
Miscellaneous

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The Intersection between AI Literacy and Media and Information Literacy Scales – A Bibliometric Study and Conceptual Analysis

Abstract

This study conducted a bibliometric and thematic analysis of 9,624 publications on media and information literacy (MIL) and artificial intelligence literacy (AIL) (2004–2024) to investigate the global scholarly landscape, identify commonalities and distinctions between AIL and MIL, and explore the influence of AIL research on MIL metrics. Findings indicate a burgeoning interest in both fields, with a notable increase in publications over time. While MIL research predominantly consists of peer-reviewed articles, conference papers dominate AIL, reflecting its nascent nature. The United States and Spain lead in contributions, with English as the dominant language, and the dominance of educational and pedagogical themes (59%) and the media and communication research (21.5%).

A bibliometric analysis of scientific publications indexed in the Web of Science (WoS) and Google Scholar (GS) databases revealed five dominant research themes: digital and information literacy, AI and data literacy, critical literacy and curriculum, media literacy and education, and health literacy. While initial interests were directed towards media literacy and health literacy, recent attention has shifted towards AIL. The COVID-19 pandemic notably renewed interest in digital health literacy as a critical research area during and after the crisis.

A comparative and thematic analysis of metrics for MIL and AIL identifies shared dimensions in usage and evaluation.

However, AIL uniquely prioritizes ethical considerations and an understanding of machine learning principles. Contemporary MIL metrics are undergoing a transformation to incorporate awareness of information ecosystems, algorithmic bias, and privacy concerns. To address the rapid pace of technological change, interdisciplinary research is essential for the development of comprehensive AIL metrics that extend existing MIL frameworks.

Keywords

AI literacy, media and information literacy, bibliometric study, scales.

1. Introduction

Media and information literacy (MIL) has transitioned from an ancillary skill to an indispensable component of individual and societal development in the contemporary media landscape. The United Nations Educational, Scientific and Cultural Organization (UNESCO)'s teacher curriculum conceptualized MIL as a set of competencies, including knowledge, skills, and attitudes, that empower individuals to engage critically with media and information sources (Wilson et al., 2011). This framework promotes active citizenship by cultivating critical thinking, lifelong learning, and effective media interaction. Within a global humanistic framework, MIL is conceptualized as both a fundamental right requiring recognition and a policy imperative demanding promotion. Its implementation serves to enhance communication systems and democratic processes, consequently strengthening citizens' capacity to access reliable information and counter challenges posed by disinformation, fake news, and poor journalism. The cultivation of media literacy presents substantial potential within pedagogical contexts and global communication frameworks, particularly when aligned with a new humanism. Such a humanistic perspective underscores the importance of respecting pluralism and cultural diversity, fosters media development conducive to a culture of peace and international dialogue, and advocates for equitable access to knowledge and quality education for all populations (Pérez-Tornero & Varis, 2010; Pérez-Tornero et al., 2021).

Mackey and Jacobson (2011) advocated for a reconceptualization of information literacy as metaliteracy, positing that the latter serves as a comprehensive framework encompassing media, digital, information, communication, and visual literacies. This theoretical shift offers a unified approach that bridges existing conceptual disparities, fosters practical interconnections, and reinforces the overarching objective of lifelong learning across diverse literacy domains. Pérez-Tornero (2004) delineated several key domains pertinent to digital literacy and media education. These encompass: formal educational systems; media systems involved in training and informal education; primary socialization agents, including families and peer groups; institutions responsible for communication promotion and regulation; and the spheres of citizen participation and public services concerning their interaction with the media landscape.

There is a strong imperative, supported by scholarly literature, for media education to be established as a core subject across all school curricula and integrated within various informal learning environments such as the family, media platforms, public arenas, and the home. Concurrently, it is essential to enhance support systems for educators engaged in MIL initiatives, ensure the formal inclusion of MIL in curricula, develop dedicated teacher training programs in MIL, and promote synergistic collaboration among diverse community members, encompassing families, teachers, students, and other relevant stakeholders (Aguaded et al., 2016; Wilson, 2012).

In 2021, UNESCO adopted the term MIL as an overarching concept encompassing various literacies, including artificial intelligence (AI) Literacy. Experts now view AI literacy as a branch of digital literacy, falling under the broader umbrella of MIL (Grizzle et al., 2021; Yang, 2022). The concept of AI literacy remains in its early stages (Ng et al., 2021), focusing on the essential skills individuals need to learn and navigate the digital world with the assistance of AI-based technologies.

Researchers have shown growing interest in publishing on AI literacy, particularly from social and humanistic perspectives. One study identified 30 prior studies on this subject from 2016 to 2021 (Ng et al., 2021). Since the late 1990s, many tools and measures have been developed

to assess media literacy. However, none offer a comprehensive and objective tool for measuring MIL as a whole (Arshad et al., 2022).

Ortiz (2024) developed an artificial intelligence methodology designed to evaluate the maturity level of educators' MIL skills. This research highlights the interconnectedness of this domain and underscores its potential as a promising area for future investigation. Research in journalism education increasingly focuses on integrating Artificial Intelligence (AI) into pedagogical frameworks. Irfan et al. (2023) found that classroom AI tool integration encourages in-depth analysis and collaboration, enhancing student writing. They conclude AI literacy is vital for preparing students for the evolving, AI-focused journalism sector. Similarly, Tejedor et al. (2024) assert the need for journalism education to adapt to the significant professional impact of AI and big data, requiring the teaching of technical skills alongside the cultivation of critical and ethical reasoning.

Today, many countries are taking significant steps to define and measure what students should learn regarding AI education from kindergarten through university, recognizing that understanding the basic functions of AI and its applications is an essential component of the digital literacy required of all citizens. While AI literacy has recently become a comprehensive research field, developing tools to measure AI literacy that meet psychometric quality standards—validity, reliability, and objectivity—remains a relatively new area of inquiry (Laupichler, Aster, Perschewski, & Schleiss, 2023). Given the above, it becomes clear that research into MIL metrics, particularly those relating to AI literacy, is of critical importance.

2. Previous Studies

Numerous bibliometric analyses have investigated media and information literacy (MIL) from diverse perspectives, encompassing digital, data, information, media, and health literacy. However, the specific domain of AI literacy has received relatively less attention.

2.1. A Bibliometric Exploration of Media, Information, and Digital Literacy Research

Early research on media, information, and digital literacy includes studies by Blummer (2008), Potter (2013), Rader (2002), and Sefton-Green et al. (2009). This review, however, concentrates on recent bibliometric studies.

Purnomo et al. (2020) utilized VOSviewer to map digital literacy research indexed in Scopus from 1997 to 2019, identifying 2,749 publications, predominantly from the US, UK, Australia, and Spain. The study noted an increasing trend in international scholarly output, focusing mainly on information and communication technology (ICT), human behavior, and education.

Kumar et al. (2021) conducted a bibliometric review of media literacy literature published by SpringerLink from 2011 to 2020, finding 3,089 publications, with the US leading in output. Growth was particularly significant in 2014 and 2019. Chen et al. (2021) examined trends in information literacy in higher education from 2011 to 2020, revealing increased output in the last five years and highlighting curriculum design based on competency standards.

Park et al. (2021) analyzed digital literacy, ICT literacy, and media literacy research from 2000 onward using data from the Web of Science, demonstrating a broadening scope that included topics such as evaluation, credibility, and media culture across various age groups.

He et al. (2021) compared trends in media literacy research from 2010 to 2019 in China and internationally, finding significant increases in Web of Science (WoS) publications and different focal points in Chinese and international studies. Setyorini (2022) performed a bibliometric analysis of digital literacy research from 2017 to 2021, analyzing 999 articles through

VOSviewer, while Rohmani et al. (2023) identified trends in digital literacy research using data from Google Scholar.

Yang et al. (2022) provided an analysis of digital health literacy literature from 1998 to 2021, noting significant growth coinciding with the COVID-19 pandemic and identifying key research clusters.

Farias-Gaytan et al. (2023) systematically reviewed 202 articles (2015–2022) on digital transformation and literacy in higher education. Findings reveal institutional interest in didactic technology, significant digital competency training gaps for faculty/students, minimal focus on media literacy, and methodological potential for future research in this area.

Wang and Si (2023) analyzed digital literacy publications from 1990 to 2022, revealing a 25.96% annual growth rate and emphasizing the US as the primary contributor. Safitri et al. (2023) examined data literacy research across disciplines from 1956 to 2023, highlighting a resurgence since 2004, primarily in social sciences and computer science. Schofield et al. (2023) reviewed media and information literacy measurements from 2000 to 2021, concluding that empirical research is limited, with most studies influenced by international organizations like UNESCO.

Kutlu-Abu and Arslan (2023) analyzed 776 media literacy studies published in WoS, noting increasing citations and interest, while Guerola-Navarro et al. (2023) focused on citizen participation in public decision-making through media and informational literacy frameworks. Misbah et al. (2024) conducted a bibliometric analysis of digital literacy research in science education using VOSviewer, examining 60 studies from the Scopus database with keywords such as “digital literacy,” “science learning,” and “science education.” The analysis revealed a rising trend in digital literacy research, particularly in education, underscoring its significance for 21st-century competencies and online training, with peak publications in 2019 and 2021.

Wu et al. (2024) explored digital literacy research through a bibliometric analysis of WoS data from 2019 to 2023, finding the United States as the leading contributor, followed by Spain, China, Australia, and the United Kingdom. Key future research trends identified included artificial intelligence, pandemics, and health literacy. The analysis highlighted “digital literacy” as a prominent keyword in 2021, with “informational literacy” and “media literacy” also gaining traction. Notably, in 2022, “COVID-19” and “online learning” emerged frequently, while in 2023, focus shifted to “artificial intelligence,” “pandemics,” and “health literacy.”

Rojas-Estrada et al. (2024) systematically reviewed literature (2013–2023) using PRISMA guidelines to analyze Media and Information Literacy (MIL) curriculum integration across formulation, implementation, evaluation, and challenges. Findings highlight political will and stakeholder activism (teachers, civil society, academia) as key drivers for MIL adoption, while emphasizing the need for robust policy evaluation regarding reach, effectiveness, and adaptability.

2.2. A Bibliometric Exploration of AI Literacy Research

Regarding AI literacy, Ng et al. (2021) analyzed 30 studies, noting limited literature encompassing K-12 to higher education from 2016 to 2021 across various databases. They observed an increase in publications, from two in 2016 to 19 in 2020–April 2021, with significant contributions from the U.S., China, Hong Kong, Spain, and Austria. Most studies focused on K-12 education, with a thematic analysis examining definitions, relevant skills, and ethical considerations in AI literacy. Laupichler et al. (2022) reviewed AI literacy in higher education, analyzing 902 studies and narrowing them to 30. Their findings indicated that research

remains nascent, particularly in defining AI literacy for adult education and curriculum development, with a notable concentration of literature from the U.S. and Canada.

Several studies have conducted systematic reviews and bibliometric analyses of AI literacy research. Casal-Otero et al. (2023) focused on K-12 education, presenting a bibliometric analysis of 179 studies sourced from Scopus, revealing modest but growing academic output since 2016, particularly from 2020 to 2022. Their findings categorized output into learning experience and theoretical perspective regarding AI education initiatives. Similarly, Tenório et al. (2023) analyzed 1,076 studies, selecting 244 for bibliometric evaluation. They noted that around 80% of AI literacy publications emerged in the last decade, with a peak in 2021. Most publications (72.13%) were conference papers, with leading contributions from the United States, China, Spain, and Germany. Key topics included machine learning, big data, deep learning, and ethics.

Li and Kim (2024) reviewed 153 studies on AI literacy in human resource development, finding 54 specifically addressed adult literacy, predominantly published post-2021. They categorized the findings into competencies, methods, and effects, highlighting the implications of AI literacy for workplace development.

Almatrafi et al. (2024) conducted a systematic review of 47 articles on AI literacy concepts and implementation from 2019 to 2023, emphasizing contributions to understanding, implementation, and evaluation across diverse demographics. Lastly, Lintner (2024) evaluated 22 studies on AI literacy measurement scales, identifying 16 scales suitable for various populations. While these scales showed good structural validity and internal consistency, few were tested for content validity or cross-cultural applicability.

3. Research Gap

From the preceding review, it is evident that the bibliometric analysis approach has been widely applied in numerous studies on MIL literature reviews. However, the focus on AI literacy within these reviews has been minimal, with only five studies identified. Some of these studies provide preliminary exploratory reviews of AI literacy literature, such as the works by Ng et al. (2021) and Laupichler et al. (2022). Others offer systematic literature reviews in conjunction with bibliometric analysis in the AI literacy domain, including studies by Casal-Otero et al. (2023) and Tenório et al. (2023). The fifth study, by Li and Kim (2024), reviews AI literacy literature within the context of work and human resource development. Their findings indicate that scientific output in AI literacy began in 2016 and saw significant growth after 2020, confirming that AI literacy is a relatively new concept. On the other hand, studies that have conducted comprehensive reviews of media, information, and digital literacy literature are numerous and have emerged relatively early. Examples include Rader (2002), Blummer (2008), Sefton-Green et al. (2009), and Potter (2013). More recent studies that adopted bibliometric analysis to review literature on digital, information, and media literacy include Purnomo et al. (2020), Kumar et al. (2021), Chen et al. (2021), and Park et al. (2021). Collectively, these studies point to a growing density of scientific output in this field, particularly in recent years, with English-speaking countries, especially the United States, the United Kingdom, and Australia, leading this production, alongside contributions from Spain, Germany, and China. A notable gap in the existing literature is the absence of studies that have specifically examined the literature on metrics for media, information, or AI literacy using extensive bibliometric analysis. While Schofield et al. (2023) attempted to review this literature, their approach was not fully bibliometric. Siddiq et al. (2016), Haddon et al. (2020), and Almatrafi et al. (2024) have

conducted more systematic reviews of assessment tools and metrics, but these studies have not focused on the intersection of AI literacy and broader MIL concepts.

Lintner's (2024) review of AI literacy metric studies further emphasizes the need for a more comprehensive analysis. Despite the substantial body of research on MIL, existing studies have not adequately explored the connections between AI literacy and general literacy concepts, particularly in the context of developing metrics.

This study aims to address this research gap by conducting a bibliometric analysis of AI literacy literature and examining its relationship to the development of MIL metrics.

This investigation aims to:

- Identify the principal research themes within the scholarly literature concerning Artificial Intelligence (AI) literacy and Media and Information Literacy (MIL) during the specified timeframe.
- Characterize the distribution of the extant literature on AI literacy and MIL according to publication chronology, document typology, linguistic representation, and publication venues.
- Assess the relative contribution of different nations to the overall scientific output within the research domain of AI literacy and MIL.
- Identify emergent research trends within the AI literacy and MIL literature through a bibliometric analysis based on keyword co-occurrence.
- Determine the indicators that characterize the temporal evolution of scholarly publication activity within the examined corpus of AI literacy and MIL literature.
- Evaluate the extent to which contemporary AI literacy research has influenced the development of MIL metrics, and to compare the metrics employed in both fields, identifying points of commonalities and unique aspects.

4. Methodology

Eom (2009) notes the frequent interchangeable use of the terms bibliometrics, scientometrics, and informetrics. However, while bibliometrics focuses its analysis on publications within scientific journals, scientometrics broadens its scope to achieve a better understanding of the mechanisms of scientific research as a social activity (Chellappandi & Vijayakumar, 2018; Santos & Kobashi, 2009).

Bibliometric analysis is one of the key techniques that offers a microscopic examination of previous literature (Metli, 2023). It is a scientifically accepted methodology for exploring and analyzing large volumes of scientific data to verify the formal characteristics of a research field, track changes and growth within it, and identify current research trends to guide future studies (Setyorini, 2022; Tenório et al., 2023; Wang & Si, 2023). Bibliometric measurements are a valuable scientific tool used across disciplines and serve as a starting point for future research, revealing trends in scientific development and identifying research gaps (Rohmani et al., 2023; Wang & Si, 2023; Zhu et al., 2023).

This study utilized a dual methodological framework to attain its research goals. The first component entailed a bibliometric analysis of the extant literature pertaining to AI literacy and MIL. This analysis sought to evaluate the global scholarly interest in these domains, identify intersecting themes and interconnections, and pinpoint significant contributions from relevant studies. The second component involved a targeted review of literature specifically addressing the metrics employed to measure AI literacy and MIL.

The second approach was employed as a subsequent stage of analysis, as research on AI literacy is limited and still in its early stages, as noted by Laupichler et al. (2022). Therefore,

systematic methods like meta-analysis or systematic literature reviews, which require a large number of relatively homogeneous publications to derive accurate data, are not suitable for this review.

Given the nascent state of research on metrics within AI literacy studies, a scoping literature review methodology was deemed more suitable than a systematic review. This approach prioritizes the qualitative synthesis of content from a focused selection of studies, rather than relying heavily on statistical analysis. Consequently, the second phase of this analysis involved a critical examination of ten highly-cited publications addressing media, information, and AI literacy metrics. In accordance with scoping review principles, sample size determination is guided by the achievement of thematic saturation, rather than adherence to a predetermined numerical threshold. It is considered sufficient when the researcher reaches a saturation level, as “search criteria and what studies to include in a qualitative analysis are determined by the focus of the research questions” (Leary and Walker, 2018)

Both phases of analysis employed the Web of Science (WoS) and Google Scholar (GS) as bibliographic databases. WoS, a curated database, offers a selective collection of scholarly journals and sources adhering to stringent criteria. In contrast, GS, an automated indexing database, provides a broader range of scientific materials sourced from diverse repositories, thereby facilitating access to a wider spectrum of pertinent literature.

This investigation leverages the advanced capabilities of VOSviewer 1.6.20, a state-of-the-art bibliometric analysis tool renowned for its comprehensive visualization and mapping of scientific literature (Aldakr, 2023). VOSviewer’s ability to effectively retrieve, analyze, and visualize co-occurrences of terms, citations, and institutional contributions within a bibliometric network has made it a cornerstone of numerous studies in media, information, and digital literacy (Kutlu-Abu & Arslan, 2023; Misbah et al., 2024; Park et al., 2021; Purnomo et al., 2020; Rohmani et al., 2023; Safitri et al., 2023; Setyorini, 2022; Yang et al., 2022). To complement this, the study also employed Harzing’s Publish or Perish, a widely-recognized software for managing bibliographic data (Aldakr, 2023). Data extracted from Google Scholar using Publish or Perish was subsequently visualized in VOSviewer to generate co-occurrence networks of research terms, authorship, and citations, as detailed in the following sections.”

4.1. Inclusion and Exclusion Criteria

To effectively address the research objectives, a two-tiered approach was employed to select relevant literature:

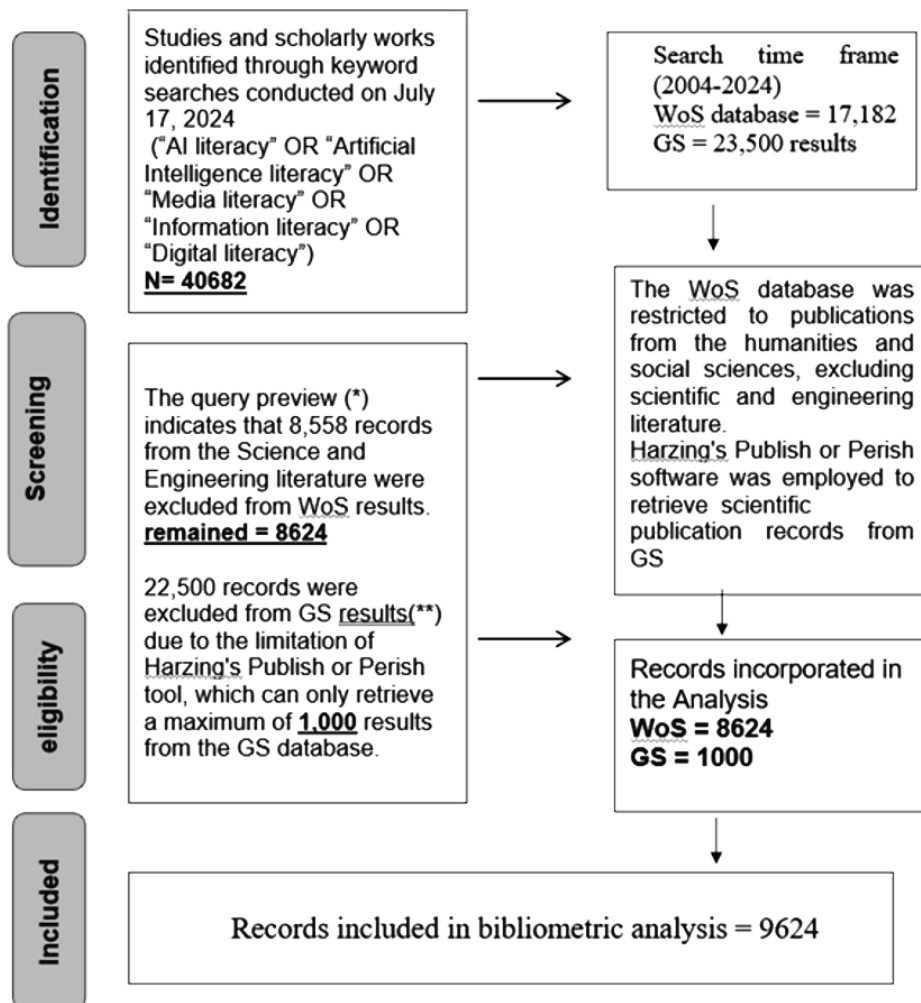
Phase I: Comprehensive Literature Identification: An extensive search was conducted to identify all pertinent literature related to literacy studies, thereby establishing a broad foundation for the bibliometric analysis.

Phase II: Focused Literature Selection: A more targeted search was then undertaken to identify specific literature addressing literacy metrics, ensuring a concentrated focus on the thematic analysis component of the study.

Figure 1 outlines the methodological framework for conducting a bibliometric analysis of 9,624 publications within the domains of media literacy, information literacy, and AI literacy. Subsequent to the bibliometric analysis, a qualitative thematic analysis was conducted on a subset of publications focusing on measurement scales. A citation-based approach was employed to select ten studies on measurement scales from the WoS database: five focusing on media literacy and five on AI literacy. The search query utilized the following Boolean operators: (“Media literacy” OR “AI literacy”) AND (“Measurement” OR “Scale” OR “Assessment”).

The primary methodology employed was a bibliometric analysis encompassing 8,624 publications indexed within the WoS database. WoS provides researchers with a broad analysis of scientific output, a feature not available to the same extent with GS. Data acquisition from GS was necessarily limited to the initial 1,000 results, representing the maximum permissible retrieval using Harzing's Publish or Perish software. These 1,000 GS publications were subsequently analyzed (see Annex, Figures 7 and 8) and compared against bibliometric indicators derived from the 8,624 WoS records (see Annex, Figure 6) to delineate the principal research areas and ascertain prevailing trends within the studied corpus of literature.

Figure 1. Framework for literature inclusion in bibliometric research



(*)The query preview (WoS): Database: Web of Science Core Collection: ALL-(“AI literacy” OR “Artificial Intelligence literacy” OR “Media literacy” OR “Information literacy” OR “Digital literacy”) and Education Educational Research or Communication or Psychology or Social Sciences Other Topics or Arts Humanities Other Topics or Sociology or Social Issues or Art or Film Radio Television or Cultural Studies or Social Work or Religion or Women S Studies or History or Development Studies or Family Studies or Music or Philosophy or International Relations (Research Areas). Timespan: 2004-01-01 to 2024-07-17. Date Run: Wed Jul 17 2024 14:24:07 GMT+0300 (Arabian Standard Time). Results: 8624

()The query preview (GS):**

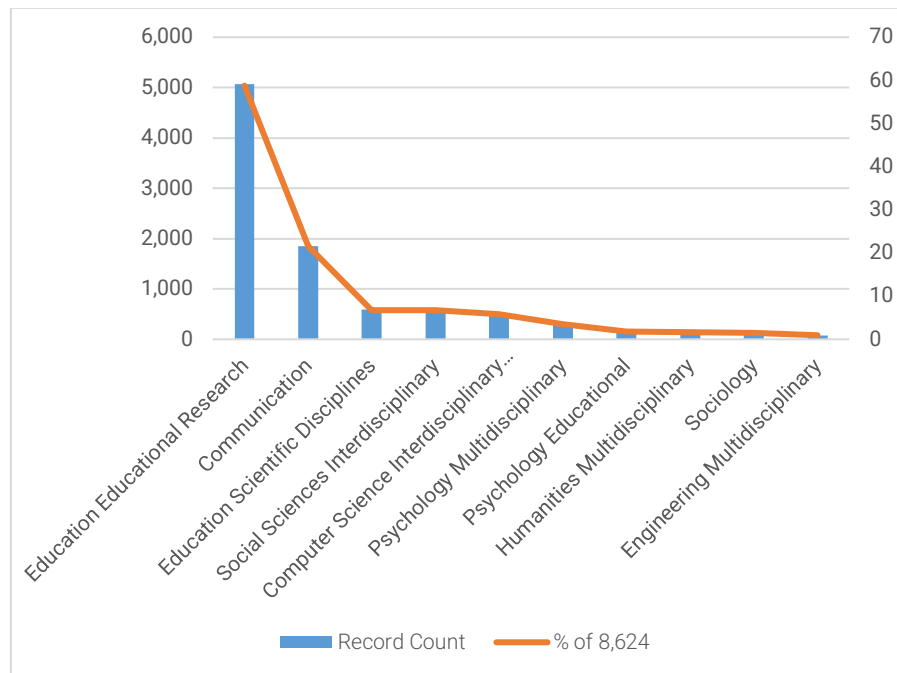
<https://scholar.google.com/scholar?q=%28%20%26%20AI+literacy%20OR+%20Artificial+Intelligence+literacy%20OR+%20CMedia+literacy%20OR+%20CInformation+literacy%20OR+%20CDigital+literacy%20%29&hl=ar&sdt=0%2c5&s vlo=2024&as?yhi=2004>

Source: Own elaboration.

5. Results

5.1. Bibliometric Analysis of the Target Literature

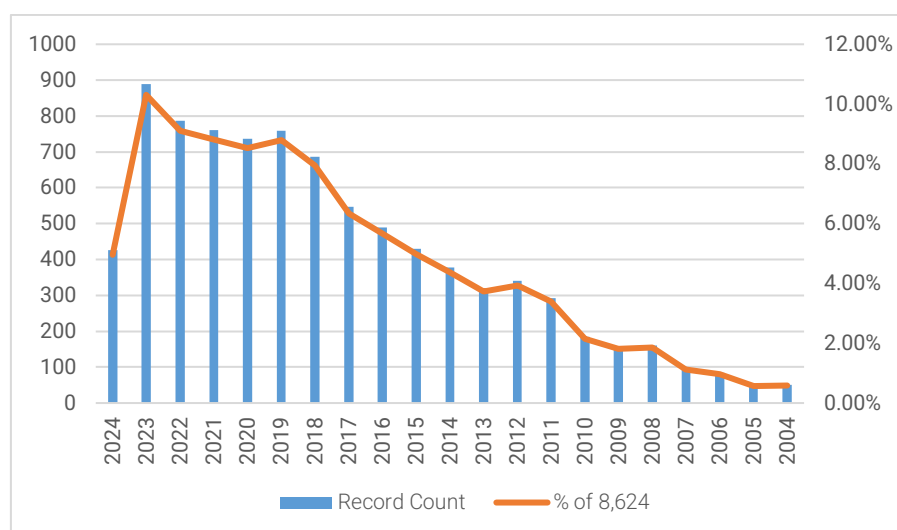
Figure 2. Research areas of the target literature (media, information, and AI Literacies)



Source: Own elaboration.

Figure 2 shows a predominance of research in educational and pedagogical domains, comprising approximately 59% of the literature examined (according to the publication analysis in the WoS). Research within the field of media and communication constituted the second most prevalent category, accounting for 21.5% of the total. Furthermore, interdisciplinary and multidisciplinary studies represented nearly 19% of the corpus.

Figure 3. Distribution of literature by publication year



Source: Own elaboration.

Figure 3 underscores the escalating scholarly attention devoted to scientific publication within the corpus of literature examined spanning the last two decades. The annual rate of publication did not surpass 50 studies in the years 2004 and 2005, constituting less than 1% for each year. This figure culminated in 2023, reaching a zenith of 889 studies, representing 10.3%. It is noteworthy that the analysis was concluded in July 2024, which may potentially explain the observed diminution in publication rates for the final year.

As depicted in Annex, Table 1, peer-reviewed articles and original research comprise approximately 72% of the literature analyzed, while conference papers account for 21%.

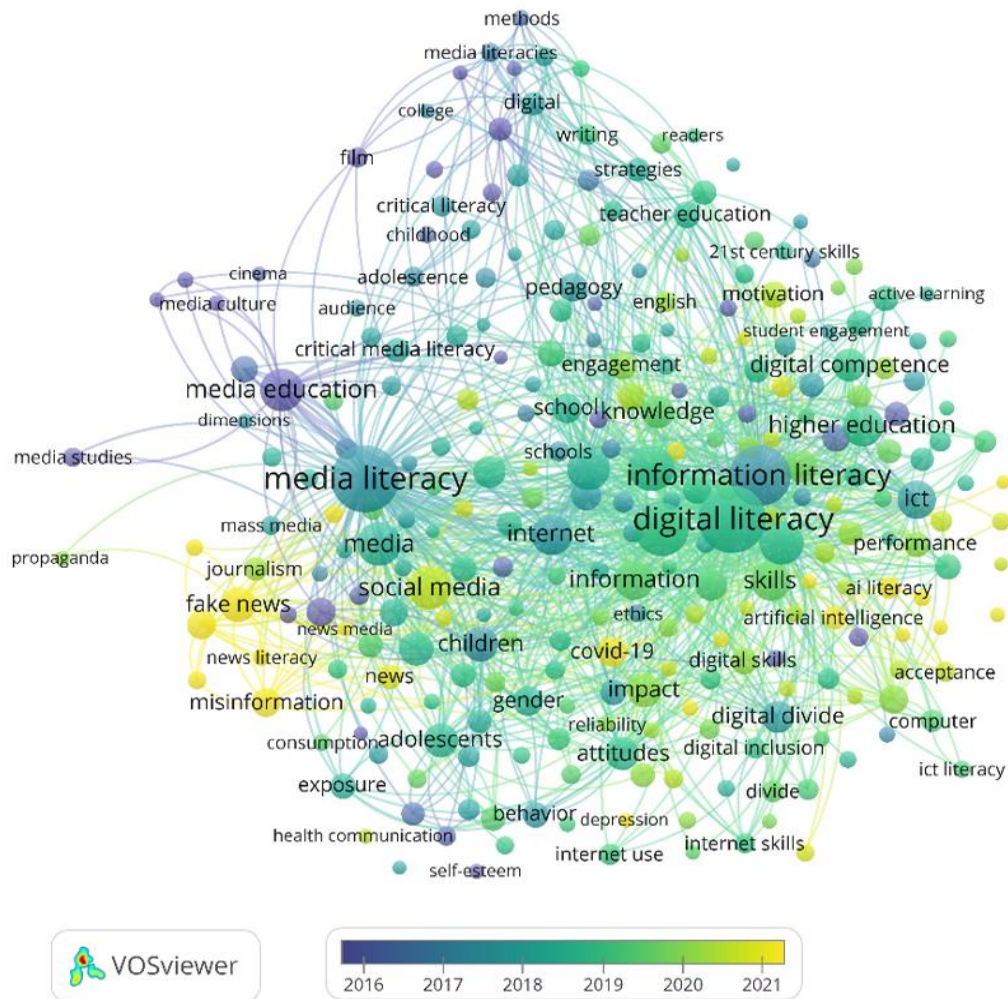
Table 2 (Annex) reveals a significant predominance of English in the scholarly literature pertaining to the field under investigation, comprising approximately 85% of publications. Spanish follows at a considerable distance, accounting for 8.7% of the total. Additional languages represented include Russian, Portuguese, Norwegian, German, and Chinese.

Table 3 (Annex) presents the universities that have contributed significantly to the field of inquiry with 50 or more published studies. The Universidad de Huelva from Spain stands out as the leading institution in terms of research output, followed by the Ministry of Education of Ukraine. Notably, American universities account for a substantial portion of the top 20 institutions, with 10 represented.

The presented network visualization (see Annex, Figure 6) depicts a semantic map where nodes symbolize keywords and their size corresponds to the frequency of their occurrence within the corpus. Links connecting these nodes signify the co-occurrence of terms in published literature. This keyword network exhibits a distinct clustering structure, with five discernible clusters, each visually differentiated by color, representing divergent research avenues:

- Cluster One (Red), comprising 72 keywords, was characterized by a strong emphasis on digital literacy, with information literacy, skills, and assessment also prominent. The term “digital literacy” appeared most frequently with 1,565 occurrences.
- Cluster Two (Green), encompassing 68 keywords, focused on the social media landscape and its impact on adolescents and children. Key terms included “social media,” “Internet,” “adolescents,” “children,” “impact,” and “behavior.”
- Cluster Three (Blue), comprising 51 keywords, highlighted the broader context of technology and literacy. Terms such as “technology,” “literacy,” and “information” were central, while “digital divide” emerged as a significant concern. The terms “AI literacy,” “ICT literacy,” and “data literacy” were represented to a lesser extent.
- Cluster Four (Yellow), consisting of 48 keywords, emphasized the pedagogical aspects of literacy. Key terms included “knowledge,” “pedagogy,” “teacher education,” and “critical literacy.”
- Cluster Five (Purple), containing 36 keywords, focused on media literacy and its relationship to misinformation and fake news. Terms such as “media literacy,” “media education,” “fake news,” and “misinformation” were particularly prominent.

Figure 4. The overlay visualization (N=8,624)



Source: Own elaboration.

Figure 4 presents a temporal overlay visualization of scientific publications related to media literacy, information literacy, and AI literacy, retrieved from the WoS. The dataset, encompassing 8,624 studies, reveals a distinct trajectory of research interest from 2016 to 2021. While initial scholarly attention was concentrated on media literacy and education, a subsequent shift towards digital and information literacy became evident. More recently, since 2021, there has been a notable surge in research focused on AI literacy.

Figure 7 (Annex) presents a co-occurrence network of key terms extracted from 1,000 scientific publications on GS related to media literacy, information literacy, and AI literacy. This visualization identifies nine distinct clusters of 211 keywords, visually represented by color-coded nodes. The largest cluster, denoted in red, encompasses 42 terms such as ‘reading,’ ‘skill,’ and ‘learning.’ Other notable clusters include terms associated with artificial intelligence (green), fake news (third cluster), ChatGPT (yellow), media literacy (purple), COVID-19 (light blue), social media (orange), literacy and health (brown), and machine learning (final cluster). The visualization provides valuable insights into the interconnections and relationships among these concepts within the field of digital literacy.

Figure 8 (Annex) depicts a temporal overlay visualization of scientific publications concerning media literacy, information literacy, and AI literacy (N=1000) indexed in Google Scholar. The visualization illustrates the shifting research foci within the database from 2012 to 2020. While early studies primarily centered on health literacy, subsequent research increasingly emphasized media literacy. Notably, a surge of interest in AI literacy emerged in 2020, as evidenced by the yellow-highlighted trendline.

5.1. A thematic analysis of literacy measurement studies

Table 4 (Annex) delineates the ten studies and the corresponding scientific citations they received in both WoS and GS. It is evident that studies on MIL are the earliest (2009), whereas studies on AI literacy are relatively recent (2022). Moreover, studies on MIL garnered a significantly higher number of citations (approximately three times that of the studies on AI literacy). This disparity may be attributed to several factors, including:

- The temporal precedence of MIL research has facilitated its increased utilization as a foundational resource within the scholarly discourse.
- As previous literature reviews indicate, MIL encompasses a broad spectrum of competencies essential for achieving sustainable development goals, including AI literacy, digital health literacy, data literacy, and civic literacy. This broader context likely enhances the relevance and citation of MIL studies as scientific references.

Table 5 (Annex) provides a comparative analysis of the literacy measures employed in the ten studies, offering the following key observations:

- The dimensions of MIL literacy and AI literacy exhibit notable overlap, particularly in the areas of usage, understanding, analysis, and evaluation.
- AI literacy measures distinctly emphasize ethical aspects more than those for MIL, although the latter also incorporate ethical considerations within the critical evaluation dimension.
- AI literacy measures uniquely expand the understanding dimension to encompass recent developments in AI, such as comprehension of machine learning and deep learning fundamentals.
- Recent advancements in artificial intelligence have significantly impacted contemporary media and information literacy frameworks. As evidenced by the research of Tandoc et al. (2021) and Cuervo Sánchez et al. (2021), these frameworks have expanded to incorporate dimensions such as information awareness, algorithmic understanding, privacy considerations, and programming.

6. Discussion and conclusion

The findings indicate that bibliometric analysis methods have been widely employed in reviews of MIL literature; however, the knowledge pertaining to AI literacy remains notably limited, with even fewer studies focusing on the relevant metrics. This study aimed to establish connections between the literature on AI literacy (a specialized field) and general media, information, and digital literacy (a broader field) to delineate research trends within these domains, specifically those aimed at developing metrics.

A comprehensive search of the WoS database spanning two decades (2004–2024) yielded a significant body of literature. The results indicate a predominant focus on educational and pedagogical aspects of MIL and AI literacy, comprising approximately 59% of the studies. Media and communication research accounted for 21.5% of the corpus, suggesting a growing need for interdisciplinary approaches.

The analysis reveals a notable increase in scholarly output on MIL and AI literacy over the past two decades. This trend aligns with previous studies on MIL (e.g., He et al., 2021; Kumar et al., 2021; Purnomo et al., 2020; Wang & Si, 2023) as well as those specifically addressing AI literacy (e.g., Casal-Otero et al., 2023; Ng et al., 2021; Tenório et al., 2023). It is noteworthy that these studies often extend beyond the WoS and GS to include other databases, such as Scopus, SpringerLink, and ProQuest Education Collection.

Although peer-reviewed articles comprised 72% of the literature on media, information, and digital literacy, as revealed by this study, Tenório et al. (2023) observed a preponderance of conference papers within the specific domain of AI literacy. This discrepancy may reflect the relatively recent emergence of AI literacy as a field of study, given the generally more rigorous methodological standards and extended publication timelines associated with peer-reviewed journal articles, particularly those indexed in the Web of Science.

The present study aligns with prior research in identifying English as the dominant language of scientific discourse within this field, followed by Spanish at a substantial margin. Moreover, the United States and its academic institutions demonstrate a substantial lead in scholarly contributions, surpassing Spain by a significant margin.

A bibliometric analysis of key terms within the WoS (see Annex, figure 6) and GS (see Annex, figure 7) databases identifies five primary research themes emerging from the co-occurrence network of scientific publications:

- **Digital and information literacy:** Investigations into the development and assessment of digital and information literacy skills.
- **Artificial intelligence, data literacy, and communication technologies:** Studies exploring the integration of AI and data literacy into educational contexts and the effective use of communication technologies.
- **Critical literacy and curriculum development:** Research on the development of critical thinking skills and the design of curricula that promote critical engagement with information.
- **Media education and media literacy:** Investigations into the role of media in education and the development of media literacy skills.
- **Health literacy:** Studies examining the relationship between health literacy and health outcomes, as well as the promotion of health literacy through education and communication.

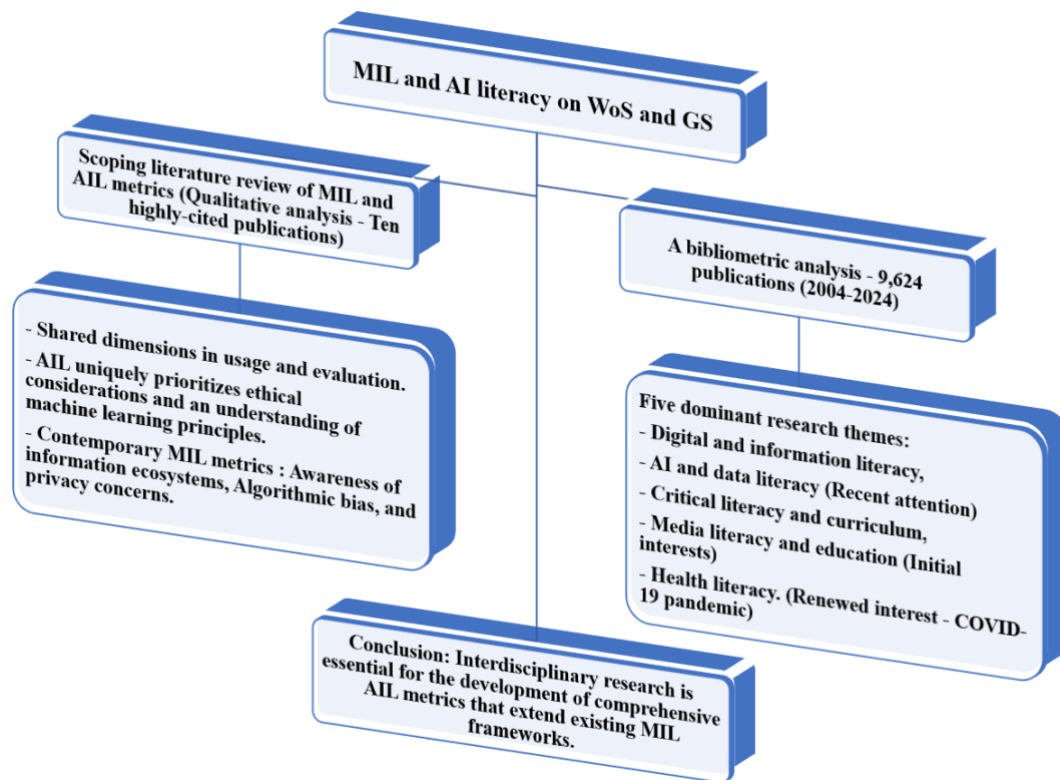
In terms of temporal development, initial interests were directed towards media literacy, media education, and health literacy, followed by digital and information literacy, culminating in more recent attention towards AI literacy. This progression is supported by prior studies, such as Ng et al. (2021), which classified AI literacy as a new field, and Guerola-Navarro et al. (2023) and Yang et al. (2022), which noted early interest in media and health literacy. Notably, the COVID-19 pandemic re-emphasized digital health literacy as a significant research avenue during and after the crisis (Wu et al., 2024).

The terms metric and measure have some overlap. While related, ‘measure’ typically refers to concrete, objective attributes, whereas ‘metric’ often describes more abstract or subjective qualities (Black, 2008). Therefore, ‘metrics’ is may deemed the more suitable terminology for the context of this study.

The thematic analysis of ten studies concerning metrics revealed commonalities between MIL metrics and those for AI literacy, particularly regarding dimensions related to usage, comprehension, analysis, and evaluation. However, AI literacy metrics uniquely

emphasize ethical considerations amid rising concerns over the misuse of AI technologies. Additionally, these metrics introduce new dimensions related to understanding fundamental concepts in machine learning and deep learning, while contemporary MIL metrics strive to incorporate new aspects pertaining to information awareness, algorithmic consciousness, privacy, and programming—dimensions previously absent from the early metrics of media literacy.

Figure 5. The structure of the study, methodological stages and the principal results



Source: Own elaboration

This flowchart (figure 5) summarizes the research procedures undertaken within the two analytical frameworks, highlighting the significant outcomes and salient recommendations of the study.

7. Limitations and implications

This study employed a bibliometric and thematic analysis of 9,624 publications primarily extracted from the Web of Science database. The interpretations of the results must be qualified by the inherent limitations of the methodology and the specific search filters utilized. While Web of Science provides a curated and selective collection of scholarly journals adhering to rigorous standards, a more comprehensive understanding of the global landscape of this field's literature, particularly concerning non-English publications, would benefit from the implementation of broader analytical methodologies.

Based on the insights gained from this investigation, several recommendations are proffered. Firstly, the nascent field of AI literacy, considered a specialized subset of media and digital literacy, requires further scholarly investigation. Specifically, emphasis should be placed on the development of valid and reliable metrics, the precise articulation of key

dimensions, and the identification of effective pedagogical strategies for fostering AI literacy across individual and societal levels. Such endeavors are crucial for ensuring the substantive contribution of AI literacy to sustainable development goals and the maintenance of societal equilibrium. Secondly, there is a compelling need to intensify research efforts within this domain to align with the accelerated pace of technological advancement, notably through interdisciplinary collaborations among scholars specializing in education, media and communication, computer science, psychology, and sociology. Thirdly, leveraging the identified research trends elucidated by this bibliometric analysis, researchers are encouraged to pursue novel research trajectories that promote interdisciplinary and multidisciplinary collaboration. Finally, the development of a comprehensive scientific metric for AI literacy is recommended, drawing upon established frameworks within media, information, and digital literacy. This metric should adopt a multi-tiered approach, acknowledging varying levels of literacy, from fundamental comprehension for non-specialists to advanced and expert-level proficiency, and thus necessitate the creation of composite metrics capable of assessing these diverse levels of AI literacy.

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Annex

Tables 1,2,3,4,5 and figures 6,7 and 8 are available in the Zenodo data repository with the following doi:

Table 1 is available in the Zenodo data repository with the following doi:

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