OSSERVATORIO

Mapping the thematic evolution of AI literacy research: a text-mining analysis of Scopus-indexed articles

by Mahsa Torabi, Mohammadamin Erfanmanesh

Introduction

Artificial Intelligence (AI) has evolved from back-end technology into a public-facing infrastructure that impacts education, workplaces, media, and daily life. As AI capabilities grow, AI literacy, which includes cognitive understanding, practical skills, and ethical reasoning, has become essential for citizens, students, educators, and professionals. Originally defined in Human-Computer Interaction (HCI) as the ability to use AI responsibly, AI literacy now emphasizes evaluating and engaging with AI technologies to support educational and policy initiatives[1].

In recent years, the emergence of generative models has accelerated the development of institutional initiatives and research projects to advance AI literacy, including institution-wide frameworks, quality enhancement plans, and discipline-specific curricula. Conceptual reviews and syntheses of AI literacy are increasingly adopting multidimensional frameworks that depict it as comprising layered forms of knowledge and practice. These models often align with learning taxonomies, ranging from basic knowledge to advanced skills such as synthesis and evaluation, and explicitly incorporate ethical, social, and equity considerations. Many AI literacy frameworks build on previous conceptualisations of literacy, while others are integrated into or reframed within the educational technology and learning sciences literature. Together, they

MAHSA TORABI, Semnan University, Semnan (Iran), e-mail: mahsatorabi515@gmail.com*
MOHAMMADAMIN ERFANMANESH, New Brunswick (Canada), e-mail: amin.erfanmanesh@gmail.com
Last website consultation: December 15, 2025.

* Corresponding Author.

1 Duri Long; Brian Magerko, *What is AI literacy? Competencies and design considerations*. In: *Proceedings of the 2020 CHI conference on human factors in computing systems*. New York: Association for computing systems, 2020, p. 1-16.

AIB studi, vol. 65 n. 2-3 (maggio/dicembre 2025), p. 361-380. DOI 10.2426/aibstudi-14206
ISSN: 2280-9112, E-ISSN: 2239-6152 - Copyright © 2025 by Mahsa Torabi, Mohammadamin Erfanmanesh

emphasise distinctions between knowing about AI, knowing how to use and apply AI in context, and evaluating AI systems and their implications[2].

In line with bottom-up curriculum design efforts, international organizations are formalizing AI competencies as part of broader policy frameworks. For example, UNESCO has created competency frameworks for students and teachers that help countries develop safe, ethical, and responsible ways to engage with AI, showing how AI literacy is shifting from an institutional focus to a national and global priority. This guidance focuses on the responsible use and critical evaluation of AI, as well as on enhancing teacher capability, and aligns with the development of local frameworks developed by universities and school systems[3].

A rapidly growing research base now focuses on AI literacy across diverse populations, including K-12, higher education, teacher training, and workforce development, and employs methods such as design experiments, assessments, case studies, and comprehensive reviews. Recent systematic reviews and meta-analyses have explored conceptualizations, curricular interventions, and evaluation methods, while highlighting both progress and fragmentation, especially regarding conceptual clarity, measurement validity, and the balance between technical and socio-ethical dimensions[4]. Measurement work has started to catch up, including new instruments with validation studies that operationalize AI literacy as a multidimensional latent construct (e.g., technological understanding, critical appraisal, practical application, and ethics), and employ modern psychometric methods to assess reliability and validity. Such tools are crucial for moving from anecdotes to comparable evidence of what learners know and can do, as well as for assessing the impact of interventions at scale[5].

Simultaneously, studies with population-specific relevance, primarily in teacher education, explore the factors that lead to AI literacy such as attitudes, perceived

2 Thomas K. F. Chiu [*et al.*], *What are artificial intelligence literacy and competency? A comprehensive framework to support them*, «Computers and education open», 6 (2024), DOI: 10.1016/j.caeo.2024.100171; Siu-Cheung Kong; Man-Yin William Cheung; Olson Tsang, *Developing an artificial intelligence literacy framework: evaluation of a literacy course for senior secondary students using a project-based learning approach*, «Computers and education: artificial intelligence», 6 (2024), DOI: 10.1016/j.caeai.2024.100214; Davy Tsz Kit Ng [*et al.*], *Conceptualizing AI literacy: an exploratory review*, «Computers and education: artificial intelligence», 2 (2021), 100041, DOI: 10.1016/j.caeai.2021.100041.

3 UNESCO, *What you need to know about UNESCO' s new AI competency frameworks for*, 2024, <https://www.unesco.org/en/articles/what-you-need-know-about-unescos-new-ai-competency-frameworks-students-and-teachers>.

4 Omaima Almatrafi; Aditya Johri; Hyuna Lee, *A systematic review of AI literacy conceptualization, constructs, and implementation and assessment efforts (2019–2023)*, «Computers and education open», 6 (2024), DOI: 10.1016/j.caeo.2024.100173; Gabriele Biagini, *Towards an AI-literate future: a systematic literature review exploring education, ethics, and applications*, «International journal of artificial intelligence in education», (2025), p. 1-51, DOI: 10.1007/s40593-025-00466-w; Muhammad Yasir Mustafa [*et al.*], *A systematic review of literature reviews on artificial intelligence in education (AIED): a roadmap to a future research agenda*, «Smart learning environments», 11 (2024), n. 1, p. 59, DOI: 10.1186/s40561-024-00350-5.

5 Ying Dong [*et al.*], *Validating and refining a multi-dimensional scale for measuring AI literacy in education using the Rasch Model*, «Humanities and social sciences communications», 12 (2025), n. 1, p. 1317, DOI: 10.1057/s41599-025-05670-6; Marie Hornberger [*et al.*], *Development and validation of a short AI literacy test (AILIT-S) for university students*, «Computers in human behavior: artificial humans», 5 (2025), DOI: 10.1016/j.chbah.2025.100176.

usefulness, and self-efficacy and how particular AI-enabled tools (like AI assistants for assessment) can impact practices and professional identities. These studies are based on real instructional settings and examine a combination of opportunities (efficiency, differentiation, feedback) and challenges (overreliance, equity, and assessment integrity)[6]. At the same time, the knowledge base is evolving: new fields are publishing work on AI literacy, disciplinary areas are expanding, and the research landscape is growing. Bibliometric and scientometric studies, some examining AI in education broadly and others focusing specifically on AI literacy, show clear growth trends, shifting research boundaries, and the emergence of thematic clusters (e.g., K-12 curricula, ethics and policy, assessment and measurement, teacher training, and generative AI practices).

There is increasing interest in AI literacy, but significant gaps remain in the literature. First, varying definitions and competency models lead to inconsistencies and challenges in comparative research. Second, most studies focus on higher education and teacher training, leaving K-12, vocational, and informal learning settings less studied. Finally, while some bibliometric studies outline the field's outputs, there is a lack of long-term thematic analyses of how the research area has evolved[7]. Addressing these gaps is essential for clarifying the intellectual structure of the field, identifying areas that are still underexplored, and guiding the development of future research, curricula, and policy actions.

This paper examines the evolving landscape of AI literacy research using a systematic text-mining method applied to publications indexed in Scopus. It provides two main contributions: a longitudinal overview of the research field, including annual publication trends, geographic distribution, institutional affiliations, and disciplinary focuses; and a model of AI literacy discourse development, highlighting the emergence and fragmentation of thematic clusters over time. The study also examines shifts in subject-area shares associated with the rise of generative AI and explores evolving leadership patterns across countries and institutions. Additionally, it aligns with educational technology and computational social science research by employing topic modeling techniques to uncover hidden structures and shifts in this quickly evolving field.

Attention to Scopus-indexed literature is considered essential for providing broad coverage of journals and conferences, while also allowing for reproducible sampling and normalization across years and fields. Triangulated trends in volume, shares across subject areas, thematic clusters, and contributor ecosystems (including countries, institutions, and venues) aim to create a field map that is descriptive rather than strategic. This map is designed to be useful for scholars designing studies, teachers developing curricula, institutions formulating policies, and funders or policymakers seeking influence in building responsible AI capacity. Accordingly, this research aims to answer the following research questions:

RQ1: How has the annual volume of AI literacy publications evolved, and what distinct growth phases can be identified?

6 Gamze Erdem Co gun, *Artificial intelligence literacy in assessment: empowering pre service teachers to design effective exam questions for language learning*, «British educational research journal», (2025), DOI: 10.1002/berj.4177; Jari Laru [*et al.*], *The antecedents of pre-service teachers' AI literacy: perceptions about own AI driven applications, attitude towards AI and knowledge in machine learning*, «European journal of teacher education», (2025), p. 1–23, DOI: 10.1080/02619768.2025.2535623.

7 O. Almatrafi; A. Johri, H. Lee, *A systematic review of AI literacy* cit.

RQ2: How have subject areas changed in their relative share over the years?
RQ3: What are the dominant thematic clusters, and how have they evolved over time?
RQ4: Which countries and institutions are leading in AI literacy research output, and how have their contributions changed over time?

Methodology

Data collection

The dataset for this study was obtained from the Scopus database on July 26, 2025, including publications from that year up to the data collection date. The search focused on documents specifically addressing AI literacy, utilising title and keyword fields to filter unrelated publications, with the full search query provided in Appendix 1. The data were exported as a CSV file containing bibliographic metadata such as title, authors, year, abstract, keywords, affiliations, and source title. An initial screening process removed duplicates and irrelevant publications, resulting in a final dataset of 881 peer-reviewed articles published between 2016 and 2025. Scopus was selected for its extensive global coverage and established indexing standards; however, it has limitations, including incomplete coverage of regional publications, particularly from developing countries. This limitation might impact the representation of global AI literacy studies. The study's timeframe starts in 2016, the first year when the term 'AI literacy' appeared in Scopus-indexed literature, thus excluding relevant works published before that year.

Data preprocessing

Before starting the analysis, the dataset was carefully cleaned and standardized to guarantee accuracy and consistency. This process included unifying bibliographic details like author names, institutional affiliations, and country identifiers to maintain uniformity across all records. This foundational step was essential for subsequent analysis, and the associated text data, including titles, abstracts, and keywords, were systematically cleaned using natural language processing (NLP) techniques. The process involved converting all text to lowercase, removing punctuation, numbers, and stop words to keep the meaningful content, tokenizing the text into individual terms for accurate analysis, and applying lemmatization to reduce words to their base forms, ensuring consistency among semantically similar terms. A manual inspection was also conducted to correct misclassified subject areas, review venues for accurate categorization, and standardize affiliation data by consolidating variant institution names, ultimately ensuring consistent institution names and country codes. This comprehensive approach resulted in a high-quality dataset that supports reliable and interpretable analyses.

Analytical approach

RQ1: temporal trends in AI literacy research

To analyze the annual growth of AI literacy publications, a custom Python pipeline was used to process the cleaned dataset. Four-digit year values were extracted from date fields, converted to numeric format, and filtered for records from 1990 to 2025. Publication counts per year were calculated and organized into a year–count table. Years were categorized into four phases: Pre-2019, 2019-2021, 2022-2023, and 2024-2025. Summary statistics were computed for each phase, including total publications, average publications per year, and median year-over-year growth rates. Change-point detection was applied using the ruptures Python library to identify significant shifts in publication trends.

RQ2: subject area distribution
For RQ2, we created a lexicon to categorize subject areas using the Scopus ASJC Subject Classification and domain-specific terms derived from the dataset. Each subject area includes regular expression patterns to identify key terms, subfields, and notable conferences. Considering the interdisciplinary nature of AI literacy studies, our classifier allows for multiple subject-area assignments per paper. We use fractional allocation for cross-disciplinary papers, meaning contributions are proportionally shared across relevant subject areas. Manual inspections of titles, abstracts, and keywords confirmed that interdisciplinary papers often clustered within 'Social Sciences' and 'Computer Science.' The observed decrease in Computer Science classifications reflects the growing prominence of AI literacy research within educational contexts, rather than a decline in computing-related publications.

RQ3: thematic structure and evolution
To investigate the main thematic groups in AI literacy research and their evolution, we employed a multi-step text-mining and topic-modelling approach in Python on a cleaned dataset of Scopus-indexed publications.

Step 1: keyword extraction and normalization
We identified potential keyword fields from the dataset by extracting keywords from titles and abstracts when needed. These keywords were split using common delimiters, converted to lowercase, and cleaned of stop words and overly generic AI-related terms. The remaining tokens were lemmatized to form a normalized keyword set for each publication.

Step 2: keyword co-occurrence analysis
We constructed a binary keyword-document matrix for the 100 most frequent keywords, each appearing in at least three publications, and generated a symmetric co-occurrence matrix. Edges with frequencies below two were removed to improve interpretability, and the resulting network was visualized with nodes representing keywords and edges indicating co-occurrence strength.

Step 3: topic modelling
We applied topic modelling using a Term Frequency-Inverse Document Frequency (TF-IDF) vectorizer and trained a Latent Dirichlet Allocation (LDA) model with eight topics. The model's topic-term distributions helped identify the top keywords for each topic, including themes such as K-12 curricula and ethics.

Step 4: temporal thematic evolution
Each publication was assigned to a publication period, and we identified the top 20 keywords for each period to observe emerging, stable, and declining themes. A thematic evolution matrix was created and visualized as a heatmap to show changes in keyword frequency over four periods.

Step 5: synthesis
We combined findings from the co-occurrence analysis and topic modelling to summarize thematic evolution, highlighting the main topics per period, the emergence or disappearance of specific themes, and evidence of thematic recombination in recent years.

RQ4: geographic and institutional contributions
To identify leading countries and institutions in AI literacy research, institution names were standardized through text cleaning and manual disambiguation (e.g., 'MIT' and 'Massachusetts Institute of Technology' as 'Massachusetts Institute of Technology'). Country names were converted to ISO 3166-1 alpha-2 codes for consistency, and ambiguous affiliations were resolved when possible. Two methods were used for calculating publication contributions:
1. Full counting, in which each institution or country received full credit.
2. Fractional counting, in which credit was distributed equally among contributors.

Fractional counting was primarily used in longitudinal analysis to minimize the impact of highly collaborative publications. Contributions were grouped into four predefined time periods, and the top 10 countries and institutions were identified based on fractional publication counts for each period. Rankings were stored in time-slice tables to track emerging leaders and trends in output.

Tools and software
All analyses were conducted in Python, utilizing:
- pandas for data handling and aggregation
- scikit-learn and gensim for NLP preprocessing and topic modelling
- NetworkX for network analysis
- matplotlib and seaborn for visualization

The complete code, preprocessing scripts, and visualization outputs will be made available upon reasonable request.

Results

RQ1: how has the annual volume of AI literacy publications evolved, and what distinct growth phases can be identified?
The pre-2019 period was characterized by a single publication in 2016, and although it marked the established phase of the field, there were no sustainable research activities. The period between 2019-2021 represents the take-off phase, with 37 total publications (M = 12.33 publications per year) and a median year-on-year growth rate of 300%, reflecting a sharp relative increase from a small baseline (Fig. 1).

Period	Total Publications	Mean Pubs/Year	Median YoY Growth (%)
Pre-2019	1	1.00	NaN
2019-2021	37	12.33	300.00
2022-2023	129	64.50	135.44
2024-2025	714	357.00	122.60

Figure 1 - Summary of AI Literacy publications by period (2016-2025)

The period between 2022-2023 showed meaningful acceleration (129 publications, M = 64.50 publications per year), and a median year-on-year growth rate of 135.44%. This phase coincided with a broader, sustained introduction of AI across education and the early uptake of generative AI technologies.

The period between 2024-2025 showed an unprecedented upward trend (714 publications, M = 357.00 publications per year) and a median year-on-year growth rate of 122.60%. This surge largely reflects the mainstreaming of AI literacy scholarship and its emergence as a durable research area, with expanded coverage across academic journals, conferences, and professional practice-oriented outlets (Fig. 2).

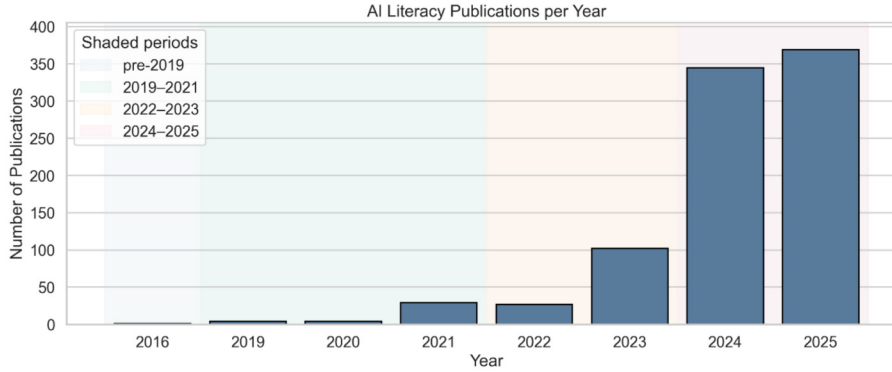

Figure 2 - AI literacy publications per year

RQ2: how have subject areas changed in their relative share over the years?
By fractionally counting the subjects based on the publication metadata using a subject-specific dictionary, we observed substantial variation in subject classification over time (Fig. 3). In the pre-2019 formative phase, the very small number of publications was distributed equally between Computer Science (50.0%) and Engineering (50.0%), indicating that the initial work on AI literacy originated from a predominantly technical perspective. In the 2019-2021 launch phase, Social Sciences emerged as the clear leader, with an average share of 68.6% of publications. Business, Management, and Accounting followed with 20.5%, and Computer Science ranked third at 12.1%. The prominence of Business and Management research during this period encouraged an early focus on workplace- and organization-led applications of AI literacy. Representation from Arts and Humanities (4.6%) and Psychology (3.7%) was minimal, indicating an initial broadening toward more diverse disciplinary perspectives.

Period	Social Sciences (%)	Psychology (%)	Computer Science (%)	Business/ Management (%)	Arts & Humanities (%)	Engineering (%)	Information Science (%)
Pre-2019	—	—	50.0	—	—	50.0	—
2019-2021	68.6	3.7	12.1	20.5	4.6	—	—
2022-2023	74.9	4.1	4.4	—	3.7	—	1.2
2024-2025	72.3	6.7	4.3	2.9	3.0	—	19.6

Figure 3 - Fractional share of top subject areas by period

In the 2022-2023 acceleration phase, representation by subject category showed that Social Sciences had the largest average share (74.9%). This higher share indicates an increased emphasis on educational, policy, and societal dimensions of AI literacy. Meanwhile, Computer Science sharply declined to 4.4%, suggesting that the conversation was moving toward contexts beyond a purely technical disposition. Psychology and Arts and Humanities accounted for 4.1% and 3.7% of publications, respectively. The 2024-2025 surge phase was characterized by Social Sciences maintaining dominance (72.3%) while stabilizing slightly below the previous peak. Notably, Information Science and Psychology grew to 19.6% and 6.7%, respectively, indicating an increasing interest in the emotional, cognitive, and behavioral aspects of AI literacy, possibly driven by the widespread adoption of generative AI tools in educational settings. Computer Science remained modest at 4.3%, highlighting that the field continues to be driven more by education and social sciences than by technical disciplines. Arts and Humanities (3.0%) and Business/Management (2.9%) continued to hold smaller shares (Fig. 4).

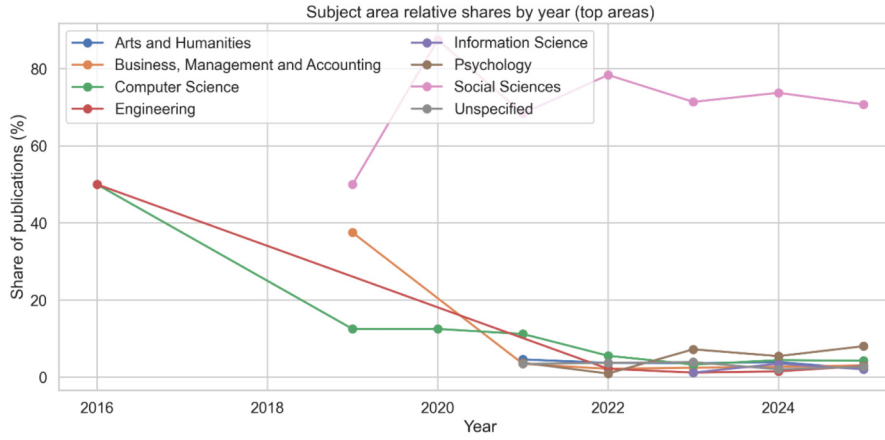

Figure 4 - Subject area relative shares by year (top areas)

These results indicate that AI literacy research has undergone a clear disciplinary shift from its early technical foundations toward a predominantly Social Sciences-oriented focus. The steady rise of Psychology in recent years reflects increasing attention to learner cognition, attitudes, and behaviors within AI literacy contexts. The small but steady share of Computer Science since 2019 indicates that, although AI literacy has technical foundations, its scholarly discussion is now mainly influenced by education, policy, and social research communities.

RQ3: what are the dominant thematic clusters, and how have they evolved over time?
Keyword frequency and topic modeling analyses revealed a clear progression in thematic focus over the study period and shifts reflecting the field's growth. (Fig. 5).

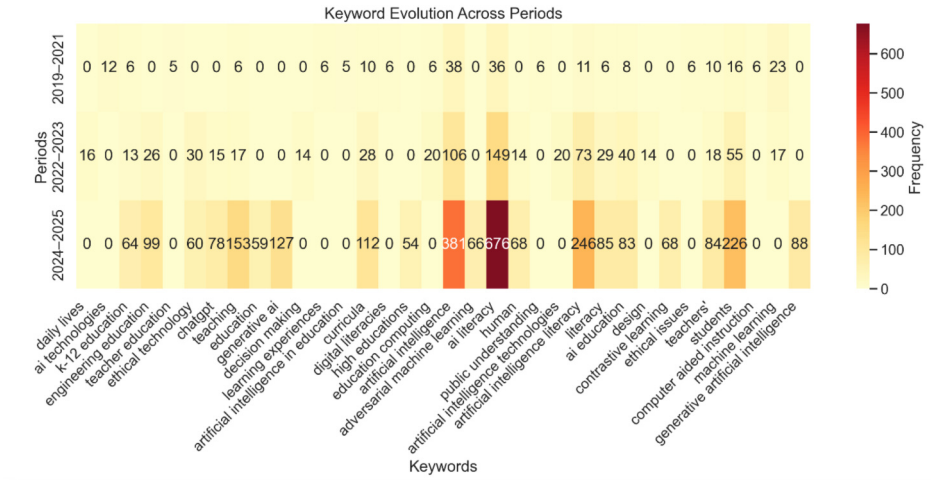

Figure 5 - Evolution of keywords across periods

During the initial phase from 2019 to 2022, which comprised 37 documents, the main themes were largely exploratory in nature. Emphasis was placed on defining AI literacy, introducing AI within the educational context, and identifying its relevance to students and teachers. Frequently occurring keywords included 'machine learning' (23), 'curricula' (10), 'teachers' (10), and 'K-12 education' (6). These patterns suggest foundational scholarship focused on the conceptualization of AI literacy and early efforts toward curricular articulation, particularly in school settings. During the growth stage (2022-2023), which included 129 documents, definitions mainly were expanded, with discussions on ethical, curricular, and disciplinary integration discussed prominently. New themes such as 'ethical technology' (30), 'engineering education' (26), and 'education computing' (20) emerged. These patterns indicate a wider scope of research, covering ethical issues as well as discipline-specific topics in engineering and computing education. The mature stage from 2024–2025 (714 documents) showed both breadth and depth. There was a notable rise in generative AI-related terms, such as 'generative AI' (127) and 'generative artificial intelligence' (88), along with significant mentions of 'teaching' (153), 'curricula' (112), and 'students' (226). This pattern reflects a clear shift toward applied, classroom-focused research, including topics related to teachers, teacher training, and teaching and learning with generative AI tools (e.g., ChatGPT).

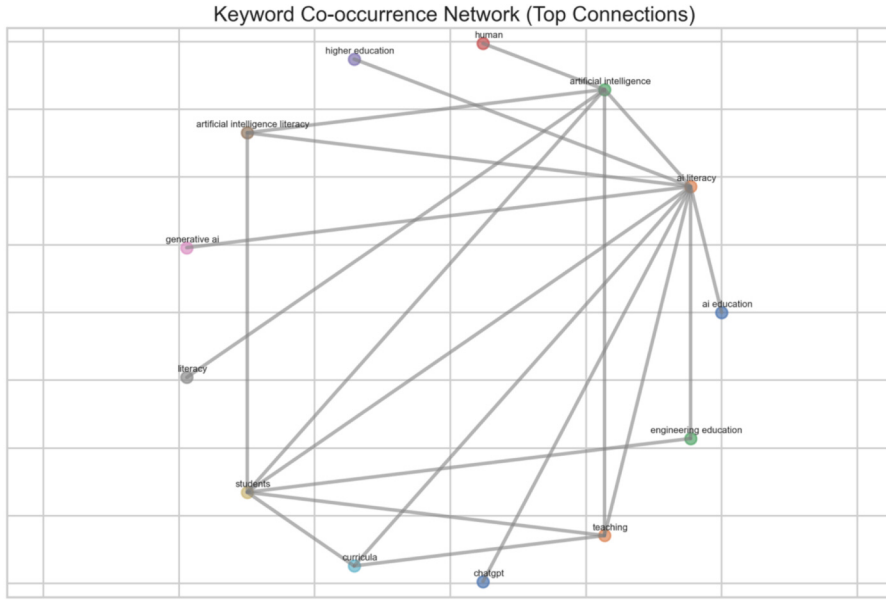

Figure 6 - Keyword co-occurrence network (Top connections)

Figure 6 shows the keyword co-occurrence network. As seen, the most common links to AI literacy include AI education, teaching, students, higher education, and curricula. This pattern suggests that the discussion on AI literacy mainly takes place within educational contexts, including instructional methods, student involvement, curriculum development, and the integration of AI concepts in schools and universities. The eight main thematic clusters in AI literacy identified through topic modeling are shown in Figure 7.

Topic #	Keywords	Interpretation
1	AI, user, design, interaction, creativity, algorithmic, bias, cultural	Human-centred AI design, focusing on bias, interaction, and cultural impacts
2	critical, AI, children, primary, review, thinking, education, artificial	AI literacy in early education with an emphasis on critical thinking
3	AI, digital, intelligence, artificial, generative, ChatGPT, academic, education	Generative AI in academia and the use of digital tools such as ChatGPT in educational contexts
4	AI, assessment, education, competency, data, ethics, teacher, secondary	AI for educational assessment, including competencies, ethics, and secondary education
5	learning, education, AI, intelligence, artificial, machine, students, engineering	AI and machine learning in engineering education
6	artificial, intelligence, innovation, sustainable, elementary, responsible, educational	Ethical and sustainable innovation in elementary education
7	AI, language, self, writing, generative, efficacy, model, large	Writing and self-efficacy using large language models
8	intelligence, artificial, human, scale, nursing, adult, development, questionnaire	Human-AI interaction in adult education and healthcare (nursing)

Figure 7 – Eight topics extracted from the AI literacy literature

Each cluster within AI literacy research emphasizes different focus areas, such as human-centered AI design, early education, and the use of AI in engineering, adult learning, and healthcare. Some clusters examine generative AI, including ChatGPT's influence on academic writing and teaching, while others consider ethical, cultural, and sustainability issues. Overall, these themes show that besides technical skills, AI literacy also involves pedagogical aspects and value-based approaches to incorporating AI into educational and organizational settings.

RQ4: which countries and institutions are leading in AI literacy research output, and how have their contributions changed over time?
Fractional counting of publications by country showed that AI literacy research originates primarily from a small number of countries, with the United States leading with a significant overall number (326.4), followed by China (102.8), Germany (60.0), Hong Kong (49.4), and the United Kingdom (46.6). Other notable contributors include South Korea (26.2), Finland (20.0), Canada (18.7), Turkey (17.5), Taiwan (13.3), Spain (12.9), and Italy (11.1). (Fig. 4). From a longitudinal perspective, the United States was dominant across all periods, though its relative share declined as participation expanded worldwide (Fig. 5). In the 2019-2021 phase, the U.S. accounted for approximately 46% of all output, followed by Spain (25%), Canada (16.8%), China (11.4%), Hong Kong (9.7%), and Germany (7.6%). In the 20222023 phase, the U.S. share of output decreased to 39.4%, while Germany (16.0%) and Hong Kong (12.0%) increased their participation. China (10.1%) maintained a comparable share, followed by the emergence of the United Kingdom (4.6%). In the final phase (20242025), when output surged, the U.S. share declined further to 36.5%, while China (12.2%), the United Kingdom (5.5%), Hong Kong (5.1%), and Germany (4.9%) maintained stable contributions. New contributors, such as Turkey (2.2%), also became visible.

Rank	Country	Overall Fractional Count	Rank	Institution	Overall Fractional Count
1	United States	326.8	1	The Education University of Hong Kong (Hong Kong)	24.6
2	China	102.8	2	The University of Hong Kong (Hong Kong)	23.3
3	Germany	60.0	3	Chinese University of Hong Kong (Hong Kong)	14.0
4	Hong Kong	49.4	4	Carnegie Mellon University (USA)	11.6
5	United Kingdom	46.6	5	Northwestern University (USA)	9.5
6	South Korea	26.2	6	Massachusetts Institute of Technology (USA)	8.4
7	Finland	20.0	7	Oulun Yliopisto (Finland)	6.5
8	Canada	18.7	8	University of California, Irvine (USA)	6.4
9	Turkey	17.5	9	Georgia Institute of Technology (USA)	6.2
10	Taiwan	13.3	10	Technische Universität Darmstadt (Germany)	6.2

Figure 8 – Top contributing countries and institutions in AI literacy research (fractional counts)

At the institutional level, leadership is highly concentrated, with a small number of institutions dominating research output. The Education University of Hong Kong (24.6), the University of Hong Kong (23.3), and the Chinese University of Hong Kong (14.0) account for a substantial portion of global institutional contributions. Leading

non–Hong Kong institutions include Carnegie Mellon University (11.6), Northwestern University (9.5), the Massachusetts Institute of Technology (8.4), Oulun Yliopisto (6.5), the University of California, Irvine (6.4), the Georgia Institute of Technology (6.2), Technische Universität Darmstadt (6.2), Julius-Maximilians-Universität Würzburg (6.0), and Aarhus Universitet (5.8).

Reviewing results by period highlighted notable shifts in institutional leadership. In 2019-2021, early momentum came from U.S. institutions in computer science and engineering-focused fields, such as the Georgia Institute of Technology (15.9%) and the Massachusetts Institute of Technology (6.8%), along with the Chinese University of Hong Kong (8.3%), the Education University of Hong Kong (6.9%), and the University of Hong Kong (4.6%). During 2022-2023, output increased among Hong Kong-based universities, particularly the University of Hong Kong (8.1%) and the Education University of Hong Kong (5.7%). Over time, European institutions, such as Aarhus Universitet (5.6%) and Technische Universität Darmstadt (2.9%), began to increase their output, joining a broader group of leading U.S. institutions, including Carnegie Mellon University, the University of California, Irvine, and the Georgia Institute of Technology, although at lower output levels than in the previous period. In 2024-2025, the Education University of Hong Kong (2.3%) and the University of Hong Kong (2.1%) emerged as leading contributors, with the Chinese University of Hong Kong also contributing at lower percentages. Outputs during this period were comparable in scale to those of institutions that had led in earlier phases, such as Carnegie Mellon University, Julius-Maximilians-Universität Würzburg, Northwestern University, Oulun Yliopisto, and the Massachusetts Institute of Technology, but at substantially smaller shares than in earlier years.

Discussion

The remarkable growth in AI literacy publications, from just one in 2016 to 714 by 2024–2025, highlights how AI literacy has evolved from an emerging research topic into a well-established and rapidly growing academic field. During the 2019-2021 take-off phase, the annual growth rate of AI literacy publications peaked at a median of 300%, indicating that researchers' early efforts to define and conceptualize the components of AI literacy were beginning to influence educational frameworks, policy discussions, and teaching methods. This trend indicates that academic institutions and workforce development systems are increasingly recognizing that AI proficiency is now an essential requirement for success in the digital era. Notably, national initiatives such as the establishment of the Digital Education Council in 2024 demonstrate coordinated institutional and global efforts to integrate AI literacy into higher education governance. Additionally, recognizing AI literacy as LinkedIn's fastest-growing skill in 2025 highlights the increasing cross-sector demand for people who can critically engage with and skillfully use AI tools.

As we look ahead to the 2024-2025 surge phase, it is clear that AI literacy research is attracting increasing interest, with the average annual publications rising to 357. This increase reflects a focused scholarly effort to understand and evaluate the impact of generative AI tools, such as ChatGPT and Gemini, in educational settings from classrooms to universities. Institutions across the U.S., including the Massachusetts Institute of Technology, Columbia University, and New York University, are making strategic decisions to incorporate AI into their curricula and teaching methods. These developments emphasize a shared recognition of the importance of preparing students as AI-literate graduates for a changing workforce. At the same time, new assessment approaches are emerging, including the Generative AI Literacy Assessment Test

(GLAT), which aims to provide a more comprehensive understanding of AI literacy by moving beyond simple self-report measures. Basically, this period reflects a significant shift: what was once seen as a minor research topic is now becoming integral to education, impacting teaching methods, policies, and professional practices across different sectors. This transformation is setting the way for a future where AI literacy becomes a fundamental part of learning and development[8].

The noticeable shift in AI literacy research from its technical origins toward a primary focus within the Social Sciences probably reflects broader institutional and societal recognition that AI is not just a computational artifact but a transformative force with complex educational, ethical, and policy implications. As Yang [*et al.*][9] observe in a bibliometric study, AI literacy research has transitioned from exploratory, technically driven beginnings to rapid expansion in the educational, social, and ethical dimensions. The dominance of the Social Sciences, reaching 74.9% in 2022-2023, can be explained by work that views AI literacy as a set of skills essential to critical thinking, ethical reasoning, and civic participation rather than merely as tools. For example, Ng [*et al.*][10] conceptualize AI literacy as the ability to know and understand, use, evaluate, and responsibly engage with AI systems. Recent integrative reviews further emphasize that AI literacy must balance functional, critical, and sociocultural dimensions, which naturally fall within the realm of social scientific inquiry. This trajectory also aligns with the rapid adoption of AI in educational settings, driven by the rise of generative tools like ChatGPT, prompting social scientists, educators, and policymakers to explore questions of equity, pedagogy, and power that go beyond purely technical domains. The rising share of Psychology in the 2024-2025 surge phase (6.7%, up from around 4%) indicates increasing scholarly interest in the cognitive, affective, and behavioral aspects of AI literacy, especially considering generative AI's impact on how people learn, think, and act. Educational psychologists, for example, are actively investigating AI's role in supporting social and emotional learning, metacognition, and learner motivation[11].

Additionally, recent measurement studies explicitly include psychological constructs like self-efficacy, emotion regulation, and problem-solving within AI literacy frameworks, such as the Meta AI Literacy Scale (MAILS), which enhances competency models by adding psychological meta-competencies[12]. Similarly, the emergence of psychometric research defining an 'A-Factor,' a latent construct that includes creative idea generation, content evaluation, and collaborative communication, highlights the growing focus on the human–AI cognitive interface[13]. As generative AI tools reshape educational

8. Yueqiao Jin [*et al.*], *GLAT: the generative AI literacy assessment test*, «Computer and education: artificial intelligence», 9 (2025), DOI: 10.1016/j.caeai.2025.100436.

9 Yuqin Yang [*et al.*], *Navigating the landscape of AI literacy education: insights from a decade of research (2014–2024)*, «Humanities and social sciences communications», 12 (2025), n. 1, p. 374, DOI: 10.1057/s41599-025-04583-8.

10 D. Tsz Kit Ng [*et al.*], *Conceptualizing AI literacy* cit.

11 Zara Abram, *Classrooms are adapting to the use of artificial intelligence*, «Monitor on psychology», 56 (2025), n. 1.

12 Astrid Carolus [*et al.*], *MAILS - Meta ai literacy scale: development and testing of an AI literacy questionnaire based on well-founded competency models and psychological change- and meta-competencies*, «Computers in human behavior: artificial humans», 1 (2023), n. 2, DOI: 10.1016/j.chbah.2023.100014.

13 Ning Li; Wenming Deng; Jiatan Chen, *From G-Factor to A-Factor: establishing a psychometric framework for AI literacy*, «arXiv preprint arXiv:2503.16517», (2025).

interactions, understanding how learners perceive, trust, and emotionally respond to AI becomes essential, contributing to the field's growing importance. Meanwhile, the steady yet modest presence of Computer Science after 2019 indicates that, although AI literacy remains rooted in technical systems, intellectual leadership has shifted toward areas focused on learning, behavior, and societal context.

According to the results, while the United States remains the largest total contributor to AI literacy research, as shown by its leading cumulative fractional output (approximately 326 publications), its relative dominance has decreased over the three phases of research in the field. During 2019-2021, authors from the United States produced nearly half of all publications (around 46%), but this share dropped to just over one-third (about 36%) in 2024-2025. At the same time, contributions from other regions, especially China, Hong Kong, Germany, and the United Kingdom, have increased significantly, reflecting the field's growing global reach. Notable institutions in Hong Kong have emerged as major contributors, while U.S. institutions continue to be important players but no longer dominate the field as much.

This pattern aligns with broader bibliometric trends in AI literacy research. Recent integrative literature reviews show that, while the United States has historically led the field, the East Asian region, particularly Hong Kong, has become a main research hub and is often part of international research agendas covering education, policy, and design. For example, Zheng [*et al.*][14] found that the combined output of AI literacy research in the United States, Hong Kong, mainland China, and Germany accounts for more than half of AI literacy publications, indicating both the continuing importance of the United States for the discipline and its relative decline as other regions expand their contributions. Similarly, Zhou [*et al.*][15] confirmed that the United States, China, Germany, and the United Kingdom are the major contributors in bibliometric maps of the AI literacy literature. These findings collectively show increased geographic diversity and mark the growth of AI literacy as a globally distributed and multidisciplinary research field, compared to earlier times that were more U.S.-focused and narrowly technical.

Thematic landscapes of AI literacy research

The thematic structure of AI literacy scholarship shows its multidimensional and quickly changing nature, as demonstrated through topic modeling. We identified eight thematic clusters covering educational, technical, ethical, and societal topics, including human-centered AI design, early education interventions, generative AI in academia, AI in assessment, engineering education, sustainable innovation, writing with large language models, and human-AI collaboration in healthcare. These topics highlight key areas of debate shaping the field and reflect AI literacy's evolution from focusing on technical skills to a complex socio-technical understanding that emphasizes ethics, pedagogy, and professional practice[16]. While examining these themes in detail is valuable, we emphasize not only the differing priorities among research

14 Hao Zheng [*et al.*], *Knowledge mapping, thematic evolution, and future directions of ai literacy research: an integration of bibliometric analysis and systematic review*, (2025). Available at SSRN 5332129.

15 Qiqi Zhou; Liandi Ding; Jia Liu; *Decade-Spanning Bibliometric Visual Analytics for AI Literacy*. In: *Proceedings of the 2025 International conference on digital education and information technology*. New York: Association for computing machinery, p. 223-231.

16 H. Zheng [*et al.*], *Knowledge mapping* cit.; Q. Zhou; L. Ding; J. Liu, *Decade-spanning bibliometric visual analytics for AI literacy* cit.

communities within AI literacy but also that the epistemic center of the field continues to shift from purely functional knowledge of AI toward critical, contextual, and discipline-specific literacies.

Topic 1: human-centered AI design (bias, interaction, culture)
Recent human-AI interaction (HAI) agendas suggest that the future of AI literacy will be socio-technical, emphasizing that users must understand model limitations, bias pathways, and the cultural context of design, enabling meaningful participation in co-adaptive systems. Jiang [*et al.*][17] map HAI themes such as collaboration, conflict, and symbiosis, linking them to theories from communication, psychology, and sociology that foreground users' interpretive and cultural work, rather than focusing solely on technical mechanics. Systematic reviews in education likewise emphasize responsible and ethical fluency (bias, transparency, governance) as a core part of AI literacy rather than as supplementary technical skills[18]. Together, these elements support a framework where 'design, interaction, bias, and culture' come together around human-centered literacies essential for critiquing, adapting, and co-designing AI.

Topic 2: AI literacy in early education: critical thinking focus
The K-6 space has quickly centered around frameworks that translate AI concepts into developmentally appropriate, inquiry-based activities, emphasizing critical thinking, fairness, and safety. A scoping review of early childhood AI literacy combines curricula and tools with clear attention to ethical reflection and age-appropriate conceptual models[19]. A review focused on primary schools details 25 empirical studies and emphasizes critical-inquiry approaches and teacher mediation as key success factors, while calling for validated assessment tools[20]. Complementing these syntheses, Yim[21] develops an intelligence-based framework for young learners that combines core concepts with critical assessment and context-aware methods, which exactly follow the pattern suggested by the Topic 2 keywords.

17 Tingting Jiang [*et al.*], *Human-AI interaction research agenda: a user-centered perspective*, «Data and information management», 8 (2024), n. 4, DOI: 10.1016/j.dim.2024.100078.

18 Marc Pinski; Alexander Benlian, *AI literacy for users: a comprehensive review and future research directions of learning methods, components, and effects*, «Computers in human behavior: artificial humans», 2 (2024), n. 1, DOI: 10.1016/j.chbah.2024.100062; Haotian Zhu; Yao Sun; Junfeng Yang, *Towards responsible artificial intelligence in education: a systematic review on identifying and mitigating ethical risks*, «Humanities and social sciences communications», 12 (2025), n. 1, p. 1111., DOI: 10.1057/s41599-025-05252-6.

19 Iris Heung Yue Yim, *A critical review of teaching and learning artificial intelligence (AI) literacy: developing an intelligence-based AI literacy framework for primary school education*, «Computers and education: artificial intelligence», 7 (2024), DOI: 10.1016/j.caeai.2024.100319.

20 Iris Heung Yue Yim; Jiahong Su, *Artificial intelligence literacy education in primary schools: a review*, «International journal of technology and design education», (2025), p. 1-30, DOI: 10.1007/s10798-025-09979-w.

21 Iris Heung Yue Yim, *A critical review of teaching and learning artificial intelligence (AI) literacy: developing an intelligence-based AI literacy framework for primary school education*, «Computers and education: artificial intelligence», 7 (2024), DOI: 10.1016/j.caeai.2024.100319.

Topic 3: generative AI in academia (ChatGPT in educational contexts)
Since late 2022, higher education literature has shifted toward generative AI policy, pedagogy, and academic integrity. Wang [*et al.*][22] review U.S. university policies and instructional guidance for generative AI, documenting rapid but uneven institutionalization and the rise of 'use-with-transparency' norms. A systematic review synthesizes academic integrity risks and opportunities, including assessment redesign, disclosure norms, and skill development, focusing on governance and literacies for responsible use. Policy guidance from the U.S. Department of Education also defines AI literacy as both functional, meaning how to use AI, and critical, meaning how to evaluate and reflect on AI, thereby strengthening the 'generative AI in academia' focus[23].

Topic 4: AI for assessment; competencies, ethics, teacher/secondary focus
Across secondary and teacher education settings, scholarship now blends assessment innovation with competency and ethics frameworks. A systematic review of outlines how to design content, instruction, and assessments for AI integration in schools and highlights competency mapping and measurement validity concerns[24]. Research on LLM-generated feedback examines reliability and educational effectiveness, suggesting the use of paired human-AI feedback and clear AI literacy education that emphasizes evidence evaluation, bias recognition, and citation practices. At the same time, K-12 teachers express 'responsible AI' priorities, such as privacy, fairness, and transparency, which directly influence assessment design and classroom norms, especially in secondary settings[25].

Topic 5: AI/ML in engineering education
Engineering programs increasingly embed AI and machine learning concepts alongside generative AI tools, while debating epistemic trade-offs such as automation versus conceptual understanding. A 2025 case study in chemical engineering reports structured adoption of generative AI teaching tools within the Unified Theory of Acceptance and Use of Technology, highlighting performance gains while emphasizing the need for explicit AI literacy instruction, including prompt design, verification, and error analysis[26]. Broader reviews of AI in schools and higher education similarly mention curricular redesign toward problem-based learning, where students

22 Hui Wang [*et al.*], *Generative AI in higher education: seeing ChatGPT through universities' policies, resources, and guidelines*, «Computers and education: artificial intelligence», 7 (2024), DOI: 10.1016/j.caeai.2024.100326.

23 kyle bittle; omar el-gayar, *generative ai and academic integrity in higher education: a systematic review and research agenda*, «Information», 16 (2025), n. 4, p. 296, DOI: 10.3390/info16040296.

24 Xinyan Zhou [*et al.*], *Defining, enhancing, and assessing artificial intelligence literacy and competency in K-12 education from a systematic review*, «Interactive learning environments», (2025), p. 1-23.

25 Yaxuan Yin; Shamya Karumbaiah; Shona Acquaye, *Responsible AI in education: understanding teachers' priorities and contextual challenges*. In: *Proceedings of the 2025 ACM Conference on fairness, accountability, and transparency.* New York: Association for computing machinery, p. 2705–2727.

26 Christopher Honig; Shannon Rios; Aditya Desu, *Generative AI in engineering education: understanding acceptance and use of new GPT teaching tools within a UTAUT framework*, «Australasian journal of engineering education», (2025), p. 1-13.

critically analyze model behavior, positioning engineering classrooms as testbeds for applied AI literacy[27].

Topic 6: ethical & sustainable innovation in elementary education
Elementary-level work combines 'responsible AI' themes, such as safety, bias, and sustainability, with futures-oriented thinking to support ethical decision-making. Scenario-based studies in AI in education demonstrate how anticipatory ethics activities help young learners consider long-term social and environmental impacts of AI, rather than only focusing on immediate functionality[28]. Systematic mappings of ethical risks of AI in education also argue for early, developmentally suitable ethics curricula that highlight sustainability and equity as essential components of AI literacy[29]. Reviews of primary-school AI literacy support the trend toward 'responsible innovation' tasks that are age-appropriate, values-oriented, and embedded in project-based learning[30].

Topic 7: writing and self-efficacy with large language models
As large language models (LLMs) become integrated into academic writing processes, researchers explore how self-efficacy, perceptions of feedback, and dependency dynamics influence outcomes and AI-related literacies. Empirical studies associate students' writing profiles with LLM acceptance and self-efficacy, suggesting that confidence levels and self-regulation strategies can moderate the advantages of AI-supported writing[31]. Related research highlights complex links between generative AI use, perceived competence, and technological dependence, emphasizing the importance of teaching metacognitive AI skills like calibration, verification, and source triangulation[32]. Research on feedback ecosystems further shows that LLM-assisted feedback impacts learning outcomes by shaping students' perceptions of feedback, again emphasizing self-efficacy and critical evaluation skills as essential parts of AI writing literacies[33].

27 Jingjing Liang; Jason M. Stephens; Gavin T. L. Brown, *A systematic review of the early impact of artificial intelligence on higher education curriculum, instruction, and assessment*, «Frontiers in education», 10 (2025), DOI: 10.3389/feduc.2025.1522841.

28 Micha Wieczorek, *Using ethical scenarios to explore the future of artificial intelligence in primary and secondary education*, «Learning, media and technology», (2025), p. 1-17.

29 H. Zhu; Yao Sun, J.Yang, *Towards responsible artificial intelligence in education* cit.

30 I. Heung Yue Yim; J. Su, *Artificial intelligence literacy education in primary schools* cit.

31 Soonhee Hwang, *Unpacking the impact of writing feedback perception on self-regulated writing ability: the role of writing self-efficacy and self-regulated learning strategies*, «Behavioral sciences», 15 (2025), n. 2, p. 100, DOI: 10.3390/bs15020100.

32 Ling Zhang; Junzhou Xu, *The paradox of self-efficacy and technological dependence: Unraveling generative AI's impact on university students' task completion*, «The Internet and higher education», 65 (2025), DOI: 10.1016/j.iheduc.2024.100978.

33 Soonhee Hwang, *Unpacking the impact of writing feedback perception on self-regulated writing ability: the role of writing self-efficacy and self-regulated learning strategies*, «Behavioral sciences», 15 (2025), n. 2, p. 100, DOI: 10.3390/bs15020100.

Topic 8: human–AI interaction in adult education and healthcare (nursing)
In healthcare education, especially in nursing, AI literacy frameworks are now quite established, incorporating ethics, safety, and teamwork alongside technical skills. An umbrella review summarizes AI uses in nursing practice and education and addresses privacy, bias, and accountability concerns that require clear guidance[34]. Experimental studies show that targeted ethics programs can significantly improve nursing students' AI ethical awareness and behavioral intentions, providing evidence that literacy interventions lead to measurable changes in attitudes and practice[35]. Practitioner-oriented resources further conceptualize nursing AI literacy as a combination of technical knowledge, clinical judgment, and governance fluency, closely aligning with the 'human-AI at scale' thematic interpretation[36].

Conclusion

This study maps the AI literacy research landscape from 2016 to 2025 and highlights its transition from a technical orientation to a multidisciplinary domain. By analyzing 881 Scopus-indexed publications using text-mining and topic-modeling techniques, we identified significant growth, shifts in disciplinary focus, and the increasing integration of educational, ethical, and socio-cultural dimensions. The results show a move toward a socio-technical understanding of AI literacy, especially within the Social Sciences, with a growing emphasis on emotional and ethical considerations. We also observed a geographic shift, with East Asia, particularly Hong Kong, emerging as a key research hub alongside the United States, China, Germany, and the United Kingdom. This highlights the growing recognition of AI literacy as essential for informed citizenship and equitable access to education.

The findings have significant implications for practice, policy, and future research. Practitioners should prioritize integrating critical and ethical engagement into AI literacy curricula, while policymakers can utilize this research to promote collaboration and develop consistent competency frameworks. Institutions should allocate resources to under-researched areas, such as vocational education and community-based initiatives. The rise of generative AI highlights the urgent need for effective assessment methods and comprehensive educator training, with the identified thematic clusters acting as a guide for future educational efforts in AI literacy. A major limitation of this study relates to language representation. Since Scopus primarily indexes a large number of publications in English, there may be a bias against AI literacy studies published in other languages, especially those in local or country-specific outlets. Consequently, the geographic and thematic patterns found in this study might reflect the landscape of English-language scholarship rather than the entire global scope of AI literacy research.

34 Rabie Adel El Arab [*et al.*], *The role of ai in nursing education and practice: umbrella review*, «Journal of medical internet research», 27 (2025), DOI: 10.2196/69881.

35 Mohammad Abuadas; Zainab Albikawi; Ahmad Rayani, *The impact of an AI-focused ethics education program on nursing students' ethical awareness, moral sensitivity, attitudes, and generative AI adoption intention: a quasi-experimental study*, «BMC Nursing», 24 (2025), p. 720, DOI: 10.1186/s12912-025-03458-2.

36 Stephanie H. Hoelscher; Ashley Pugh, *N.U.R.S.E.S. embracing artificial intelligence: a guide to artificial intelligence literacy for the nursing profession*, «Nursing outlook», 73 (2025), n. 4, DOI: 10.1016/j.outlook.2025.102466.

This study provides a comprehensive examination of AI literacy while emphasizing important gaps that need further research. Specifically, more empirical focus is required in marginalized learning environments, such as K-12 education, vocational training, and lifelong learning, where AI literacies are often poorly defined and unevenly assessed. Additionally, longitudinal and mixed-methods research should investigate how AI literacy evolves over time at the individual level, with particular emphasis on the effects of generative AI, cognitive development, and socio-emotional outcomes. Stronger psychometric validation of AI literacy measures across diverse cultural contexts, disciplines, and learner groups is crucial for creating adaptable and transferable competency models. Cross-national comparative studies can further clarify how policy environments, educational traditions, and technological infrastructures influence AI literacy perceptions and practices. Finally, interdisciplinary collaborations combining psychology, sociology, and ethics will be essential for creating frameworks that help individuals engage with AI responsibly and critically shape its societal role.

Authorship

Both authors equally contributed to all aspects of the study, including conceptualization, data collection and analysis, interpretation of results, and writing. The draft was reviewed and improved using Grammarly Pro and ChatGPT to enhance readability and editing. The author reviewed the final version and accepted full responsibility for the content and integrity of the work.

Conflict of interest

The authors state that there are no conflicts of interest related to this work.

Funding

No funding was received for this research.

Ethical approval

This study did not involve human participants, animal subjects, or personally identifiable data; therefore, no ethical approval was required.

Data availability

The dataset created for this research is available upon reasonable request.

Appendix 1 - Search query used for data collection

((TITLE('AI Literacy') OR TITLE('Artificial Intelligence Literacy') OR KEY('AI Literacy') OR KEY('Artificial Intelligence Literacy') OR TITLE('ChatGPT* Literacy') OR KEY('ChatGPT* Literacy') OR TITLE('LLM Literacy') OR KEY('LLM Literacy') OR TITLE('Large Language Model* Literacy') OR KEY('Large Language Model* Literacy')) AND (LIMIT-TO(DOCTYPE,'ar') OR LIMIT-TO(DOCTYPE,'cp') OR LIMIT-TO(DOCTYPE,'ch') OR LIMIT-TO(DOCTYPE,'re') OR LIMIT-TO(DOCTYPE,'cr') OR LIMIT-TO(DOCTYPE,'no') OR LIMIT-TO(DOCTYPE,'ed') OR LIMIT-TO(DOCTYPE,'bk') OR LIMIT-TO(DOCTYPE,'le'))).

Articolo proposto il 15 ottobre 2025 e accettato il 28 dicembre 2025.

ABSTRACT

AIB studi, 65 n. 2-3 (maggio/dicembre 2025), p. 361-380. DOI 10.2426/aibstudi-14206
ISSN: 2280-9112, E-ISSN: 2239-6152 - Copyright © 2025 by Mahsa Torabi, Mohammadamin Erfanmanesh

MAHSA TORABI, Semnan University, Semnan (Iran), e-mail: mahsatorabi515@gmail.com
MOHAMMADAMIN ERFANMANESH, New Brunswick (Canada), e-mail: amin.erfanmanesh@gmail.com

Mappare l'evoluzione tematica della ricerca sull'alfabetizzazione all'IA: un'analisi di text mining degli articoli indicizzati in Scopus

L'alfabetizzazione all'intelligenza artificiale (IA) si è evoluta in un fenomeno socio-tecnico complesso e multidimensionale che va ben oltre una competenza specialistica. La ricerca sull'AI literacy è intrinsecamente interdisciplinare e comprende ambiti quali gli studi curricolari, l'etica dell'educazione e lo sviluppo delle politiche educative.

Questo studio analizza l'evoluzione tematica della ricerca sull'alfabetizzazione all'IA attraverso un'analisi testuale approfondita di 881 pubblicazioni indicizzate nel database Scopus tra il 2016 e il 2025. Mediante l'impiego di tecniche di elaborazione del linguaggio naturale, analisi di co-occorrenza e topic modeling, sono stati individuati i principali temi emergenti e i cambiamenti disciplinari che caratterizzano il campo di ricerca.

I risultati evidenziano una crescita significativa delle pubblicazioni sull'AI literacy, passate da un solo contributo nel 2016 a un totale di 714 pubblicazioni nel biennio 2024–2025. Tale crescita è accompagnata da una marcata espansione dell'ambito disciplinare, con una crescente concentrazione di studi nelle scienze sociali e nella psicologia.

L'analisi ha inoltre individuato otto temi chiave nella ricerca sull'alfabetizzazione all'IA, tra cui: la fase formativa del campo, l'educazione precoce, l'interazione uomo–IA, l'insegnamento e l'apprendimento supportati dall'IA, le questioni di progettazione e le implicazioni etiche, nonché l'integrazione di prospettive tecniche, pedagogiche e socioculturali.

Infine, emerge una rapida crescita del contributo globale alla ricerca sull'AI literacy, con una forte partecipazione dei Paesi dell'Asia orientale – in particolare Hong Kong – che si affiancano a nazioni tradizionalmente leader come Stati Uniti, Cina, Germania e Regno Unito.

Mapping the thematic evolution of AI literacy research: a text-mining analysis of Scopus-indexed articles

AI literacy has evolved into a multifaceted socio-technical phenomenon that extends far beyond a specialized skill. Research on AI literacy is inherently interdisciplinary, covering fields such as curriculum studies, educational ethics, and policy development. This paper examines the thematic evolution of AI literacy research through a detailed textual analysis of 881 publications indexed in the Scopus database between 2016 and 2025. Using natural language processing techniques, co-occurrence analysis, and topic modeling, we identified dominant themes and disciplinary shifts related in AI literacy research. The results showed a significant increase in AI literacy-related publication from a single publication in 2016 to 714 publications in the combined years 2024 and 2025. This growth is accompanied by a clear expansion in disciplinary scope, with a rising concentration of studies in the social sciences and psychology. The results identified eight key topics in AI literacy studies during the formative phase, early education, human-AI interaction, AI-supported teaching and learning, design and ethical considerations, and the intersection of technical, pedagogical, and socio-cultural perspectives. There is a rapidly growing global contribution to AI literacy research, with East Asian countries, especially Hong Kong, joining leading nations such as the United States, China, Germany, and the United Kingdom.