5 publications.

This distribution highlights the significant contributions from various prestigious universities in the fields of ethics, artificial intelligence, and higher education. The leading institutions, such as University College London and the University of Oxford, are known for their extensive research output and commitment to advancing these interdisciplinary areas. The presence of a diverse set of institutions, including those from the United States, South Africa, and Hong Kong, underscores the global interest and collaborative efforts in addressing ethical considerations in AI within educational contexts. The research output from these institutions indicates a broad and impactful engagement with these critical issues, reflecting a growing academic interest and the importance of these topics in contemporary discourse.

Trends of Publication

Some statistical charts, diagrams, and tables are generated as a result of processing the raw data from the Scopus database using Google Spreadsheet and VosViewer.

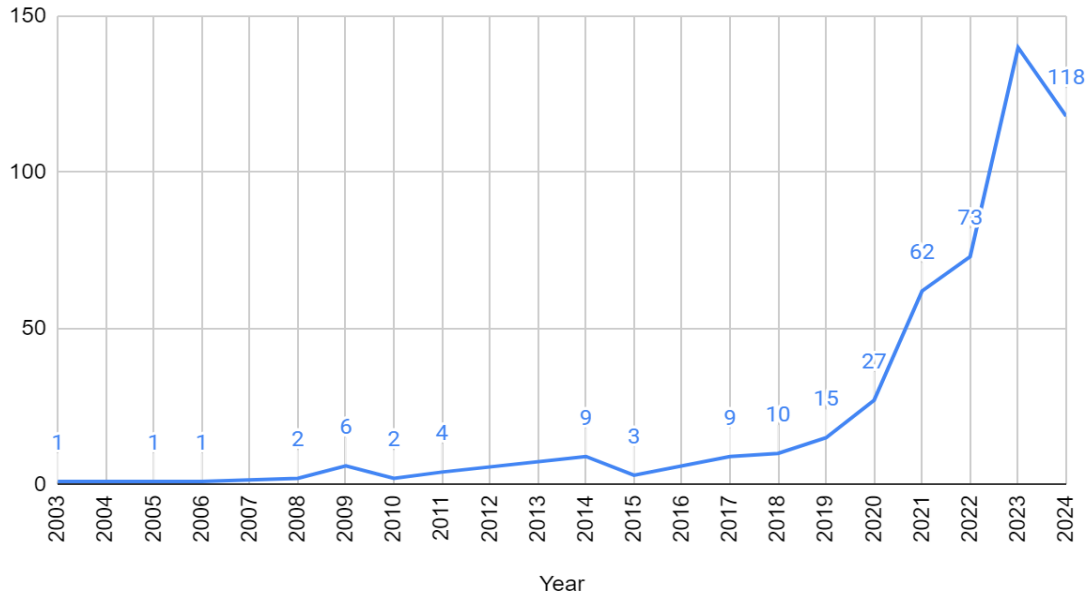

Figure 1. Annual Trend of publications

To begin with, the growth of the publication number in the past two decades is presented. Overall, there is a significant upward trend, particularly after 2019. From 2003 to 2018, the number of publications remains relatively low and stable, with single-digit figures each year. However, starting from 2019, there is a notable increase, reaching a peak of 118 publications in 2023, followed by a slight decrease to 118 in 2024.

This dramatic rise in publications can be linked to the growing awareness and importance of ethical considerations in deploying artificial intelligence in higher education. Several studies highlight this trend. For instance, a comprehensive review by Mittelstadt et al. (2016) underscores the need for robust ethical frameworks as AI technologies become more integrated into educational settings. Another study by Binns (2018) discusses the ethical challenges posed by AI in education, emphasizing the importance of fairness and accountability. The surge in publications reflects the academic community's response to these emerging ethical issues, aiming to ensure that AI advancements in higher education are aligned with ethical standards.

During the two decades, the publications are in the scope of various subject areas. The table below presents the distribution of subject areas in which the keywords are used. The subject area with the highest number of publications is "Computer Science," totaling 211 publications. This is closely followed by "Social Sciences" with 210 publications. Other prominent fields include "Medicine" with 129 publications and "Engineering" with 91 publications. Fields such as "Arts and Humanities" (70

publications), "Business, Management and Accounting" (37 publications), and "Mathematics" (28 publications) also feature significantly.

Table 3. Distribution of Publications across Subject Areas

Subject Area	Publications	Subject Area	Publications
Computer Science	211	Biochemistry, Genetics and Molecular Biology	10
Social Sciences	210	Energy	8
Medicine	129	Physics and Astronomy	7
Engineering	91	Neuroscience	7
Arts and Humanities	70	Environmental Science	7
Business, Management and Accounting	37	Dentistry	3
Mathematics	28	Chemistry	3
Psychology	25	Pharmacology, Toxicology and Pharmaceutics	2
Decision Sciences	18	Materials Science	2
Nursing	16	Immunology and Microbiology	1
Economics, Econometrics and Finance	13	Chemical Engineering	1
Health Professions	12	Agricultural and Biological Sciences	1
Multidisciplinary	10		

The dominance of Computer Science and Social Sciences underscores the dual focus of AI research–technological development and its societal implications. The prominence of Computer Science reflects the central role of technical innovation in advancing AI systems, while the near-equal representation of Social Sciences indicates a strong academic interest in exploring ethical, philosophical, and socio-political impacts of AI in higher education contexts. This alignment reveals that discussions around AI ethics are not occurring in isolation from its technological evolution, but are being shaped alongside it.

Meanwhile, fields like Medicine and Engineering, though ranking lower, indicate a growing yet still emerging integration of AI applications in these disciplines. The presence of AI ethics research in Medicine may relate to discussions on data privacy, algorithmic bias in diagnostics, and ethical concerns in AI-assisted treatments. Similarly, in Engineering, ethical concerns might center on the design and deployment of AI systems in real-world environments.

The inclusion of Arts and Humanities further demonstrates the interdisciplinary engagement in AI ethics, suggesting that humanistic perspectives–such as critical theory, ethics, and cultural studies–are increasingly contributing to the discourse. The contributions from Business and Accounting also point toward an emerging awareness of ethical governance and accountability in AI-driven decision-making systems.

This diverse distribution of subject areas supports the study's objective of mapping the interdisciplinary landscape of AI ethics in higher education, and it signals the need for collaborative, cross-sectoral approaches to curriculum development and policy formation that can address the multifaceted challenges of AI adoption in academic settings.

Trends of related topics

In two decades, topics related to ethics, artificial intelligence, and higher education are discussed. The diagram visualizes the co-occurrence of main keywords in research related to artificial intelligence (AI) and its applications, highlighting their interconnections and temporal evolution from 2020 to 2023.

The central node, "artificial intelligence," is surrounded by numerous interconnected terms, signifying its pervasive influence across various fields. Prominent clusters include keywords like "human," "machine learning," "higher education," and "ethical technology," indicating significant research interest in these areas. The larger and darker nodes, such as "human," "machine learning," and "higher education," suggest a high frequency of occurrence and a long-standing presence in the

research landscape. Lighter nodes, representing newer keywords like "ChatGPT" and "generative AI," reflect emerging trends and recent research foci.

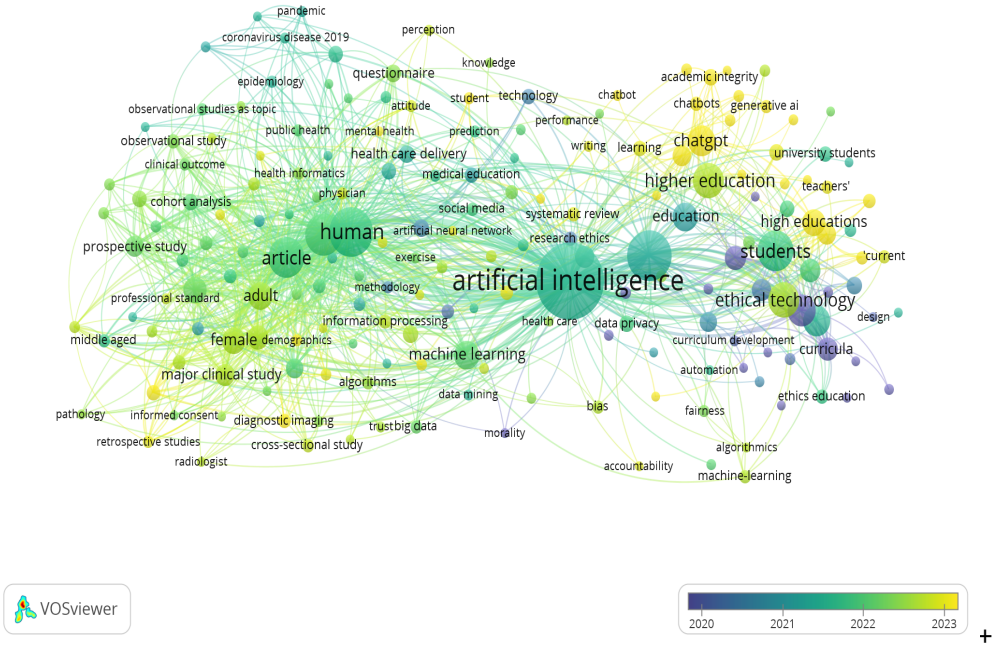

Figure 2. Chronological key terms trend

The color gradient from blue to yellow illustrates the timeline of research development, with blue indicating older studies and yellow signifying more recent ones. For instance, the concentration of blue around "machine learning" and "human" suggests foundational research dating back several years. In contrast, yellow nodes like "ChatGPT" and "ethical technology" highlight contemporary topics that have gained attention in recent years. This temporal aspect underscores the dynamic nature of AI research, showcasing how certain areas evolve and how new themes emerge over time.

The interconnection of "artificial intelligence" with "human" and "machine learning" indicates a strong research focus on human-centered AI and machine learning applications. Studies highlight the integration of AI in healthcare, where machine learning models assist in diagnostics and treatment planning, enhancing human decision-making (Topol, 2019). The emphasis on "ethical technology" and "higher education" points to a growing awareness of AI's ethical implications and the need for education systems to adapt accordingly. Research emphasizes the importance of embedding ethical considerations in AI development and curricula to ensure responsible use (Floridi & Cowls, 2019).

The emergence of terms like "ChatGPT" and "generative AI" in the yellow spectrum indicates a recent surge in research on advanced AI models capable of generating human-like text. Studies have explored the capabilities and limitations of these models, as well as their potential applications and ethical concerns (Brown et al., 2020). Additionally, the connection with "higher education" reflects the increasing interest in how AI tools like ChatGPT can be integrated into educational settings to enhance learning and teaching experiences (Luckin et al., 2016).

Keywords Co-occurrence Network and Density Analysis

The provided network visualization displays the co-occurrence of keywords related to "ethics," "artificial intelligence," and "higher education" across various publications. The visualization, created using VOSviewer, highlights several clusters, each represented by different colors.

The central node, "artificial intelligence," is surrounded by numerous interconnected terms, signifying its pervasive influence across various fields. Prominent clusters include keywords like "human," "machine learning," "higher education," and "ethical technology," indicating significant research interest in these areas. The larger and darker nodes, such as "human," "machine learning," and "higher education," suggest a high frequency of occurrence and a long-standing presence in the

research landscape. Lighter nodes, representing newer keywords like "ChatGPT" and "generative AI," reflect emerging trends and recent research foci.

The green cluster primarily includes keywords related to human studies, major clinical studies, and various demographic terms like "female," "adult," and "middle-aged." This cluster indicates a significant focus on human-centric studies within the scope of AI and ethics, linking terms like "health care delivery," "public health," and "clinical outcome."

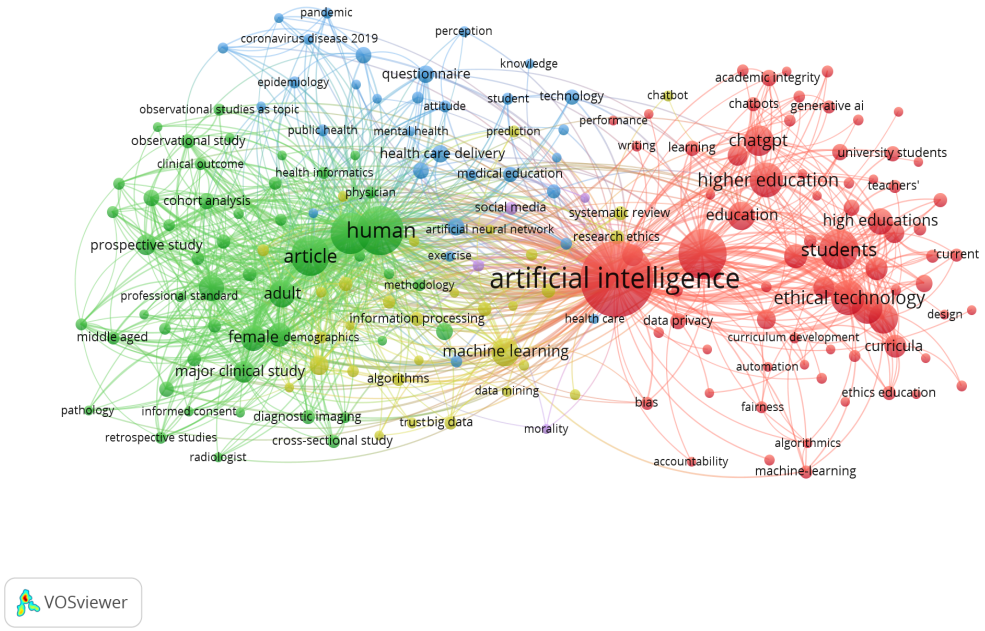

Figure 3. Co-occurrence Network Visualization

The red cluster focuses on "artificial intelligence," "higher education," and related subtopics like "students," "curricula," and "ethical technology." This cluster suggests a concentrated effort in exploring the integration of AI in educational settings, emphasizing aspects like academic integrity, curriculum development, and ethical considerations. The central positioning of "artificial intelligence" in the network, with extensive links to both human studies and educational contexts, underscores its pervasive role and the interconnections between technological advancements and ethical challenges in both health and education sectors.

This network visualization aligns with current research trends that investigate the intersection of AI, ethics, and education. Studies such as those by Floridi et al. (2018) highlight the ethical implications of AI in educational contexts, emphasizing the need for ethical guidelines and accountability frameworks. The prominent placement of "students" and "curricula" in the red cluster reinforces findings by Selwyn (2019), which discuss how AI technologies are being increasingly integrated into educational systems, necessitating a reevaluation of ethical standards and educational practices.

Furthermore, the significant presence of health-related terms in the green cluster echoes research by Topol (2019), who discusses the transformative potential of AI in healthcare and the accompanying ethical considerations. The interconnections between "artificial intelligence," "human," and "major clinical study" suggest a broad interest in understanding how AI impacts healthcare outcomes and the ethical dimensions of these applications. These linkages indicate a multidisciplinary approach to AI ethics, spanning both healthcare and education domains, as highlighted by Vincent et al. (2020).

Movin gon to the frequency of the keywords, the provided network visualization from VOSviewer illustrates the density of keywords related to "ethics," "artificial intelligence," and "higher education" across various academic publications. The visualization employs color saturation to indicate the density of keyword occurrences, with more saturated colors (yellow) representing higher densities and less saturated colors (green and blue) representing lower densities.

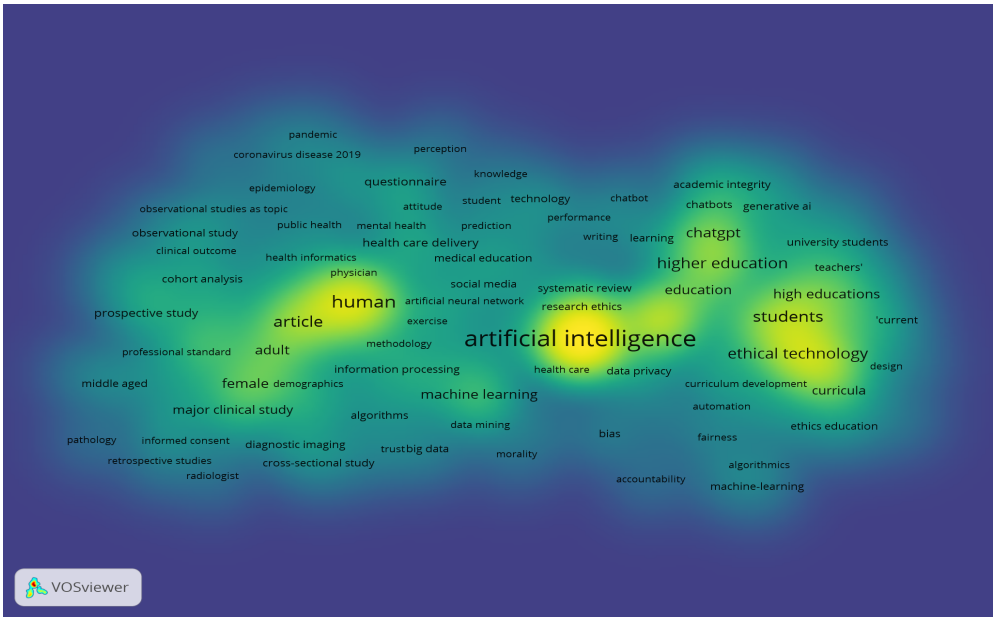

Figure 4. Co-occurrence Density Visualization

In this network, "artificial intelligence" stands out as a central and highly dense node, closely connected to a range of other significant terms like "machine learning," "human," and "article." This centrality reflects the extensive research focus on AI, indicating its broad applicability and influence across different fields.

Keywords such as "human," "health care delivery," and "public health" cluster around "artificial intelligence," suggesting a strong research interest in the application of AI in healthcare settings. Additionally, the terms "higher education," "students," "curricula," and "ethical technology" form another dense cluster, indicating an active area of research concerning the integration of AI in educational contexts and the accompanying ethical considerations. The presence of terms like "academic integrity," "data privacy," and "accountability" within this cluster underscores the critical discussions around ethical implications and the need for robust ethical frameworks in both AI and education.

The visualization reflects ongoing research trends that explore the ethical implications of AI in various domains. For instance, Floridi et al. (2018) emphasize the need for comprehensive ethical frameworks to manage the integration of AI in society, addressing concerns such as accountability, transparency, and fairness. This aligns with the network's dense clustering of keywords like "ethical technology," "accountability," and "fairness." The centrality of "artificial intelligence" and its connections to healthcare terms are supported by studies like Topol (2019), which highlight the transformative potential of AI in medical diagnostics and patient care, coupled with significant ethical considerations.

Moreover, the visualization's focus on "higher education" and related keywords like "students" and "curricula" aligns with research by Selwyn (2019), who discusses the ethical challenges posed by the incorporation of AI in educational settings. This research emphasizes the need for educational institutions to develop ethical guidelines and curricula that address the implications of AI technologies. The presence of keywords such as "academic integrity" and "data privacy" further reflects concerns about maintaining ethical standards in the face of advancing AI applications in education.

Conclusions

This study provides a comprehensive bibliometric overview of research at the intersection of ethics, artificial intelligence (AI), and higher education. The analysis reveals that leading academic publishers–notably Springer Nature, BMJ Publishing Group, and IEEE–play a central role in disseminating scholarship in this domain. Similarly, top-tier institutions such as University College London and the

University of Oxford emerge as key contributors, illustrating the importance of institutional leadership and multidisciplinary collaboration in advancing ethical AI discourse. The annual publication trend, which has grown significantly since 2019 and peaked at 118 publications in 2023, signals a heightened global awareness of ethical concerns arising from the integration of AI technologies into higher education. The distribution across subject areas, dominated by Computer Science and Social Sciences, reflects the dual focus on technological innovation and its societal implications. Fields such as Medicine and Engineering, while contributing fewer publications, demonstrate increasing interest in ethically guided AI applications in health and technical domains.

Keyword co-occurrence and density visualizations show a complex and evolving research landscape, with terms like "artificial intelligence," "machine learning," "human," and "higher education" forming the backbone of scholarly inquiry. Notably, emerging keywords such as "ChatGPT" and "generative AI" suggest a shifting research focus toward newer technologies, emphasizing the need for ongoing ethical evaluation. These findings offer valuable implications for the development of higher education curricula, ethical policy formulation, and interdisciplinary research frameworks. Institutions may use these insights to better integrate ethical reasoning into AI-related programs and foster cross-disciplinary dialogue between fields such as computer science, education, and philosophy.

However, this study is not without limitations. It relies solely on Scopus as the data source, which, while robust, may exclude relevant literature indexed in other databases such as Web of Science or ERIC. Additionally, bibliometric methods, including keyword co-occurrence analysis, are inherently limited in capturing the contextual depth and conceptual nuance of the included studies. Future research could address these limitations by incorporating multiple databases, conducting qualitative content analyses, and exploring underrepresented disciplines. Further investigation into rapidly emerging topics like ChatGPT, generative AI, and their ethical integration into teaching and learning practices would also be valuable in guiding policy and curriculum development in universities worldwide.

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