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(JISTM)**www.gaexcellence.com/jistm**THE EVOLUTION OF ARTIFICIAL INTELLIGENCE
LITERACY RESEARCH: A BIBLIOMETRIC ANALYSIS**Nor Famiza Tarsik^{1*}¹Faculty of Information Science, Universiti Teknologi MARA Cawangan Kedah Malaysia norfamiza@uitm.edu.my<https://orcid.org/0000-0001-5240-7177>

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Abstract:

The rapid adoption of artificial intelligence and growing concerns regarding workplace disruption and misinformation, traditional digital literacy frameworks lack updated, systematic mapping to account for the disruptions brought by generative AI. To address this gap, this study identify annual research trends, identifies dominant topics, and evaluates the intellectual structure of AI literacy literature published between 2020 and 2025. Literature was retrieved from the Scopus database following PRISMA systematic screening guidelines and analyzed using VOSviewer for science mapping, Harzing's Publish or Perish for citation metrics, and Microsoft Excel. A final dataset of 443 records was selected for bibliometric analysis. The analysis reveals an exponential growth in scholarly output, peaking in 2025 with 292 documents (65.91%). The United States (85 publications) and China (80 publications) are the leading research contributors, S.C. Kong is identified as the most prolific author (17 publications), and Computers and Education: Artificial Intelligence serves as the top publication source (25 publications). Analysis also demonstrates a central focus on educational technology and digital competency, with rapidly emerging themes including prompt engineering, academic integrity, large language models, AI ethics and teacher education. This study contributes to the literature by providing a longitudinal evaluation of the post-ChatGPT AI literacy landscape, offering an empirical foundation to inform future policy development and responsible AI integration frameworks.

DOI: 10.35631/JISTM.1144026**Keyword:**

AI Literacy, Artificial Intelligence, AI Technology, Bibliometric Analysis, Generative AI



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Introduction

The Artificial Intelligence (AI) landscape has been transformed significantly in recent years as evidenced by the increased integration of AI technologies being incorporated into individuals' daily lives. The development of AI is progressing rapidly, leading to a wide range of applications and systems designed to perform numerous tasks conventionally performed by humans. AI involves the design and development of machine-based intelligence through artificial means. AI literacy is defined by Laupichler et al., (2023) as a competency that encompasses basic knowledge and analytical evaluation of AI, as well as the critical use of AI applications by non-experts. Furthermore, AI typically focuses on simulating human cognitive processes completed by machines that can see, process and respond in a human-like manner. Meanwhile, Valtonen et al. (2019) consider that AI literacy can be considered a specific form of media or digital literacy.

The primary objective of AI is to develop systems that are capable of performing tasks in an intelligent and autonomous manner. As stated by Tringka et al. (2025), the accelerated development of generative AI represents a fundamental transformation in the development and integration of intelligent system. This empowers machines to generate highly realistic content across multiple mechanisms with the advancement in producing of text, images, audio and structured data. Intelligence is a characteristic commonly associated with humans and intelligent machines are expected to be able to mimic human capabilities as effectively as possible in performing a variety of tasks. However, defining intelligence remains a complex challenge as it is a contextual and dynamic trait that varies significantly based on an individual expertise, experience and learning process.
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Literature Review

The advancement of AI technology has led to the introduction of numerous applications and systems. However, significant barriers remain regarding the availability of a workforce equipped with AI-related skills. Acquiring these skills requires individuals to have expertise across various AI-related fields, usually involving a combination of technical skills, AI ethics and awareness. This shortage of skilled human capital poses a crucial obstacle to technological advancement and innovation (Jonanthan & Bin, 2018). Therefore, according to Prashant (2016), overcoming the lack of AI skills, developing countries require increased investment in education and workforce development initiatives to upskilling individuals' AI literacy. These may include vocational training programs, internships, AI courses and other AI skills-upgrading aimed at preparing individuals AI-related jobs.

Furthermore, accelerated technological growth has produced major disruptions across societal and economic domains, raising concern about the potential for job displacement in various sectors (Cao & Zhai, 2023). This concern is reinforced by the continued expansion of AI capabilities has introduced complex challenges at the societal and organizational levels (Jarrahi et al., 2023). As reported by Dwivedi et al. (2023), the rapid pace of technological developments, particularly the rise of emergence trend of new technologies such as ChatGPT and Gemini, hence, requires the acquisition of new competencies and adaptive work practices. Consequently, this situation challenges traditional assumptions and highlights the urgent need for updated AI literacy frameworks and models.

With the advancement of AI technology, there is also an emerging concern that AI may be exploited for misinformation through the malicious spread of false or misleading information. Furthermore, highly realistic and photorealistic images generated by AI are increasingly prevalent on the internet. This making that it increasingly difficult for individuals to distinguish between genuine and fabricated content.

Therefore, this study aims to analyse the current state of research on Artificial Intelligence (AI) literacy applications by examining document types, publication years, keywords, countries, and research methods. The main goals are to enrich existing knowledge on AI-powered libraries by identifying existing research gaps, providing directions for future research, and deepening the understanding needed for effective policy development. These challenges underscore the importance of AI literacy, as individuals need the knowledge, critical thinking abilities and assessment skills necessary to identify, evaluate and respond responsibly to information and media generated by AI.

Generally, AI literacy is a basic insight of AI concepts, encompassing knowledge, critical thinking and also awareness on ethical issues excluding technical expertise. Besides this, as stated by Chiu (2024) and Zhou (2025), AI literate is capable of explaining the basic principles of AI encompassing machine learning and neural networks, able to identify practical applications including recommendation systems and facial recognition. Even, AI also able to critically evaluate the broader societal implications, including algorithmic bias, privacy concerns and potential economic instability. Long and Magerko (2020) outline AI literacy as a series of competencies that allow individuals to critically evaluate AI technologies, communicate and work together effectively with AI and utilise AI responsibly as part of their everyday activities.

Interaction with AI involves engaging with adaptive technologies that respond to and are shaped by the data they process. The AI technology can facilitate the completion of various tasks and support decision making process such as information retrieval, problem-solving and decision making across various disciplines. Generative AI systems, including ChatGPT, Claude and Gemini are capable of producing text-based responses from user inputs and generate visual content. These outputs are synthetically reduced through patterns learned from large-scale datasets. The use of generative AI requires the formulation of prompts, which serve as instructions or questions guiding the system output. Effective prompt design involves clarity, specificity and interactive refinement to obtain high-quality results. It also requires user's ability to evaluate and verify the accuracy of generated content. Consequently, proficient use of generative AI demands practice, precision on communication and critical assessment skills. AI literacy was often treated as a subset of technical computer literacy involves understanding algorithms and machine learning. The definition has rapidly shifted to a multidimensional

competency that places greater emphasis on critical evaluation, ethical awareness, pedagogical application and data privacy. While some literature lacks standardized frameworks to unify understanding this newly shifted definition. This study addresses the gap by conducting a comprehensive bibliometric analysis of publications published between 2020 to 2025 which provides an integrated perspective on publication trajectories, influential contributors and thematic transformations with a particular focus on the ethical dimensions, pedagogical reorientations, and assessment challenges that have gained prominence in the post-ChatGPT era. Driven by recent and significant advancements in artificial intelligence, this study examines documents published between 2020 and 2025 and sets forth the following study objectives:

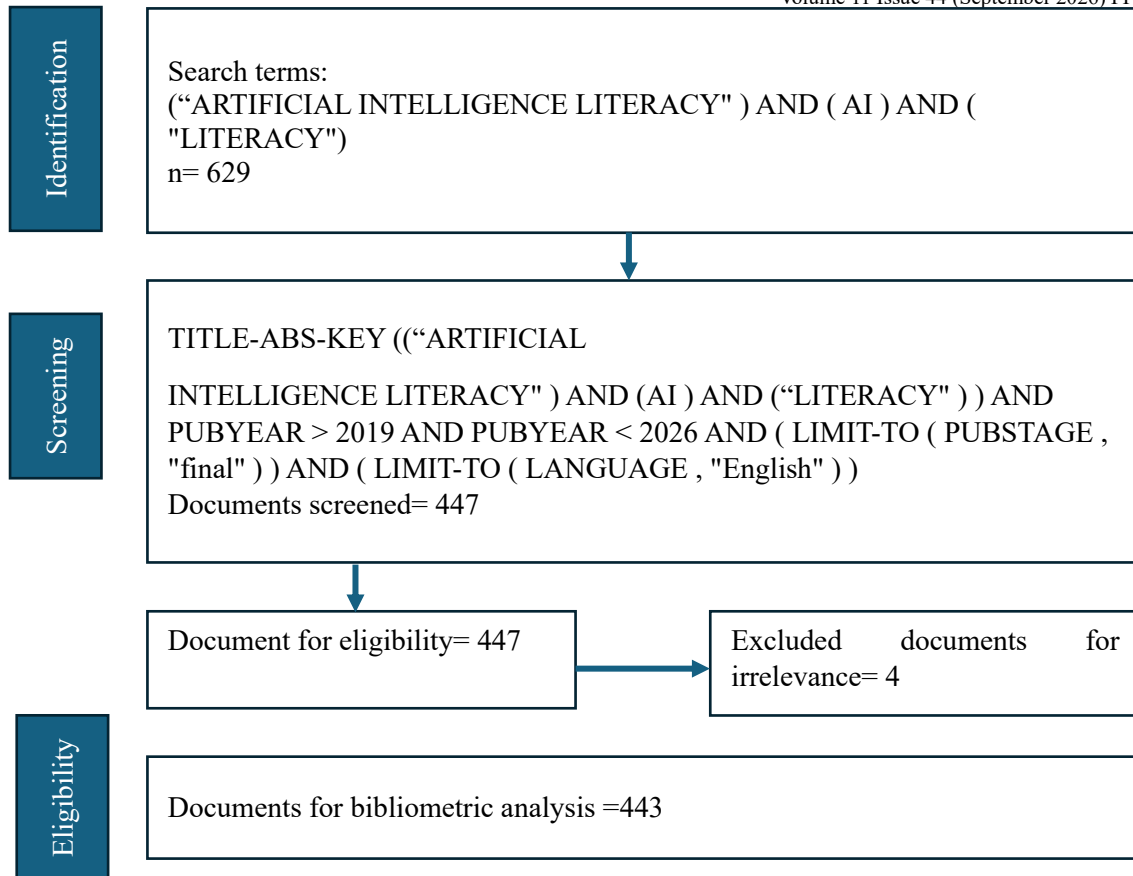
- (a) To examine research trends on the AI literacy.
- (b) To identify the most frequent topics and themes related to AI literacy.
- (c) To identify gaps in the literature and suggest future research directions.

Research Methodology

This study employs bibliometric network analysis and leverages literature retrieved from the Scopus database from 2020 to 2025. This study focuses on AI literacy by identifying and selecting relevant keywords, extract data from the database. the data is analysed using advanced bibliometric visualisation tools and then presenting the study findings. The technique measures academic output through performance analysis and also visualizes the field's intellectual structure through science mapping to provide a holistic view of its evolution (Donthu et al., 2021).

This research offers a comprehensive longitudinal view of the shifting demands AI has placed on digital literacy by exploring the body of academic literature, citation patterns and collaborative networks. This bibliometric research presented the PRISMA template to provide a clear and systematic approach to the literature selection process (Moher et al., 2009).

This study analyse data using VOSviewer, which this tool is a popular bibliometric mapping and visualization software application (Van Eck & Waltman, 2010). This study also utilizes the Microsoft Excel software as tool for analysing the data., Microsoft Excel Worksheet software was used to analyse primary data from Scopus in CSV format as these tools are readily available, familiarity among researchers and versatile data analysis functionalities. Other than that, a well-known academic citation analysis program, was also utilised in this research namely Harsing's Publish or Perish. In brief, Harsing's Publish or Perish software calculates citation metrics and frequency measures.

**Figure 1: PRIMA Flowchart**

Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

As shown in Figure 1, it indicates that a systematic search was conducted to identify relevant literature on artificial intelligence literacy. The initial query yielded that the beginning broad keyword query yielded 629 records. The search was then refined using a structured advanced query in Scopus, in conjunction with restrictions on publication as shown in Table 2 resulting in a reduced dataset of 447 records. Based on the total number of documents, it is reflecting improved precision and relevance in AI literacy. In the subsequent stage, a screening process which was applied to remove any remaining irrelevant or duplicate entries, resulted in a final dataset 443 records. Overall, the stepwise refinement demonstrates a systematic approach to enhancing data quality by progressively increasing specificity of the search strategy. The minimal loss of records during screening, indicates a strong alignment between the search strategy and the research focus.

Findings

Trends in Yearly Publications

The Figure 2 shows the number of publications trend related to AI Literacy. The research data from various sources around the world was collected from the Scopus database that has been aggregated. As showed, the number of publications has been on a rising trend from 2020 to 2025, with the greatest number of publications in 2025 at 292 (65.91%) as shown in Table 1. The annual publication trend demonstrates a significant and continuous increase in the number of documents from 2020 to 2025. This indicating growing academic interest in the research area. The number of publications climbed from only 1 (0.23%) document in 2020 to 9 (2.03%) documents in 2021. However, the publications decreased to 6 (1.35%) in 2022. Moreover, the significant increase in 2023 to 41 (9.26%) documents and 2024 was 94 (21.22%) documents. The highest number of publications was recorded in 2025 with 292 (65.91%) documents. It is representing the peak of research activity during the observed period. Consequently, this steep increase trend suggests that the field has experienced accelerated evolution and has attracted greater emphasize from researchers in recent years.

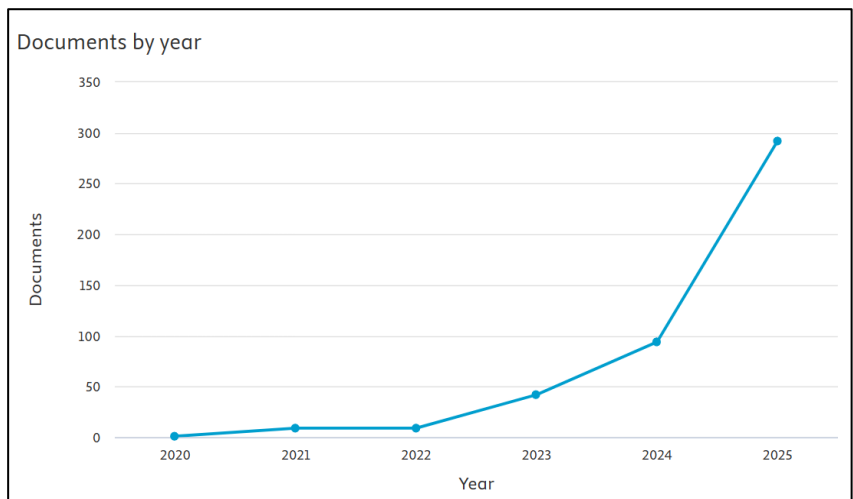


Figure 2: Cumulative Growth in the Number of Source Documents

Table 1: Total Publications by Year

Year	TP		%
2025	292		65.91%
2024	94		21.22%
2023	41		9.26%
2022	6		1.35%
2021	9		2.03%
2020	1		0.23%

Influential Authors

As illustrated in Figure 2, shows the prolific author in this area of research. The figure clearly shows that Kong, S.C. is the most prolific author who contribute the highest total of publications with 17 documents. This is followed by Breazeal, C. with 6 documents and Chiu, T.K.F. with 5 documents. Meanwhile, other authors also equally impressive with 4 documents each of them inclusive of Cheung, Hammer, Ogan, Olari, Saarela, Solyst, J., and Su, J.

The distribution suggests that although a few authors play a leading role in the field, research contributions are also shared among multiple scholars, reflecting collaborative and growing academic engagement within the area of study. Based on this data it shows the reflecting of growing academic engagement within the area of study and impressive collaboration among a few authors play a leading role to study in this research area.

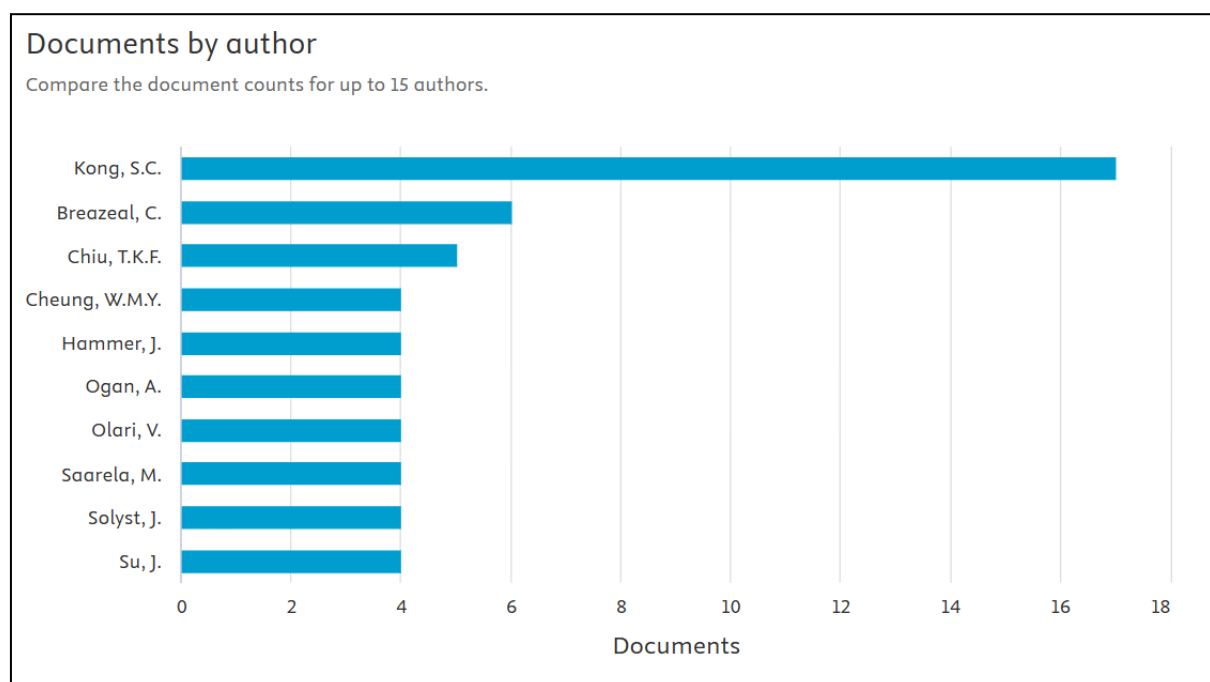


Figure 3: Documents By Author

Most Influential Countries

Table 3 shows the publication distribution by country for 5 years. The table indicates that the United States is the leading contributor with 85 publications (19.19%), closely followed by China with 80 publications (18.06%). Together, these two countries account for more than one-third of the total publications, cumulatively, these two nations generate over a third of the total output, underscoring their pre-eminence in this research domain.

The third country in ranking is Hong Kong with 38 publications (8.58%), while Germany contributes 34 publications (7.67%). These indicate that strong research activities from both Asian and European regions. other countries that also contribute to this research area are Turkey (5.19%) and the United Kingdom (4.74%) also demonstrate notable scholarly involvement. Meanwhile, countries such as Canada and Finland each contribute 3.16%,

followed by Australia (2.48%) and India (2.26%). Overall, the findings suggest that research productivity is concentrated in developed and technologically advanced nations specifically in North America, Asia, and Europe.

While the country collaboration network of the largest interconnected showed in Figure 3. It highlights that United States, China Hong Kong, United Kingdom and Germany prominently emerge as the leading countries with respect to the number of publications. Furthermore, this figure also indicates the strong connections between three influential countries, USA, China and Germany.

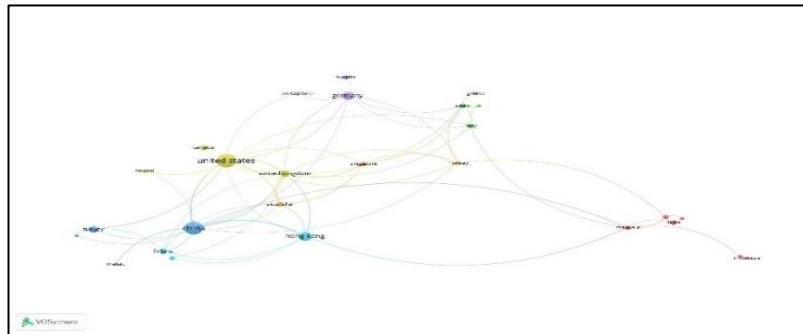


Figure 4: Countries Collaboration

Table 2: Publication Distribution

Country	TP	%
United States	85	19.19%
China	80	18.06%
Hong Kong	38	8.58%
Germany	34	7.67%
Turkey	23	5.19%
United Kingdom	21	4.74%
Canada	14	3.16%
Finland	14	3.16%
Australia	11	2.48%
India	10	2.26%

Impactful Publication Sources

Based on Table 3 suggest the most productive publication source is Computers and Education Artificial Intelligence, contributing 25 publications (5.64%). This indicates its significant influence in disseminating research related to artificial intelligence literacy. The second source of publication is Conference proceedings category that also play significant role in this research area with 13 publications (2.93%) is ACM International Conference Proceeding Series and followed by Lecture Notes in Computer Science with 11 publications (2.48%).

In addition, the Communications in Computer and Information Science, Conference on Human Factors in Computing Systems, and Education and Information Technologies, each contributed 9 publications (2.03%). Other than that, Ceur Workshop Proceedings produced 8 publications

(1.81%), while Frontiers in Education Conference and Proceedings of the Association for Information Science and Technology each recorded 7 publications (1.58%). The International Conference on Artificial Intelligence and Education 2025 contributed 6 publications (1.35%). From holistic perspective, high impact publications such as journal and conference proceedings are essential communication channel for scholarly to share the findings in this area. In addition, it is evidence that this scholarly communication reflecting the highly dynamic and multidisciplinary nature of studies including AI, technology, education and learning

Table 3: Source of Publications

Source Title	Total Publication	%
Computers and Education Artificial Intelligence	25	5.64%
ACM International Conference Proceeding Series	13	2.93%
Lecture Notes in Computer Science	11	2.48%
Communications in Computer and Information Science	9	2.03%
Conference on Human Factors in Computing Systems Proceedings	9	2.03%
Education and Information Technologies	9	2.03%
Ceur Workshop Proceedings	8	1.81%
Proceedings Frontiers in Education Conference Fie	7	1.58%
Proceedings of the Association for Information Science and Technology	7	1.58%
International Conference on Artificial Intelligence and Education (ICAIE) 2025	6	1.35%

Co-Occurrence of Author Keywords

Figure 5 shows Co-Occurrence Author Keywords which the keyword co-occurrence network visualization reveals that “AI literacy” is the central and most dominant keyword within the research field, indicating its significant role in current scholarly discussions. The map also highlights strong connections between “AI literacy” and related concepts such as “artificial intelligence,” “generative AI,” “educational technology,” “digital literacy,” and “AI in education,” suggesting that the research area is highly interdisciplinary and education oriented. Several developing themes are also apparent, including “prompt engineering,” “academic integrity,” “large language models,” and “AI ethics,”. these keywords highlighting recent scholarly concerns regarding the use of artificial intelligence in educational contexts.

Other than that, several keywords that indicate increasing attention toward equipping educators and students with AI-related competencies also highlighted such as “teacher education,” “pre-service teachers,” “critical thinking,” and “professional development”. Overall, the network shows clearly that AI literacy research is exponential growth and closely linked with educational innovation, ethical considerations and digital competency development.

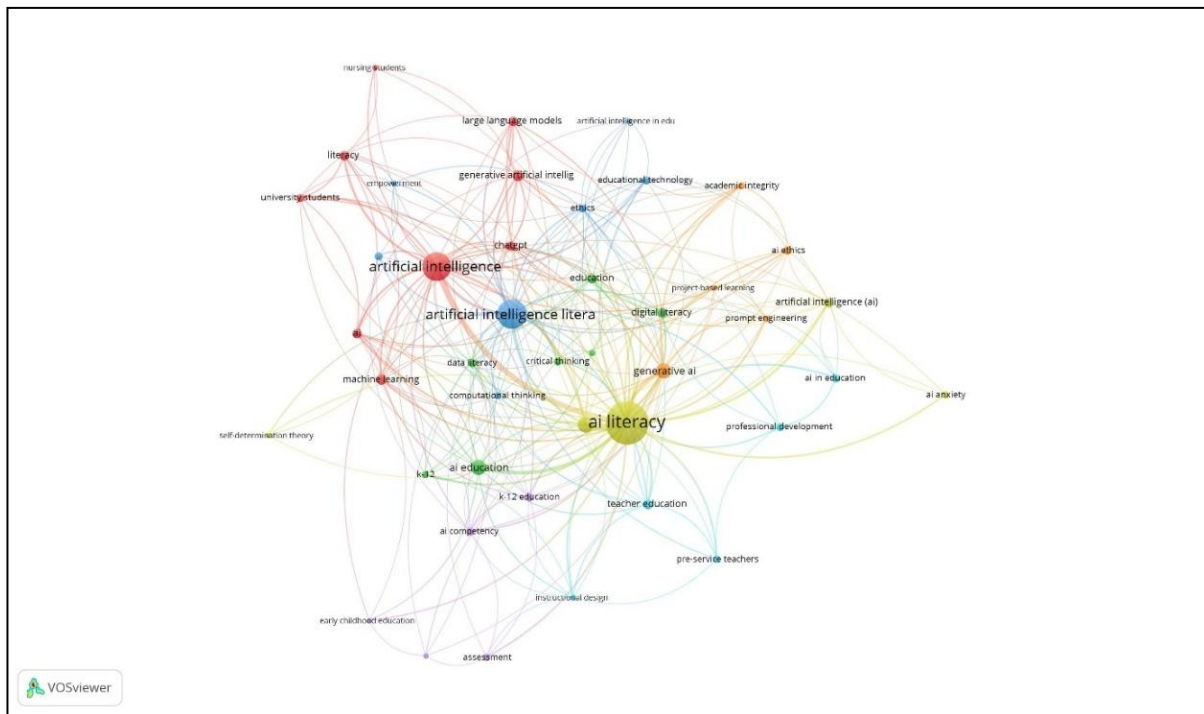


Figure 5: Co-Occurrence Author Keywords

Table 4: Citations Rate

Cites	Authors	Title	Year	Source	CitesPerYear
575	B. Wang, P.-L.P. Rau, T. Yuan	Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale	2023	Behaviour and Information Technology	191.67
458	M.C. Laupichler, A. Aster, J. Schirch, T. Raupach	Artificial intelligence literacy in higher and adult education: A scoping literature review	2022	Computers and Education: Artificial Intelligence	114.5
346	D.T.K. Ng, J.K.L. Leung, K.W.S. Chu, M.S. Qiao	AI Literacy: Definition, Teaching, Evaluation and Ethical Issues	2021	Proceedings of the Association for Information Science and Technology	69.2
288	T.K.F. Chiu, Z. Ahmad, M. Ismailov, I.T. Sanusi	What are artificial intelligence literacy and competency? A comprehensive framework to support them	2024	Computers and Education Open	144
262	N. Knoth, A. Tolzin, A. Janson, J.M. Leimeister	AI literacy and its implications for prompt engineering strategies	2024	Computers and Education: Artificial Intelligence	131
227	C. Wang, H. Wang, Y. Li, J. Dai, X. Gu, T. Yu	Factors Influencing University Studentsâ€™ Behavioral Intention to Use Generative Artificial Intelligence: Integrating the Theory of Planned Behavior and AI Literacy	2025	International Journal of Human-Computer Interaction	227
205	D.T.K. Ng, W. Wu, J.K.L. Leung, T.K.F. Chiu, S.K.W. Chu	Design and validation of the AI literacy questionnaire: The affective, behavioural, cognitive and ethical approach	2024	British Journal of Educational Technology	102.5
194	I. Celik	Exploring the Determinants of Artificial Intelligence (AI) Literacy: Digital Divide, Computational Thinking, Cognitive Absorption	2023	Telematics and Informatics	64.67
185	K. Stolpe, J. Hallstr�m	Artificial intelligence literacy for technology education	2024	Computers and Education Open	92.5
180	I.H.Y. Yim, J. Su	Artificial intelligence (AI) learning tools in K-12 education: A scoping review	2025	Journal of Computers in Education	180

170	G. Schiavo, S. Businaro, M. Zancanaro	Comprehension, apprehension, and acceptance: Understanding the influence of literacy and anxiety on acceptance of artificial Intelligence	2024	Technology in Society	85
164	D. Cetindamar, K. Kitto, M. Wu, Y. Zhang, B. Abedin, S. Knight	Explicating AI Literacy of Employees at Digital Workplaces	2024	IEEE Transactions on Engineering Management	82

Most Prolific Authors

Table 5 illustrates the most cited documents of AI literacy and highlighting ten documents from year 2020 to 2025. As the table clearly shows, the most widely cited article is “Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale” by B. Wang, P.-L.P. Rau, and T. Yuan, published in 2023 in Behaviour and Information Technology. This article has been cited with 575 citations and the highest citation rate of 191.67 citations per year. This is then followed by the scoping review by M.C. Laupichler and colleagues which received 458 citations at a rate of 114.5 citer per year. This indicates a strong scholarly interest in AI literacy within higher and adult education.

Another highly influential study with accumulation of 346 citations (69.2 citer peryear) is “AI Literacy: Definition, Teaching, Evaluation and Ethical Issues” by D.T.K. Ng and collaborators which significantly contributed to conceptualizing AI literacy. In addition, more recent studies published in 2024 and 2025 also demonstrate increasing at a rapid pace, such as works by T.K.F. Chiu, N. Knoth, and C. Wang. This study shows greater number on citation impact, reflecting the growing academic attention toward AI literacy, prompt engineering, generative AI, and AI competency in educational and workplace contexts. In brief, the citation pattern suggests that AI literacy has emerged as a highly active and rapidly expanding research domain with strong interdisciplinary relevance.

Discussion and Conclusion

The rising global recognition of AI technologies and its implications for education, society and professional development is reflected in the significant upward trend in annual publications between 2020 and 2025. In addition, the bibliometric findings show that AI literacy has evolved into a increasingly influential research domain particularly from 2023 onwards. The sharp increase in publications by 2025 indicates that AI literacy has transcended its status as a niche topic, becoming a major area of academic inquiry driven by the extensive implementation of generative AI and large language models in educational and workplace settings. In addition, this study provides significant evidence that researchers are actively exploring how individuals can effectively understand, evaluate and responsibly use AI technologies responsibly.

The rising global recognition of artificial intelligence technologies and their implications for education, society and professional development is reflected the significant upward trend in annual publications between 2020 and 2025. Furthermore, the bibliometric findings show that AI literacy has emerged as a progressively growing and highly influential research domain particularly from 2023 onwards. The sharp growth in 2025 indicates that AI literacy is no longer considered a niche topic but has become a major area of academic inquiry driven by the

extensive implementation of generative AI and large language models in educational and workplace settings. In addition, this study provides significant evidence that researchers are actively exploring how individuals can effectively understand, evaluate and responsibly use AI technologies responsibly.

The significant contributions to global AI-related publications are primarily driven by well-funded research programmes, advanced technological infrastructure and facilities. Other than that, government support also plays significant roles in the growth of AI. Literally, AI research is concentrated with strong digital infrastructure and environments that foster innovation such as the United States and China. As mentioned by Nasrallah (2024), AI provides significant opportunities to enhance governance by improving efficiency and enabling more effective decision-making through advance technological capability. Moreover, it contributes to the national development by fostering innovation and promoting sustainable growth. This pattern reflects increasing collaboration across disciplines including education, information science, computer science, and educational technology.

This suggests that AI literacy is evolving into a fundamental competency required in modern education and digital society. The rapid citation growth of recent publications also reveals that the field is still rapidly developing and transforming, especially in response to the emergence of generative AI technologies such as large language models. The findings of this study present that the rise of scholarly attention toward educational applications, ethical concerns, digital competencies and the societal implications of AI technologies.

As a conclusion, the bibliometric analysis affirms that AI literacy research has experienced substantial growth and has become a globally significant and interdisciplinary field of study. Based on the bibliometric findings specify that AI literacy will continue to be an important research agenda in the coming years, predominantly with the importance of technologically advanced countries. The field also emerged as a significant research agenda with the presence of influential authors and publications and the emergence of new research themes collectively. Amid the rapid revolution of the information and technology sectors, nations need to participate in key areas that facilitate sustainable development, including AI governance policies, AI education and training and AI infrastructure (Lund etc, 2023)

As suggested, further research should examine practical implementation strategies, assessment models, policy development and inclusive approaches to AI literacy education across different educational and cultural contexts. According to Jöhnk, Weißert and Wyrski (2021), the implementation of AI without sufficient assessment of readiness factors often leads to unsuccessful adoption and implementation outcomes. As another recommendation for future studies, the researcher should expand the research scope beyond conceptual discussions toward practical implementation and long-term impact assessment. Another important direction for researcher is examining issues related to overreliance on AI, misinformation, algorithmic bias, academic integrity, privacy concerns, and responsible AI usage. With the rapid emergence of generative AI and large language models, studies focusing on prompt engineering skills, AI evaluation competencies, and critical AI awareness will become increasingly relevant. The study done by Misra, Mishra, and Sharma (2023) proposed a model that demonstrates the potential of AI as a facilitator of lifelong learning through improved access to knowledge, personalised learning experiences, and continuous skills development. Overall, future research should continue addressing the educational, ethical, social, and technological implications of AI literacy to ensure that individuals are not only capable of using AI tools effectively but are

also able to critically evaluate and responsibly engage with artificial intelligence in an increasingly AI-driven society.

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