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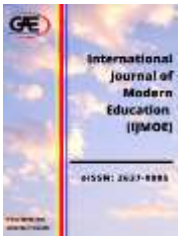

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GLOBAL RESEARCH TRENDS IN DIGITAL LITERACY AND EDUCATION

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Abstract:

The growing integration of technology in education has intensified the global discourse on digital literacy, positioning it as a core competency for learners and educators in the 21st century. Despite its importance, research trends on digital literacy within educational contexts remain fragmented, calling for a comprehensive bibliometric analysis to map its evolution, key contributors, and emerging themes. This study aims

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to examine global research patterns, collaboration networks, and thematic developments in digital literacy and education. Data were retrieved from the Scopus database using the keywords "digital literacy," "education," "teach," and "learn," yielding a total of 894 publications. The data were cleaned and harmonized using OpenRefine to ensure consistency in author names, keywords, and affiliations. Statistical and graphical analyses were conducted using the Scopus Analyzer to identify publication growth, prolific authors, institutions, and countries, while VOSviewer software was employed to visualize keyword co-occurrence, co-authorship, and citation networks. The findings reveal a consistent growth of research since 2015, with significant contributions from countries such as Indonesia, the United States, China, and the United Kingdom. The most prominent themes identified include digital literacy competence, e-learning, teacher training, and higher education transformation, indicating a strong focus should succinctly summarize the purpose of the paper, the methods used, the major results, and conclusions. on pedagogical innovation and equitable access to digital skills. Furthermore, network visualizations highlight increasing international collaboration and thematic diversification, particularly in the context of post-pandemic digital education. Overall, this study provides a holistic overview of the intellectual structure and knowledge dynamics of digital literacy in education, offering valuable insights for policymakers, educators, and researchers to strengthen digital education frameworks and guide future research directions.

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Keyword:

Digital Literacy, Research, Education, Writing

Introduction

Digital literacy has emerged as a critical competency in the 21st century, driven by the rapid integration of digital technologies into various aspects of life, including education. The concept of digital literacy encompasses a broad range of skills, knowledge, and attitudes necessary to effectively navigate, evaluate, and create information using digital technologies. As educational institutions increasingly adopt digital tools and platforms, the importance of digital literacy in fostering effective teaching and learning practices has become more pronounced. This paper aims to explore the research trends in digital literacy and education, providing a comprehensive overview of the current state of the field and identifying key areas for future research.

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Literature Review

Research on digital literacy has gained significant momentum over the past two decades, with scholars and practitioners from diverse fields contributing to the discourse. A bibliometric analysis of digital literacy research from 2012 to 2021 reveals that the most frequently explored themes include the integration of digital technology in education, the effectiveness of digital literacy practices, and the impact of the COVID-19 pandemic on digital literacy (Wang & He, 2022). The pandemic, in particular, has accelerated the adoption of digital tools in education, highlighting the need for effective digital literacy skills among both students and educators (Tan, 2024).

Digital literacy is a multidisciplinary field that intersects with various domains such as information and communication technology (ICT), media literacy, and information literacy. A scientometric study analyzing research trends from 2000 to the present identified key clusters of research, including ICT literacy, media literacy, and information literacy, with a focus on the application of digital literacy in different educational contexts. The study also emphasized the importance of customized digital literacy curriculums and the need for international collaboration to address the diverse digital literacy environments across different cultures (Park et al., 2021).

The integration of digital literacy into higher education has been a focal point of research, with studies examining the attitudes of students and professors towards digital literacy and its impact on academic success and professional development (Milković et al., 2025). The findings indicate that while there is a general awareness of the importance of digital literacy, there are significant differences in the level of engagement and trust in digital tools among different groups. For instance, students at lower levels of education tend to have greater trust in technology, whereas professors face challenges in integrating digital tools into their teaching practices (Milković et al., 2025). This highlights the need for targeted training and support to enhance digital literacy skills among educators.

In addition to higher education, digital literacy research has also focused on the development of digital competencies among preservice teachers. A study conducted in Indonesian universities found a positive correlation between improved digital literacy skills and inclusive education practices (Rofiah et al., 2024). The research emphasized the importance of hands-on digital literacy experiences in teacher education and the need for curriculum reforms to ensure that preservice teachers are equipped with the necessary digital competencies to address the diverse needs of their students (Rofiah et al., 2024). This underscores the critical role of digital literacy in promoting inclusive education and preparing future educators for the challenges of a digitized society.

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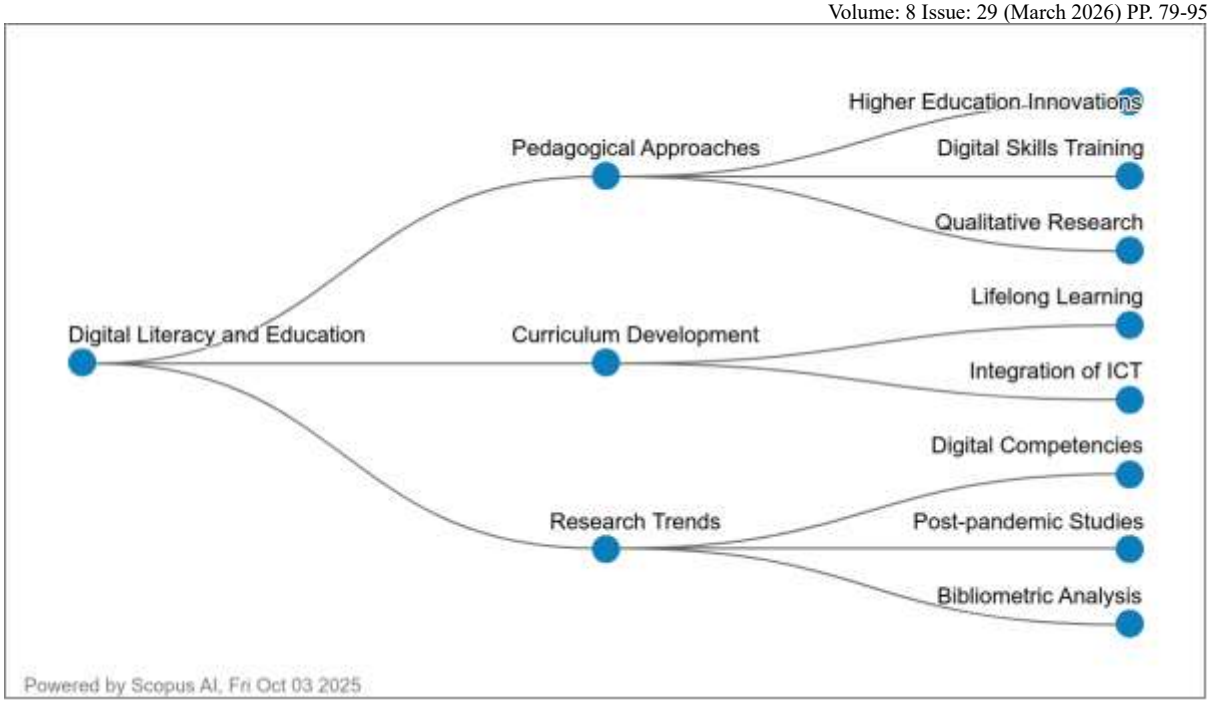

Figure 1: Thematic Branches for Research Landscape in Digital Literacy and Education

Figure 1 illustrates the evolving research landscape in Digital Literacy and Education, highlighting three major thematic branches: Pedagogical Approaches, Curriculum Development, and Research Trends. The pedagogical dimension emphasizes innovative practices in higher education, digital skills training, and the increasing use of qualitative research to explore learning experiences. Meanwhile, curriculum development focuses on promoting lifelong learning and integrating ICT to strengthen digital competencies across disciplines. The research trends segment reveals a growing emphasis on post-pandemic studies and bibliometric analyses, underscoring shifts in educational priorities and methodological approaches after COVID-19. Collectively, these themes reflect a global movement toward redefining educational frameworks, teaching methods, and research practices to align with the demands of the digital age. This conceptual map provides an integrated perspective on how digital literacy interconnects pedagogy, curriculum, and research, signaling the need for continuous adaptation and innovation in education systems.

Overall, the literature on digital literacy and education highlights the evolving nature of the field and the need for continuous research to address emerging challenges and opportunities. The integration of digital literacy into educational practices requires a multifaceted approach that considers the diverse needs of learners and educators, the rapid advancements in digital technologies, and the socio-cultural contexts in which these technologies are used. Future research should focus on developing comprehensive frameworks for digital literacy, exploring the impact of digital literacy on different educational outcomes, and identifying effective strategies for fostering digital literacy skills across various educational settings.

Research Question

The research question, together with the purpose, expected outcomes, and target audience, guides how data are found, collected, and presented. In this paper, the aim to answer several key questions:

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RQ1: What are the publication trends in digital literacy and education research from 2015 to 2025?
RQ2: Which are the top 10 most-cited articles contributing to the field of digital literacy and education?
RQ3: Which are the top 10 countries based on the number of publications in this research domain?
RQ4: What are the most frequently occurring author keywords associated with digital literacy and education?
RQ5: What are the patterns of international collaboration based on co-authorship among countries?

Methodology

The research Bibliometrics encompasses the systematic collection, organization, and analysis of bibliographic data derived from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). Beyond descriptive metrics such as identifying prolific journals, publication years, and leading authors (Wu & Wu, 2017), bibliometric studies employ advanced analytical methods, including document co-citation and network mapping, to uncover intellectual structures within a research domain. Conducting a rigorous literature review through bibliometric techniques entails an iterative process of selecting precise keywords, retrieving relevant publications, and performing comprehensive analytical validation. This method ensures the development of a robust bibliography and the generation of credible, evidence-based insights (Fahimnia et al., 2015). Guided by this approach, the present study concentrated on high-impact publications, recognizing their pivotal role in shaping theoretical and conceptual foundations within the field. SCOPUS was selected as the principal database due to its extensive coverage and high data reliability collection (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). To uphold academic rigor, only peer-reviewed journal articles were included, while books, conference papers, and lecture notes were excluded (Gu et al., 2019). Data spanning from 2015 to 2025 were retrieved from Elsevier's Scopus for further analytical exploration and mapping of research trends.

Data Search Strategy

Study employed a screening sequence to determine the search terms for article retrieval. Study was initiated by querying Scopus database with online TITLE ("digital literacy" education OR teach* OR learn*) AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "bk")), thereby assembling 894 articles. Afterwards, the query string was revised so that the search terms "digital literacy" OR "education" should be focused on students as learners. This process yielded 781 results which were additionally scrutinized to include only research articles in English and articles reviews were also excluded. The final search string refinement included 894 articles which was used for bibliometric analysis. As of October 2025, all articles from Scopus database relating to digital literacy, education, teaching and learning, were incorporated in the study.

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Table 1: The Search String

Database	Search String
Scopus	TITLE ("digital literacy" education OR teach* OR learn*) AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "bk"))

Table 2: The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	2015 – 2025	< 2015
Literature type	Journal (Article) Conference, Book, Book Chapter Review	Letter Erratum Note Editorial
Publication Stage	Final In Press	None

To ensure comprehensive and strategic data collection, this study employed the Scopus Advanced Search function, utilizing a structured search string as in Table 1 TITLE ("digital literac*" education OR teach* OR learn*) AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "bk")). The search was conducted in October 2025, targeting studies published between 2015 and 2025 to capture a decade of recent and relevant scholarship. The search string was designed to identify works that explicitly focus on digital literacy within educational contexts, encompassing teaching and learning dimensions. To enhance reliability and relevance, a rigorous screening process was applied based on inclusion and exclusion criteria as in Table 2. Only publications written in English were included to maintain consistency in linguistic interpretation, while non-English sources were excluded. The inclusion criteria prioritized peer-reviewed journal articles, ensuring academic credibility, whereas conference papers, books, book chapters, and review articles were excluded to avoid redundancy and overlap in conceptual discussions. The study also focused on five major subject areas—Social Sciences, Computer Science, Arts and Humanities, Engineering, and Psychology—reflecting the interdisciplinary nature of digital literacy research. This approach enabled the identification of studies addressing both pedagogical and technological perspectives. Following the application of these filters, a total of 894 publications were finalized for bibliometric analysis. The dataset represents a balanced and high-quality corpus that captures emerging patterns,

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evolving research priorities, and thematic intersections within the field of digital literacy and education.

Data Analysis

VOSviewer is a user-friendly bibliometric software developed by Nees Jan van Eck and Ludo Waltman at Leiden University, Netherlands (van Eck & Waltman, 2010, 2017). Widely utilized for visualizing and analyzing scientific literature, the tool specializes in creating intuitive network visualizations, clustering related items, and generating density maps. Its versatility allows for the examination of co-authorship, co-citation, and keyword co-occurrence networks, providing researchers with a comprehensive understanding of research landscapes. The interactive interface, coupled with continuous updates, ensures efficient and dynamic exploration of large datasets. VOSviewer's ability to compute metrics, customize visualizations, and its compatibility with various bibliometric data sources make it a valuable resource for scholars seeking insights into complex research domains.

One of the standout features of VOSviewer is its capacity to transform intricate bibliometric datasets into visually interpretable maps and charts. With a focus on network visualization, the software excels in clustering related items, analyzing keyword co-occurrence patterns, and generating density maps. Researchers benefit from its user-friendly interface, enabling both novice and experienced users to explore research landscapes efficiently. VOSviewer's continuous development ensures it remains at the forefront of bibliometric analysis, offering valuable insights through metrics computation and customizable visualizations. Its adaptability to different types of bibliometric data, such as co-authorship and citation networks, positions VOSviewer as a versatile and indispensable tool for scholars seeking deeper understanding and meaningful insights within their research domains.

Datasets comprising information on the publication year, title, author name, journal, citation, and keywords in PlainText format were procured from the Scopus database, spanning the period from 2005 to October 2025. These datasets were then analyzed using VOSviewer software version 1.6.20. Through the application of VOS clustering and mapping techniques, this software facilitated the examination and generation of maps. Offering an alternative to the Multidimensional Scaling (MDS) approach, VOSViewer focuses on situating items within low-dimensional spaces, ensuring that the proximity between any two items accurately reflects their relatedness and similarity (van Eck & Waltman, 2010). In this respect, VOSViewer shares a similarity with the MDS approach (Appio et al., 2014). Diverging from MDS, which primarily engages in the computation of similarity metrics like cosine and Jaccard indices, VOS utilizes a more fitting method for normalizing co-occurrence frequencies such as, the associatio strength (ASij) and it is calculated as (Van Eck & Waltman, 2007)

$$AS_{ij} = \frac{C_{ij}}{w_i w_j}$$

which is “proportional to the ratio between on the one hand the observed number of cooccurrences of i and j and on the other hand the expected number of co-occurrences of i and j under the assumption that co-occurrences of i and j are statistically independent” (Van Eck & Waltman, 2007).

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Finding and Discussions

This section presents and discusses the main findings of the bibliometric analysis conducted on the relationship between digital literacy and education. The results are organized according to the research questions outlined earlier, focusing on publication trends, citation performance, country contributions, keyword co-occurrences, and patterns of international collaboration. Each subsection interprets the statistical outputs and visual maps generated by Scopus Analyzer and VOSviewer, supported by descriptive analysis to highlight important developments and patterns within the field.

What Is the Trend in Digital Literacy and Education According to The Year of Publication?

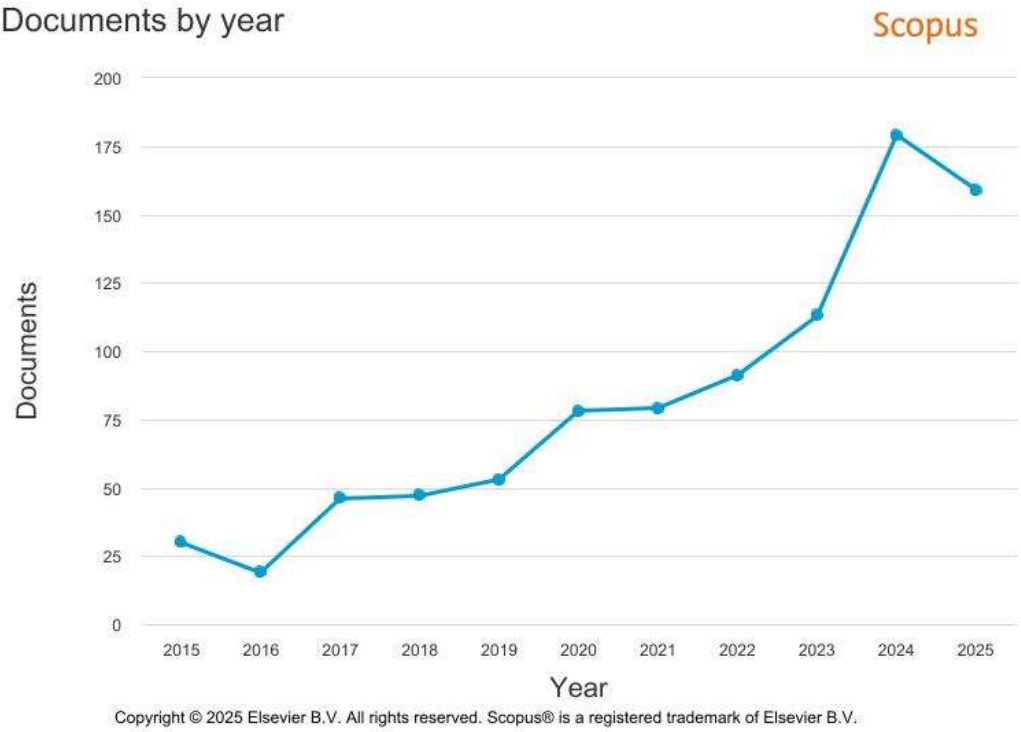

Figure 2: Publication Trends on Digital Literacy and Education

The publication trend from 2015 to 2025 reveals a steady and progressive growth in research output related to Digital Literacy and Education, particularly after 2019. From a modest count of 30 publications in 2015, the field witnessed gradual increases, reaching 53 in 2019 and accelerating thereafter. Figure 2 shows a significant surge is evident between 2020 and 2025, with publications rising sharply from 78 in 2020 to a peak of 179 in 2024, before slightly tapering to 159 in 2025. This upward trajectory underscores a growing scholarly and institutional interest in understanding digital literacy as an essential component of educational transformation. The increasing adoption of digital technologies in pedagogy, curriculum innovation, and assessment practices has likely contributed to this research expansion. Additionally, the global pivot toward online and blended learning environments, especially following the COVID-19 pandemic, heightened the urgency for studies addressing digital competencies among educators and learners.

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The post-2020 surge can be attributed to three interrelated factors. First, the pandemic acted as a catalyst for digital adoption, compelling educational institutions to re-examine digital literacy as a core competency rather than a supplementary skill. Second, funding bodies and governments began prioritizing digital education policies and sustainable development goals (SDGs), stimulating cross-disciplinary collaborations. Third, the increased accessibility of digital research tool such as Scopus, VOSviewer, and AI-assisted platforms—empowered scholars to conduct more comprehensive analyses and literature reviews. The slight dip in 2025 may reflect a stabilization phase as the field matures, with researchers shifting focus from rapid response studies to more theoretical, longitudinal, and evidence-based investigations. Overall, the pattern indicates that digital literacy in education has evolved into a dynamic and enduring research domain, responding directly to global educational and technological shifts.

What Are the Most Cited Articles?

Table 3 shows the citation trend among the top 10 most-cited articles demonstrates the central role of digital competence and literacy in shaping educational transformation, particularly in the context of online and technology-enhanced learning.

Table 3: Most Cited Articles on Digital Literacy and Education

Authors	Title	Year	Source title	Cited by
Falloon (2020)	From digital literacy to digital competence: the teacher digital competency (TDC) framework	2020	Educational Technology Research and Development	635
Spante et al., (2018)	Digital competence and digital literacy in higher education research: Systematic review of concept use	2018	Cogent Education	437
Prior et al., (2016)	Attitude, digital literacy and self efficacy: Flow-on effects for online learning behavior	2016	Internet and Higher Education	352
Mohammadyari and Singh (2015)	Understanding the effect of e-learning on individual performance: The role of digital literacy	2015	Computers and Education	325
Blau et al. (2020)	How does the pedagogical design of a technology-enhanced collaborative academic course promote digital literacies, self-regulation, and perceived learning of students?	2020	Internet and Higher Education	201
Sánchez-Cruzado et al.(2021)	Teacher digital literacy: The indisputable challenge after covid-19	2021	Sustainability (Switzerland)	180
Tejedor et al. (2020)	Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador	2020	Publications	180
Anthonysamy et al., (2020)	Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning	2020	Education and Information Technologies	180

Tang and Chaw (2016)	Digital literacy: A prerequisite for effective learning in a blended learning environment?	2016	Electronic Journal of e-Learning	168
Li and Yu (2022)	Teachers' Satisfaction, Role, and Digital Literacy during the COVID-19 Pandemic	2022	Sustainability (Switzerland)	160

The most influential article by Falloon (2020), with 635 citations, underscores the criticality of teacher digital competency (TDC) frameworks in enabling effective pedagogical integration of technology. Similarly, Spante et al. (2018) and Prior et al. (2016) received 437 and 352 citations, respectively, reflecting a strong scholarly interest in conceptual clarity and the psychological dimensions of digital literacy, such as attitudes and self-efficacy. Foundational works published before the pandemic, like Mohammadyari and Singh (2015), also continue to shape discourse by linking digital literacy with performance outcomes, indicating sustained relevance over time. Collectively, these highly cited studies represent seminal contributions that provide theoretical grounding, methodological rigor, and policy implications for digital education research.

The prominence of COVID-19–era publications such as Sánchez-Cruzado et al. (2021), Tejedor et al. (2020), and Li and Yu (2022)—each surpassing 160 citations—highlights how the pandemic accelerated global recognition of digital literacy as an educational imperative. The sharp increase in citations for post-2020 works signals the academic community's urgency to address challenges of remote instruction, teacher readiness, and digital inclusion. Articles appearing in high-impact, open-access journals like Sustainability and Education and Information Technologies also benefited from broader visibility and accessibility. This pattern reflects an evolving research landscape where teacher preparedness, lifelong learning, and sustainable education dominate scholarly discussions. Overall, citation concentration around 2020–2022 publications signify a paradigmatic shift—digital literacy is no longer peripheral but foundational to educational resilience and innovation

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Where Is the Top 10 Country Based on Number Of Publications?

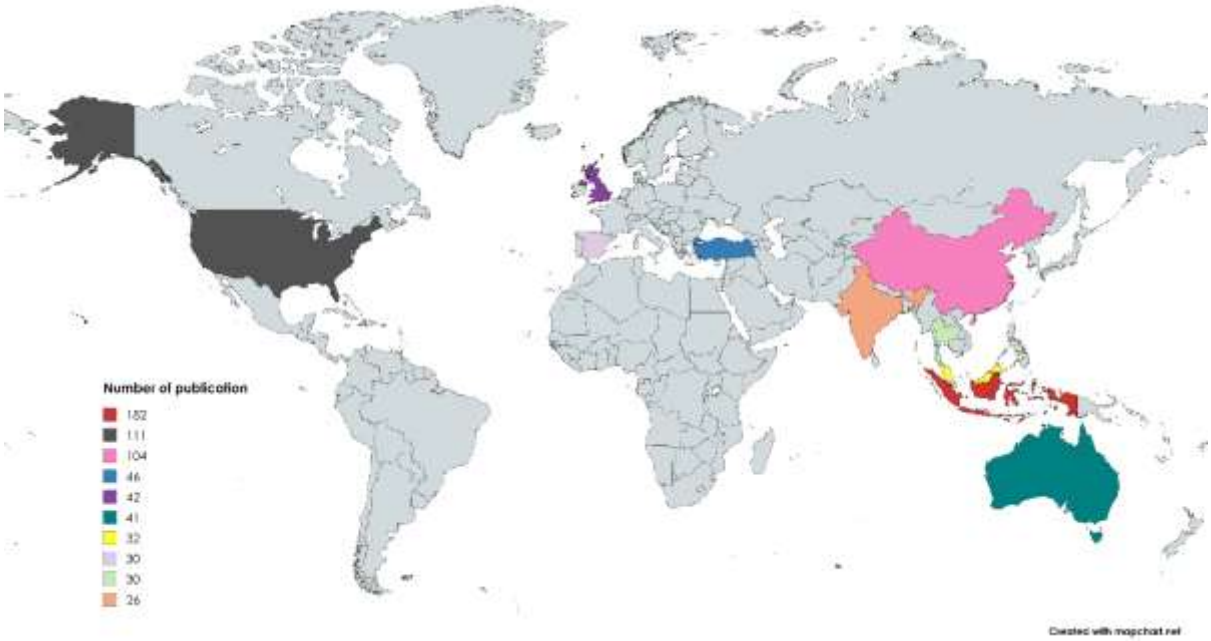

Figure 3. Top 10 Countries by Number of Publications on Research Trends in Digital Literacy and Education (2015–2025) Based on Scopus Data.

The country-wise distribution of publications reveals Indonesia as the leading contributor with 182 documents, significantly surpassing other nations such as the United States (111) and China (104). This dominance suggests Indonesia's growing academic engagement and national emphasis on digital literacy as an educational priority, aligning with its rapid digital transformation and integration of technology in schools and universities. The strong publication output may also reflect Indonesia's active participation in regional and international research collaborations, particularly through Scopus-indexed open-access journals that encourage cross-institutional authorship. Meanwhile, the United States and China's strong presence reflects their established research ecosystems, government support for educational innovation, and high levels of investment in digital learning initiatives. The mid-tier contributors, including Turkey (46), the United Kingdom (42), and Australia (41), represent countries with mature education systems that are increasingly exploring digital literacy in response to evolving pedagogical and technological needs.

Among the Southeast Asian countries, Malaysia (32) and Thailand (30) demonstrate growing interest, signaling a regional shift toward enhancing digital competencies in higher education and national curricula. This aligns with ASEAN's broader vision of promoting digital inclusion and 21st-century learning skills. The comparatively lower figures from Spain (30) and India (26) may be attributed to differing publication practices, language preferences, and indexing disparities, as substantial research from non-English outlets may not appear in Scopus. Overall, the data suggests that developing nations, particularly in Asia, are emerging as key contributors to digital literacy scholarship, driven by urgent educational reforms, digital inclusion policies, and post-pandemic recovery initiatives. In contrast, contributions from developed countries

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highlight ongoing refinement of digital education frameworks and a shift toward evaluating impact, policy integration, and learner outcomes.

What Are the Popular Keywords Related to The Study?

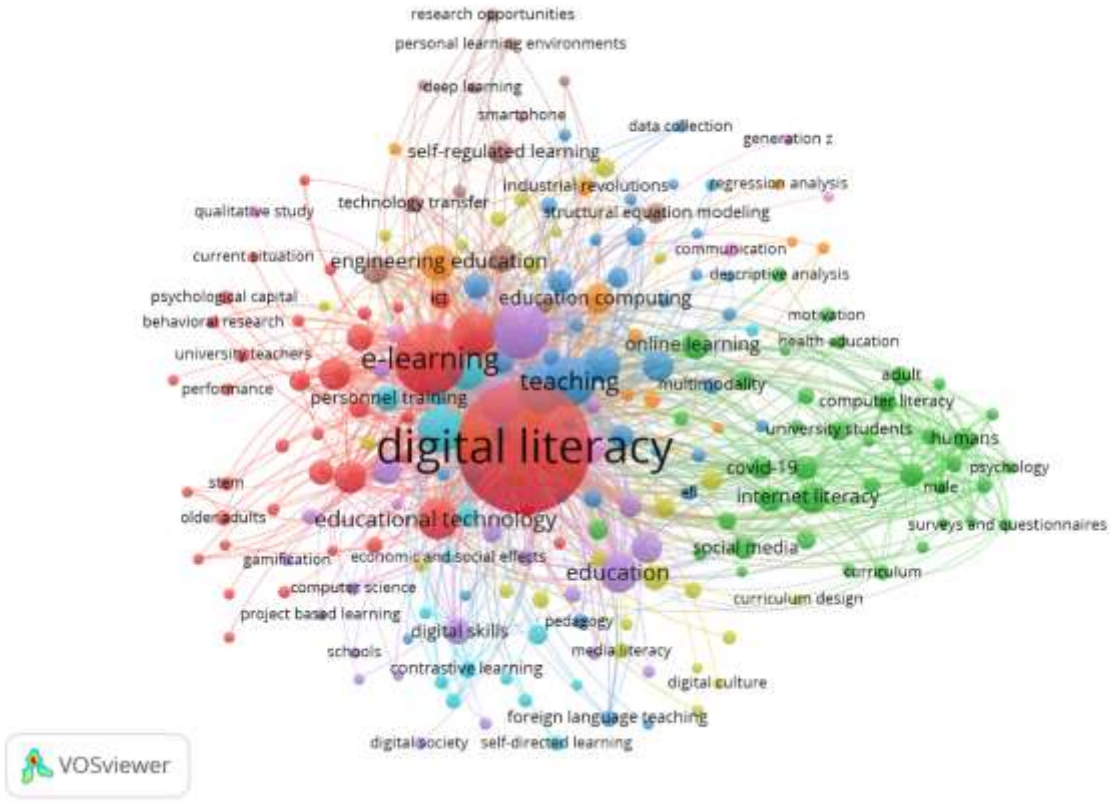

Figure 4: Popular keywords in Digital Literacy and Education (2015–2025) using VOSviewer

The co-occurrence analysis of author keywords in VOSviewer is a bibliometric technique used to explore relationships among keywords that appear together within a set of publications. In this method, each keyword represents a concept, and when two keywords frequently co-occur in the same document, it suggests a conceptual or thematic relationship between them. The network visualization produced by VOSviewer maps these relationships as nodes (keywords) and links (co-occurrences), forming clusters that represent major research themes. Using the full counting method means that each occurrence of a keyword is counted equally across documents, which gives a more balanced representation of frequently discussed topics. By setting a minimum occurrence threshold of 5, only keywords that appear at least five times are included, narrowing the focus to more influential terms. Out of 1831 total keywords, 220 met this threshold. A minimum cluster size of 5 was also applied, resulting in 9 clusters each representing a thematic group such as digital literacy, e-learning, or teaching and learning.

The findings reveal that “digital literacy” dominates the network with 670 occurrences and a total link strength of 2933, indicating it is the central theme connecting to other major topics like e-learning, students, and teaching. This demonstrates a strong global research emphasis on integrating digital competencies in education. The emergence of clusters such as digital technologies, digital competence, and higher education signifies the multidimensional nature

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of digital literacy studies, spanning pedagogical innovation, technological adoption, and digital inclusion. Furthermore, the inclusion of keywords like artificial intelligence, online learning, and covid-19 reflects recent technological and situational influences shaping educational research. Overall, the visualization contributes to the body of knowledge by identifying key thematic structures and knowledge clusters within the digital literacy discourse, offering researchers a roadmap of dominant and emerging research directions in education and technology.

What Is Co-Occurrence, Co-Citation, And Countries' Collaboration?

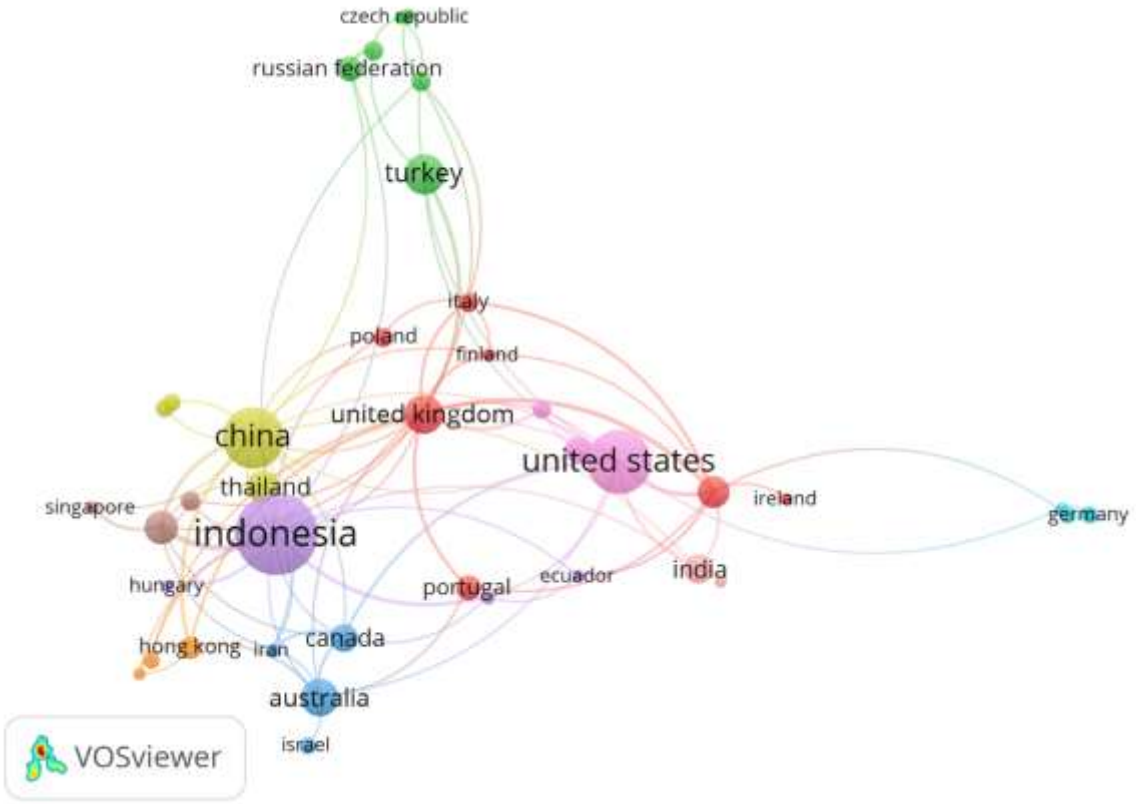

Figure 5: Co-Authorship Network by Countries' Collaboration Digital Literacy and Education (2015–2025) Using Vosviewer

The co-occurrence co-authorship analysis by countries in VOSviewer examines the patterns of international collaboration based on shared authorship across publications. Each country represents a node, and links between nodes show the number of joint publications among researchers from different nations. The larger the node, the higher the number of documents authored by that country, while thicker links represent stronger collaboration intensity. By applying the full counting method, every co-authorship between countries is counted equally, giving balanced visibility to all participating nations. The map was generated using a minimum threshold of 5 documents, meaning only countries that contributed at least five papers were included. Out of 89 countries, 43 met this criterion. With a minimum cluster size of 5, the visualization identified 10 clusters, each representing regional or thematic collaboration

networks. These clusters highlight countries that frequently co-author together, suggesting shared research interests or institutional partnerships.

The results reveal that Indonesia leads with 183 publications and the highest total link strength (1118), showing its central role in international collaboration networks, followed by the United States (1355), Australia (1603), and China (848). Countries such as Malaysia, the United Kingdom, and Spain also show strong co-authorship activity, reflecting their growing engagement in global educational research. The distribution of clusters suggests active collaborations between Asian and Western institutions, promoting cross-regional knowledge exchange. This finding enriches the body of knowledge by illustrating the global research landscape and collaboration dynamics in digital education and literacy studies. It also highlights emerging nations' increasing contributions to scholarly output, particularly in Southeast Asia, which indicates a shift toward more inclusive and diversified research partnerships in the global academic community.

Conclusion

The purpose of this bibliometric study was to explore global research trends in digital literacy within educational contexts, focusing on its evolution, thematic structures, and international collaboration. Through analysis of 894 Scopus-indexed publications from 2015 to 2025, the study sought to identify dominant research themes, influential countries, and emerging directions in the field. The findings revealed a consistent growth in scholarly interest, particularly after 2020, coinciding with the global transition to digital and blended learning environments. Indonesia, the United States, China, and the United Kingdom emerged as leading contributors, highlighting the internationalization of digital literacy research. The most frequently discussed themes include digital competence, e-learning, teacher training, and higher education innovation, reflecting a shared global priority toward equipping educators and learners with essential digital skills for contemporary education. Co-authorship and keyword network analyses further indicated an expanding scope of collaboration and interdisciplinary engagement, especially between Asian and Western institutions.

This study contributes to the broader understanding of digital literacy by offering empirical evidence of its intellectual structure and developmental trajectory. It underscores the field's role in advancing equitable access to digital education and fostering sustainable pedagogical practices. The results have practical implications for policymakers and educators, as they emphasize the need to strengthen digital literacy training, enhance institutional support systems, and promote collaborative research frameworks. Despite providing comprehensive insights, the study is limited to English-language articles indexed in Scopus, potentially overlooking relevant regional publications. Future research could integrate multiple databases or apply longitudinal citation tracking to deepen understanding of conceptual evolution. Overall, this study reaffirms the significance of bibliometric analysis as a systematic approach to map knowledge development and guide future investigations on digital literacy in education, ensuring continued relevance in a rapidly changing digital landscape.

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