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A BIBLIOMETRIC ANALYSIS OF AI LITERACY: TRENDS, TOPICS AND FUTURE DIRECTIONS

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Abstract

This study investigates the rapidly growing field of Artificial Intelligence (AI) literacy by conducting a bibliometric analysis of 608 publications (364 articles and 244 conference papers) retrieved from Scopus, spanning 2016 to 2024. AI literacy reflects the essential knowledge and skills needed to understand, engage with, and critically evaluate AI technologies. The analysis examines trends in publication frequency, prominent authors and institutions, and influential works shaping the field. It explores thematic developments, such as the rise of ChatGPT, generative AI, and ethical considerations, highlighting the interdisciplinary nature of AI literacy across education, technology, ethics, and social sciences. Findings reveal the exponential growth of AI literacy research, driven by the increasing reliance on AI systems in education and society. Key themes include AI education, machine learning, and explainable AI, alongside ethical challenges like data privacy and algorithmic bias. However, gaps remain, such as a lack of comprehensive mapping and limited focus on niche topics like behavioral intentions and social good. This study provides a detailed overview of the field's evolution, contributing to future research directions and emphasizing AI literacy's critical role in addressing technological and societal challenges.

Keywords: artificial intelligence, literacy, bibliometric analysis, research trends, technological and societal challenges.

Introduction

Artificial Intelligence (AI) is transforming daily life, influencing areas such as healthcare, education, and business. AI tools personalize learning in schools and aid in diagnosing diseases, showcasing its vast applications (Holmes et al., 2019; Ng et al., 2021). Recent advancements highlight AI's growing role in shaping human interactions, with applications expanding across diverse domains.

AI literacy-understanding how AI works, its benefits, and risks-is increasingly critical. It equips individuals to engage critically with AI systems, navigate issues like algorithmic bias and privacy concerns, and foster ethical practices (Long, 2020). Promoting AI literacy ensures people can use AI responsibly and equitably in a rapidly evolving technological world.

The multidisciplinary nature of AI literacy is evident as it bridges diverse domains, including education, technology, ethics, and social sciences. In education, AI literacy enables the integration of advanced tools to personalize learning and prepare students for an AI-driven future (Holmes et al., 2019). Technologically, it encompasses the understanding of machine learning algorithms, generative AI, and explainable AI, which form the foundation of AI systems (Ng et al., 2021). Ethical considerations are also integral, as AI literacy fosters awareness of algorithmic biases, privacy concerns, and equitable use of AI (Long, 2020).

Furthermore, social sciences contribute by examining the societal impacts of AI adoption, behavioral intentions, and the implications of digital transformation (Lin et al., 2023). This interdisciplinary approach ensures a holistic understanding of AI technologies and their role in shaping modern society.

AI literacy plays a critical role in addressing societal and educational challenges by equipping individuals with the knowledge and skills necessary to navigate a technology-driven world. In the educational context, AI literacy fosters the ability to critically assess and utilize AI tools, empowering students and educators to apply personalized learning systems, enhance problem-solving skills, and prepare for AI-driven job markets (George, 2023). Data-centric AI presents intricate ethical challenges, including protecting sensitive information, addressing inherent biases in datasets and algorithms, and ensuring transparency in its processes (Patel, 2024). Furthermore, AI literacy supports the ethical use of generative AI and large language models, addressing concerns like misinformation and societal polarization, thereby promoting technological innovation that aligns with human values (Williamson and Prybutok, 2024). As AI becomes increasingly integrated into daily life, fostering AI literacy ensures individuals and communities are prepared to meet the challenges and opportunities it presents

AI literacy is a multidisciplinary field, intersecting areas such as computer science, education, ethics, and psychology. Its scope extends beyond technical expertise, emphasizing the importance of ethical considerations, societal implications, and equitable access to AI education (Shiri, 2024; Passonneau et al 2017; Kimiafar et al, 2023) Given the increasing reliance on AI-driven systems across industries, fostering AI literacy has become a global priority, shaping academic research, policymaking, and educational practices.

Despite its growing importance, the field of AI literacy remains dynamic and complex, with varying definitions, frameworks, and approaches. To better understand its development, key contributors, and emerging trends, a systematic bibliometric analysis is essential (Boztas et al, 2024). Bibliometric studies offer a comprehensive view of the research landscape by analyzing publication patterns, citation dynamics, and thematic clusters, providing valuable insights into the evolution and future directions of a field.

This study highlights several gaps in the existing literature on AI literacy. One notable gap is the lack of comprehensive mapping of the field, with many studies focusing on specific aspects of AI literacy, such as AI education or ethical concerns, without offering a holistic view of the entire landscape. While there has been significant progress in documenting AI literacy's integration into educational frameworks, less attention has been paid to the interdisciplinary nature of AI literacy, which bridges areas like psychology, ethics, and social sciences. Additionally, underexplored themes such as behavioral intention and social good, despite their relevance, remain niche and less integrated into the broader discourse. This creates opportunities for further research to broaden the scope and better understand these emerging areas, ensuring AI literacy research can fully address the evolving technological, educational, and societal challenges.

The existing research landscape in AI literacy demonstrates rapid growth and increasing interdisciplinary. Spanning diverse domains, it includes foundational works on integrating AI into education and addressing its ethical and societal implications. This study's highlights key contributors, important publications, and new trends such as generative AI and ethical frameworks. Key themes include AI education, ethical AI use, and understanding generative AI models like ChatGPT, indicating a shift toward addressing the pedagogical,

technological, and ethical dimensions of AI. Despite its expansion, gaps persist in the integration of niche topics like social good and behavioral intentions, pointing to areas for future exploration.

This study aims to map the research landscape of AI literacy through a bibliometric analysis of 608 publications from Scopus, covering the period 2016 to 2024. By examining publication trends, influential authors and affiliations, and thematic developments, this study seeks to identify the key areas of focus, emerging challenges, and potential gaps in AI literacy research. The findings are expected to contribute to a deeper understanding of the field and guide future efforts to advance AI literacy in diverse contexts.

Methodology

Research Design

The study employs a bibliometric approach to systematically analyze AI literacy research. Bibliometrics is a technique for analyzing and quantifying text and information within datasets, particularly large ones (Cobo et al., 2011). Aria and Cuccurullo (2017) highlight that bibliometrics aim to answer three key questions: they identify the core knowledge and intellectual framework of a research area, investigate the field's conceptual advancements, and chart the social network structure of the scientific community involved.

Study Group

Data were retrieved from the Scopus database using the search terms ('AI literacy' OR 'artificial intelligence literacy'). The dataset includes 608 publications, comprising 364 articles and 244 conference papers published between 2016 and 2024. Key bibliometric indicators, such as publication trends, average citations, and trend topics, were examined using the Bibliometrix library in R.

Data Collection and Analysis Process

The methodological steps for this study involved several key phases. First, relevant publications were collected from the Scopus database to ensure comprehensive coverage of the topic. Following data collection, duplicates and irrelevant records were removed during the data cleaning and preparation phase, ensuring the quality and reliability of the dataset. The bibliometric analysis included a descriptive examination of publication trends, citation patterns, and authorship dynamics, as well as a keyword co-occurrence analysis to identify thematic clusters and emerging trends. Visualization techniques, such as thematic mapping, trend analysis, and co-authorship network analysis, were employed to provide a clear representation of the data. Finally, the findings were interpreted to uncover insights into the evolution and current state of AI literacy research, offering a detailed understanding of the field's development over time.

Findings

Main Information about Bibliometric Analyses

Figure 1. Main Information about Bibliometric Analyses

Figure 1 highlights the rapid growth of AI literacy research, with a 115.08% annual growth rate and 716 documents published between 2016 and 2024. The study involves contributions from 1,891 authors, with an average of 3.4 co-authors per document and 17.74% of works featuring international collaboration. The field demonstrates a high impact, with an average of 12.23 citations per document, reflecting its growing relevance and interdisciplinary nature.

Annual Scientific Production

Table 1.
Annual Scientific Production

Year	Articles
2016	1
2017	0
2018	2
2019	6
2020	10
2021	41
2022	44
2023	154
2024	458

Table 1 showcases the exponential growth in AI literacy research over the years. Starting with just 1 article in 2016, there was a slow increase until 2020, where 10 articles were published, marking the beginning of significant growth? The numbers surged from 41 in 2021 to 154 in 2023, with a dramatic peak in 2024, reaching 458 articles. This trend highlights the field's increasing importance and widespread academic interest, particularly in recent years.

Average Citations Per-year

Table 2. Average Citations Per-year

MeanTCperArt	N	MeanTCperYear	Year	CitableYears
167,00	1	18,56	2016	9
14,50	2	2,07	2018	7

69,00	6	11,50	2019	6
121,70	10	24,34	2020	5
38,15	41	9,54	2021	4
27,77	44	9,26	2022	3
18,62	154	9,31	2023	2
2,79	458	2,79	2024	1

Table 2 illustrates the average citations per year for AI literacy publications, highlighting the impact of research over time. Articles from earlier years, such as 2016, show a high average citation rate (18.56 per year) due to the smaller number of foundational publications with significant influence over time. As the volume of publications increased, particularly after 2020, the average citations per year slightly declined but remained consistent, with figures like 9.54 in 2021 and 9.31 in 2023. The sharp increase in publication numbers in 2024 (458 articles) results in a lower average citation rate (2.79 per year), reflecting the recency of these publications and their limited time to accumulate citations. This trend underscores the maturity of early research and the growing, diverse body of recent work in AI literacy.

Most Relevant Sources

Figure 2. Most Relevant Sources

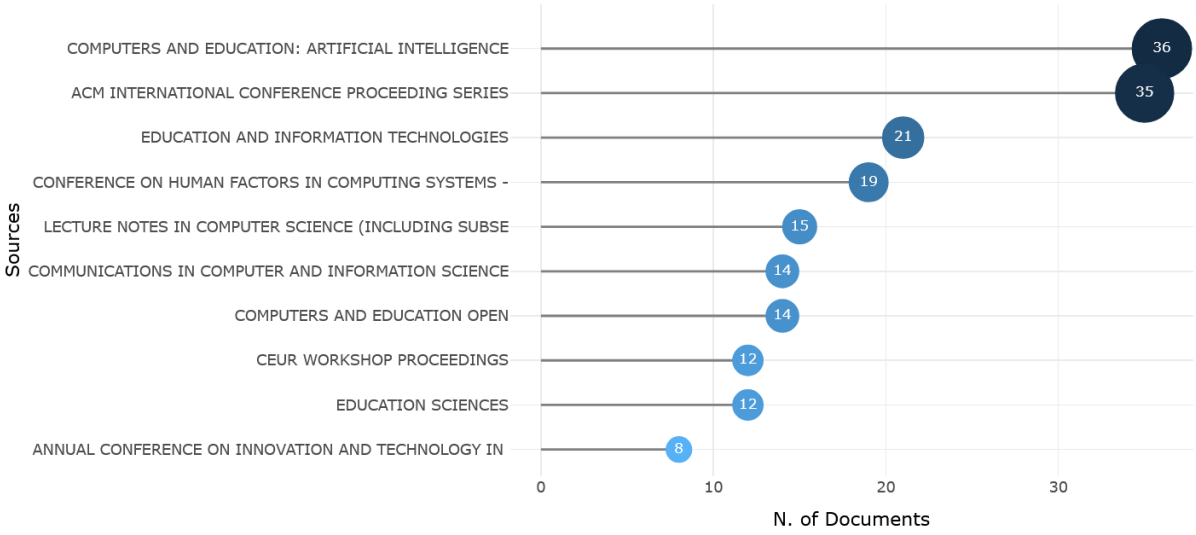


Figure 2 shows the most relevant sources for AI literacy research, led by *Computers and Education: Artificial Intelligence* (36 documents) and *ACM International Conference Proceedings Series* (35 documents), emphasizing the focus on education and computer science. Other significant contributors, such as *Education and Information Technologies* and *Conference on Human Factors in Computing Systems*, highlight the interdisciplinary nature of the field, bridging education, technology, and human interaction.

Most Relevant Authors

Figure 3. Most Relevant Authors

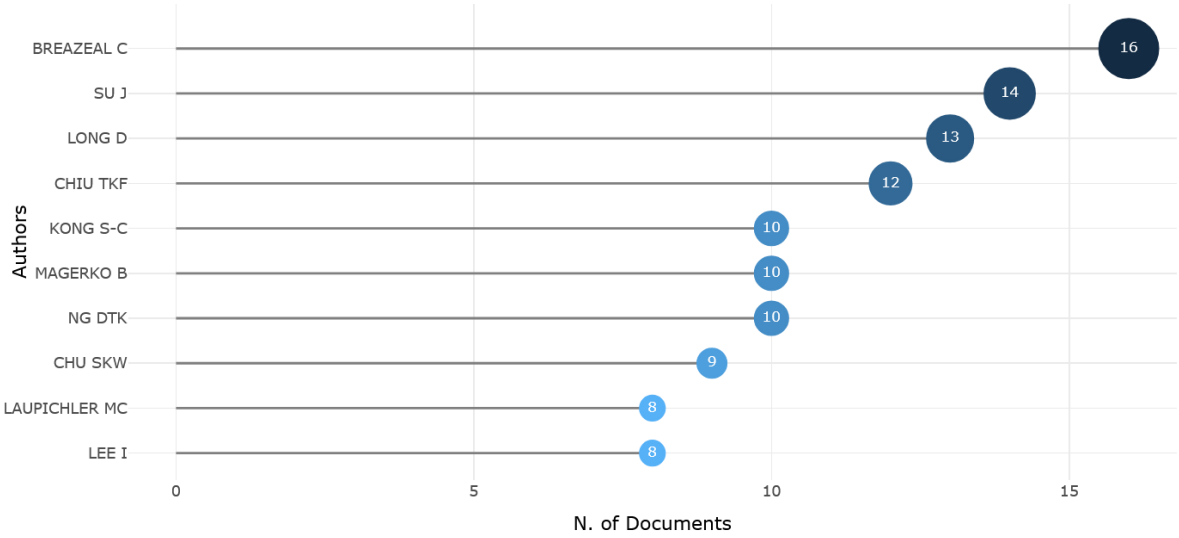


Figure 3 highlights the most prolific authors in AI literacy research. Leading the list is Breazeal C with 16 publications, followed by Su J (14) and Long D (13). These authors have made significant contributions, shaping the discourse in AI literacy. Other notable contributors include Chiu TKF (12) and Kong S-C, Magerko B, and Ng DTK (each with 10 documents), emphasizing the collaborative and interdisciplinary nature of the field. This distribution reflects a concentrated effort by a core group of researchers driving advancements in AI literacy.

Most Relevant Affiliations

Figure 4. Most Relevant Affiliations

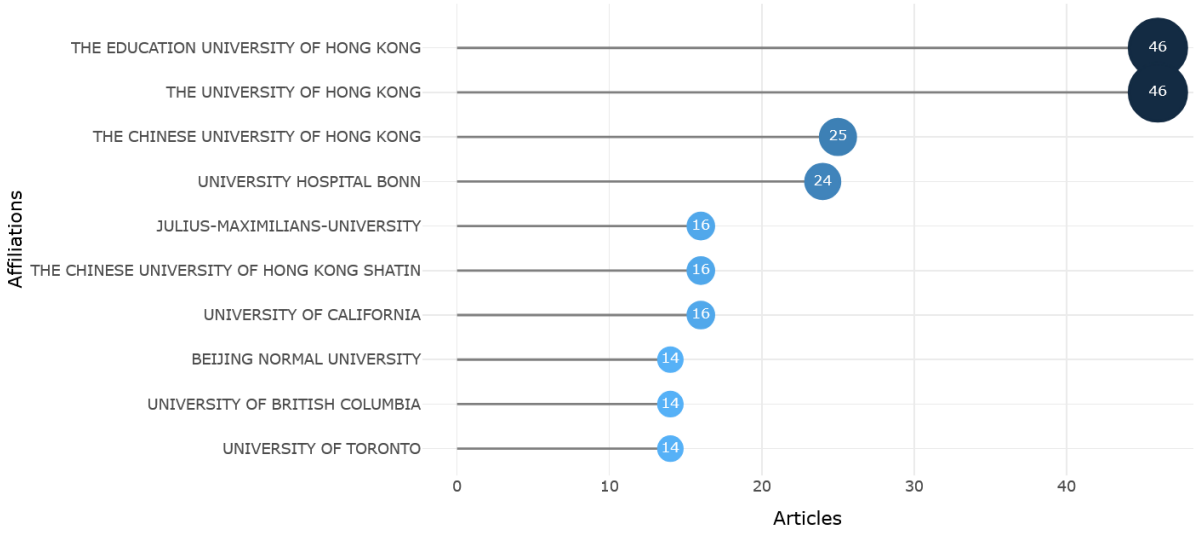


Figure 4 showcases the leading affiliations contributing to AI literacy research. The Education University of Hong Kong and The University of Hong Kong lead with 46 publications each, reflecting a strong focus on AI literacy in Hong Kong's academic institutions. Following them are The Chinese University of Hong Kong (25) and University Hospital Bonn (24), indicating notable contributions from Germany as well. Other key contributors include Julius-Maximilians-University, University of California, and Beijing

Normal University, each with 14–16 articles, underscoring the global and interdisciplinary nature of AI literacy research across education, technology, and healthcare domains.

Most Global Cited Documents

Table 3. Most Global Cited Documents

Paper	Total Citations	TC per Year	Normalized TC
LONG D., 2020, CONF HUM FACT COMPUT SYST PROC	704	140,80	5,78
NG DTK, 2021, COMPUT EDUC	393	98,25	10,30
CHAN CKY, 2023, INT J EDUC TECHNOL HIGH EDUC	293	146,50	15,73
RASUL T, 2023, J APPL LEARN TEACH	170	85,00	9,13
KANDLHOFER M, 2016, PROC FRONT EDUC CONF FIE	167	18,56	1,00
YANG W, 2022, COMPUT EDUC	161	53,67	5,80
LAUPICHLER MC, 2022, COMPUT EDUC	157	52,33	5,65
LEE I, 2021, SIGCSE - PROC ACM TECH SYMP COMPUT SCI EDUC	146	36,50	3,83
DRUGA S, 2019, ACM INT CONF PROC SER	145	24,17	2,10
ROBINSON SC, 2020, TECHNOL SOC	144	28,80	1,18

Table 3 highlights the most globally cited documents in AI literacy research, showcasing the foundational works shaping the field. The most cited paper, Long D (2020), with 704 citations and a high annual average (140.80), reflects its significant impact on human-computer interaction studies. Similarly, Ng DTK (2021) and Chan CKY (2023) have 393 and 293 citations respectively, demonstrating their influence in educational technology and high citation rates per year.

Other notable contributions include Rasul (2023) and Yang (2022), which emphasize emerging trends in AI education and ethics. The foundational work of Kandlhofer (2016), though older, highlights its enduring relevance. Collectively, these documents reveal the interdisciplinary and high-impact nature of AI literacy research across education, technology, and social science domains.

Most Frequent Words

Figure 5. Most Frequent Words

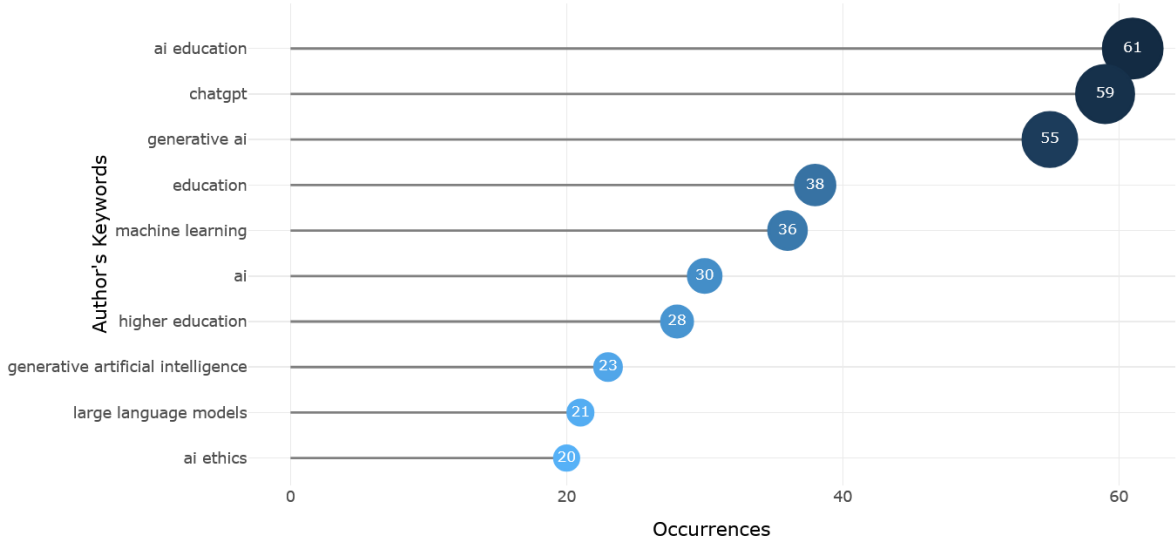
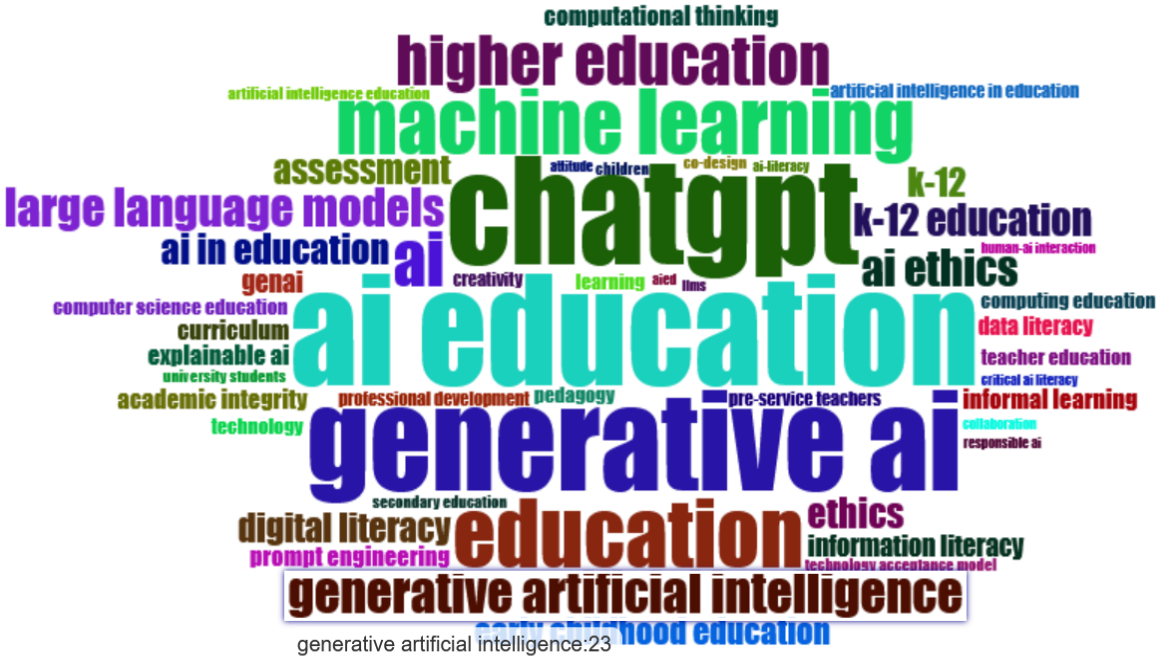


Figure 5 identifies the most frequently occurring keywords in AI literacy research, offering insights into the dominant themes. The most common keyword is "AI education" (61 occurrences), highlighting the field's strong focus on educational integration. Closely following are terms like "ChatGPT" (59) and "Generative AI" (55), reflecting the increasing relevance of large language models and generative technologies. Other frequently used terms, such as "machine learning" (36), "higher education" (28), and "AI ethics" (20), emphasize the diversity of topics, ranging from technical aspects to societal implications. This distribution underscores the interdisciplinary nature of AI literacy, linking technological innovation with educational and ethical considerations. When these explanations are visually synthesized, the Word cloud shown in Figure 6 is formed.

Figure 6. Word cloud of study



Trend Topics

Figure 7. Trend Topics over Time

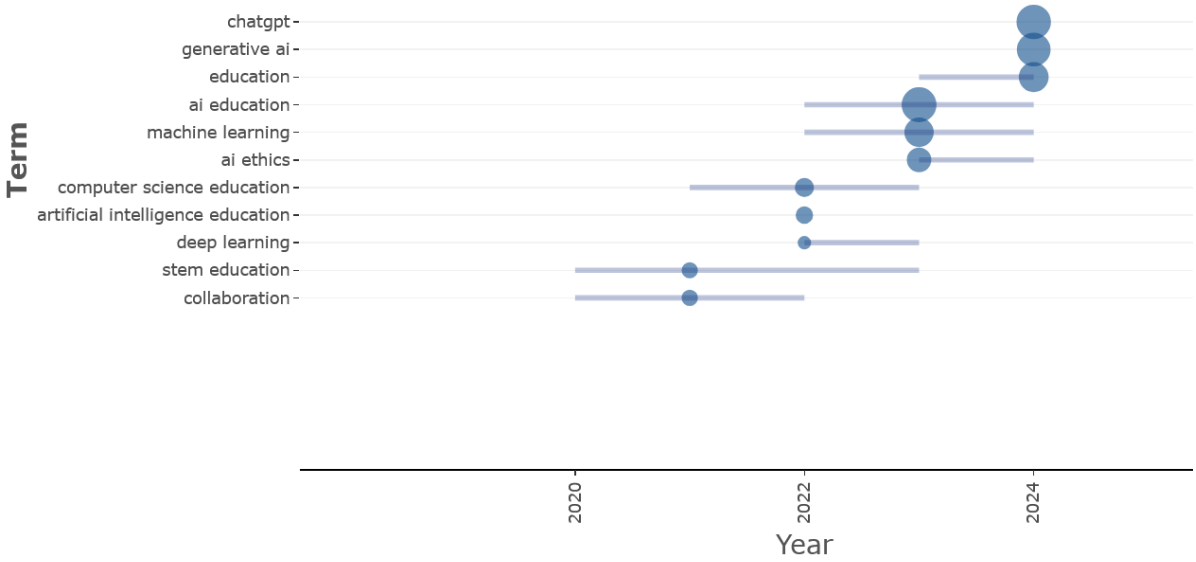
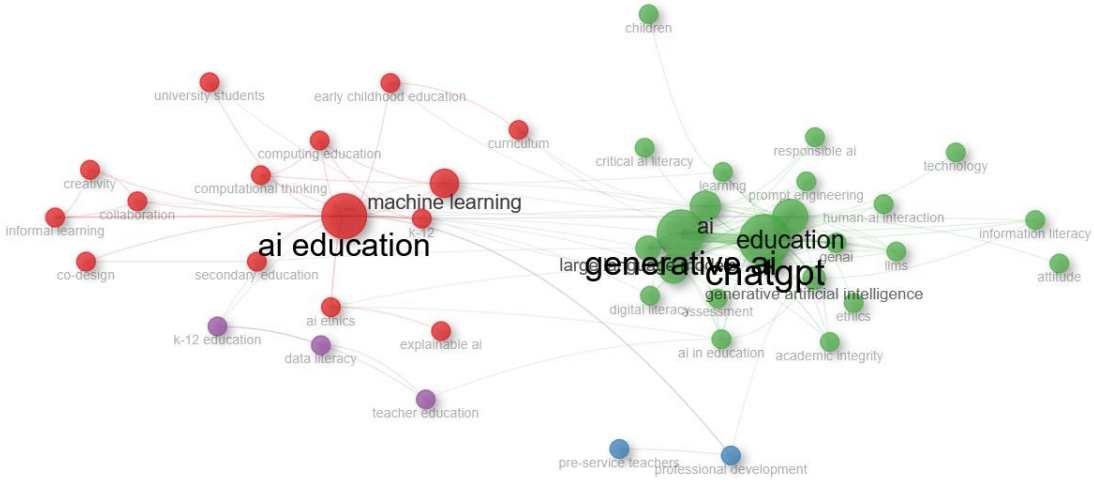


Figure 7 illustrates the evolution of key topics in AI literacy research from 2020 to 2024. Emerging terms like ChatGPT and Generative AI dominate in 2024, reflecting the surge of interest in generative technologies and their applications. Earlier topics, such as STEM education and deep learning, were prevalent during the initial phases, showcasing the foundational focus on technical and educational integration. Over time, themes such as AI ethics and AI education gained prominence, indicating a shift toward addressing societal and pedagogical implications. This timeline highlights the dynamic nature of AI literacy research, adapting to technological advancements and educational needs.

Co-occurrence Network

Figure 8. Co-occurrence Network



Thematic Map
Figure 9. Thematic Map

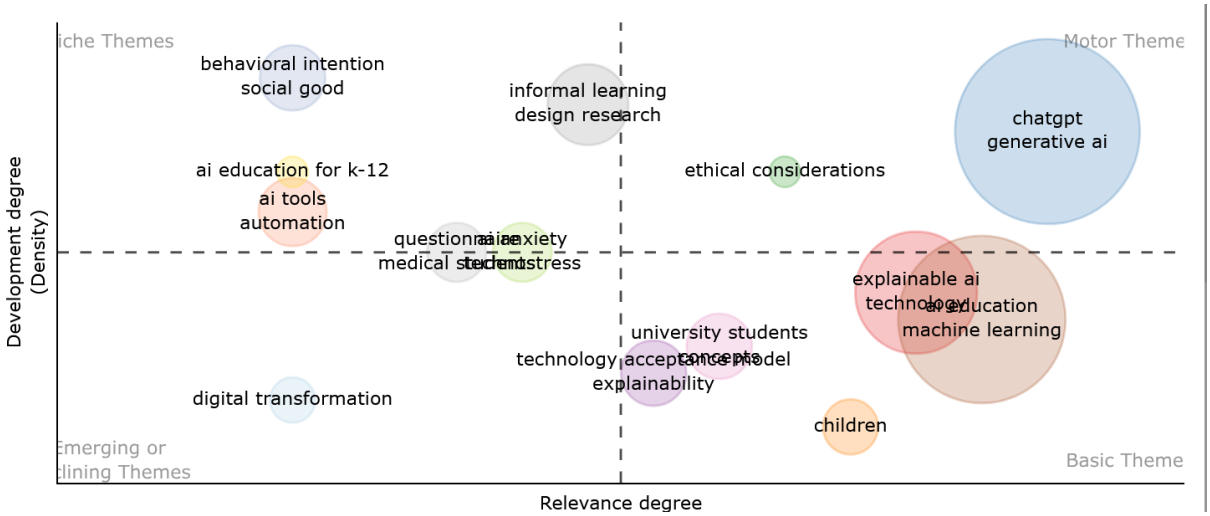


Figure 9 categorizes AI literacy research into four distinct quadrants based on relevance and development. Motor themes, such as ChatGPT and Generative AI, are highly developed and central to the field, reflecting their significant role in advancing AI literacy, particularly in recent years. Basic themes, including AI education, Machine Learning, and Explainable AI, form the foundational framework of the research, showcasing their widespread relevance and essential contributions to understanding and teaching AI literacy. On the other hand, Niche themes, such as Behavioral Intention and Social Good, are more specialized and less influential in shaping the overall discourse but address specific areas of interest within the field. Lastly, Emerging or Declining themes, like Digital Transformation, represent areas that are either gaining traction or becoming less prominent over time. This map highlights the dynamic and evolving nature of AI literacy research, with strong emphasis on technological and educational advancements while also addressing ethical and niche topics.

Discussion, Conclusion and Recommendations

The findings of this bibliometric analysis emphasize the rapid growth and interdisciplinary importance of AI literacy research. With an annual growth rate of 115.08%, the surge in publications, particularly after 2020, reflects the increasing academic and practical interest in understanding and addressing the complexities of AI technologies. This aligns with prior research that has highlighted the pivotal role of AI literacy in preparing individuals for an AI-driven society (Ng et al., 2021; Holmes et al., 2019).

The study identifies key academic hubs, such as institutions in Hong Kong and Germany, as major contributors, reflecting the global reach and interdisciplinary nature of AI literacy research. This observation echoes findings from Lin et al. (2023), who noted similar geographic clustering in AI ethics research. The methodological use of bibliometrics, including co-occurrence analysis and thematic mapping, provides a structured view of the intellectual framework, identifying dominant themes like AI education, generative AI, and ethical considerations. These findings align with the work of Aria and Cuccurullo (2017), who emphasized the utility of bibliometric methods in mapping scientific landscapes.

Key themes emerging from the analysis include the prominence of educational integration, reflected in the widespread discussion of generative AI tools such as ChatGPT and their implications for pedagogy (George, 2023). The growing attention to ethical AI use is consistent with previous literature that highlights the need for transparency, fairness, and accountability in AI systems (Patel, 2024; Williamson and Prybutok, 2024). Gaps in AI

literacy research include limited focus on behavioral intentions, which explore user interactions with AI, and social good, emphasizing AI's potential for equity and inclusivity (Shiri, 2024; Kimiafar et al., 2023). These themes are underrepresented compared to dominant topics like generative AI and ethics, highlighting the need for a holistic approach. Future research should integrate these areas into broader discussions, aligning training programs with user attitudes and fostering innovations that prioritize societal well-being. Bridging these gaps will ensure AI literacy supports both technological progress and social development.

The methodological robustness of this study ensures that its findings contribute significantly to the discourse on AI literacy. By utilizing bibliometric tools such as the Bibliometrix R package, the study not only identifies patterns in publication trends and citation dynamics but also explores the co-authorship and thematic networks within the research community. This approach builds upon the work of Cobo et al. (2011), who demonstrated the effectiveness of bibliometric methods in visualizing research evolution.

Incorporating insights from existing literature, the findings of this study provide actionable directions for advancing AI literacy research. For instance, the thematic map highlights the centrality of motor themes like generative AI and ChatGPT, which require further exploration to address their societal and educational implications (Boztaş et al., 2024). Similarly, foundational themes like AI education and explainable AI continue to serve as critical pillars of the field, reinforcing the interdisciplinary and practical nature of AI literacy.

In conclusion, this study underscores the dynamic growth and interdisciplinary character of AI literacy research, bridging gaps between technological innovation and societal needs. Future research should prioritize global collaboration, integrate niche themes into mainstream discourse, and focus on ethical considerations to ensure that AI literacy remains a key competency for navigating the complexities of the modern technological landscape.

References

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*. https://doi.org/10.1016/j.joi.2017.08.007

Boztaş, G. D., Berigel, M., & Altınay, F. (2024). A bibliometric analysis of Educational Data Mining studies in global perspective. *Education and Information Technologies*, *29*(7), 8961-8985.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research feld: A practical application to the fuzzy Sets Theory feld. *Journal of Informetrics*, 5(1), 146–166. https://doi.org/10.1016/J.JOI.2010.10.002

George, A. S. (2023). Preparing students for an AI-driven world: Rethinking curriculum and pedagogy in the age of artificial intelligence. *Partners Universal Innovative Research Publication*, *1*(2), 112-136.

Holmes, W., et al. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning.* Center for Curriculum Redesign.

Kimiafar, K., Sarbaz, M., Tabatabaei, S. M., Ghaddaripouri, K., Mousavi, A. S., Mehneh, M. R., & Baigi, S. F. M. (2023). Artificial intelligence literacy among healthcare professionals and students: a systematic review. *Frontiers in Health Informatics*, *12*, 168.

Lin, X. F., Wang, Z., Zhou, W., Luo, G., Hwang, G. J., Zhou, Y., & Liang, Z. M. (2023). Technological support to foster students' artificial intelligence ethics: An augmented

reality-based contextualized dilemma discussion approach. *Computers & Education*, *201*, 104813.

Long, D. (2020). Human factors and AI literacy. *Proceedings of the Conference on Human Factors in Computing Systems.*

Ng, D. T. K., et al. (2021). Educating for AI literacy: Challenges and strategies. *Computers & Education*, *16*(4), 45–60.

Passonneau, R. J., McNamara, D., Muresan, S., & Perin, D. (2017). Preface: special issue on multidisciplinary approaches to AI and education for reading and writing. *International Journal of Artificial Intelligence in Education*, *27*, 665-670.

Patel, K. (2024). Ethical reflections on data-centric AI: balancing benefits and risks. *International Journal of Artificial Intelligence Research and Development*, *2*(1), 1-17.

Shiri, A. (2024). Artificial intelligence literacy: a proposed faceted taxonomy. *Digital Library Perspectives*, *40*(4), 681-699.

Williamson, S. M., & Prybutok, V. (2024). The Era of Artificial Intelligence Deception: Unraveling the Complexities of False Realities and Emerging Threats of Misinformation. *Information*, *15*(6), 299.