A Bibliometric Analysis of Research Trends in Digital Literacy

XUHUI JIAO, JUMING SHEN

Abstract This study aims to conduct a bibliometric analysis of the current status, research themes, and future research directions of digital literacy. Based on 2,218 documents from the Web of Science (WoS), the results indicate that: (1) The phenomenon of multilingualism in DL research has gradually increased since 2007 and entered a rapid growth phase starting in 2011; (2) Journals such as Journal of Adolescent and Adult Literacy, Computer and Science, Education and Information Technologies, Reading Teacher, and Learning Media and Technology are essential for publishing digital literacy research; (3) Merchant,G., Burnett,C., Jiang,L., Mills,Ka,. Smith,B., and Hu,J. are relatively prolific authors whose published articles have significant impact; (4) Most highly cited literature are related with education; (5) Hot topics and keywords include education, technology, strategies, new literacies, adolescence, comprehension, and media literacy; (6) Media literacy, instructional strategies and materials, critical literacy are the most promising research trend.

Keywords: • digital literacy • bibliometric analysis • research trends

ADDRESS: Xuhui Jiao, Academy of Future Education, Xi'an Jiaotong-Liverpool University, Suzhou, China. Juming Shen (corresponding author), Academy of Future Education, Xi'an Jiaotong-Liverpool University, Suzhou, Jiangsu, China, email: jumingshen@126.com.

ISSN 1581-5374 Print/1855-363X Online © 2025 Lex localis
Available online at http://journal.lex-localis.press

1 Introduction

With the development of the internet, the influence of digital media is expanding, affecting all aspects of society. Some scholars even claim that it guides the operation of various power relationships globally in the socio-cultural and political-economic fields (Shui, 2009). In this context, countries around the world are increasingly focusing on people's ability to use digital tools, and the concept of "digital literacy" has become a basic requirement for life in the digital age (Bawden, 2008). The concept of "digital literacy" was first introduced in 1997 in Paul Gilster's book Digital Literacy, which described it as the ability to understand and use various digital resources and information displayed through computers. Over time, the meaning of digital literacy has gradually expanded and extended. It is now defined as " the skills required to achieve digital competence, the confident and critical use of information and communication technology for work, leisure and communication" (European Commission, 2021).

As time progresses, digital literacy is increasingly becoming a global hot topic. From the perspective of individuals in society, digital literacy to some extent determines whether an individual can stand firm in today's information society, which relies heavily on digital resources (Xu & Shang, 2017). At the national level, improving citizens' digital literacy can enhance talent competitiveness, reduce the digital divide, promote high-quality economic development, and increase national competitiveness and innovation capacity (van Laar et al., 2017). Furthermore, digital skills are also seen as having the potential to create and manage disruptive digital businesses in Industry 4.0 (Sousa & Rocha, 2019). Various international institutions, organizations, government departments, and researchers from different countries have tried to analyze and measure digital literacy. Research on digital literacy has been ongoing for about 60 years. Many scholars have achieved fruitful results. However, due to the multidisciplinary and multi-field nature of digital literacy research, single case studies and empirical research methods can no longer comprehensively understand the impact of digital literacy. Therefore, this research combines bibliometric analysis and descriptive analysis to comprehensively summarize and review research on field of digital literacy. It provides a systematic review and visual mapping, outlining an overall development framework for scholars in the field of digital literacy. This research also quantitatively demonstrates the development trajectory, global research trends, and emerging themes in this field. The method used is bibliometric analysis based on the Web of Science database.

Bibliometrics is a useful technique in the field of information and library science for quantitatively analyzing bibliographic data (Mas-Tur et al., 2020). It can provide a comprehensive overview of significant developments in a particular research field, journal, or country (Hood & Wilson, 2001). It also identifies authors who are particularly active in the field for potential future collaboration (Baber et al., 2022). This paper combines bibliometric data and descriptive analysis to conduct an in-depth analysis of digital literacy research outcomes,

exploring its evolution and future research trends. The purpose of this paper is to investigate research trends through bibliometrics by answer following research questions:

(1) What are the growth trends of related journal articles? This question helps researchers discuss the current status and trends of digital literacy development.
(2) Which documents, authors, journals, countries, or regions are the most influential in terms of the total number of journal articles and citations? This question helps researchers select appropriate journals to publish and study digital literacy and also helps them identify global researchers and potential collaborators.
(3) What are the most frequently discussed topics and themes? This question helps researchers explore popular research areas and gaps in digital literacy research.
(4) What are the emerging and potential trends in this field? This question helps researchers investigate the latest developments and potential research topics in the field of digital literacy in recent times.

2 Methodology

2.1 Data collection

To comprehensively cover global digital literacy research, the Web of Science (WoS) database was used to collect extensive professional and scientific literature (Boyack et al., 2005). To set up the research dataset, this research first evaluated the research questions. Keywords were determined based on the research questions and past relevant studies, allowing keyword analysis to consider qualitative and more restrictive criteria (Doiz et al., 2011; Wu & Tsai, 2022). Therefore, this study used "digital literacy" OR "Information literacy" OR "Media literacy" OR "Technology literacy" OR "Digital competence" OR "ICT skills" OR "ICT competence" OR "ICT literacy" as keywords. These keywords were derived from the study by Martínez-Bravo et al. (2020), which covered meta-research on digital literacy from 1968 to 2017.

The Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI) were selected as platforms to identify high-quality scientific articles. All literature published from January 2005 to May 2024 was included, refined, and selected. Furthermore, this study focused on all sources within the database, including peer-reviewed articles, conferences, and book chapters, as sources of knowledge. Finally, this study only considered English-language publications to increase comprehensibility. Moreover, data organization and cleaning were crucial since these databases are not specifically designed for bibliometric analysis (Donthu et al., 2021). Duplicate and erroneous entries were removed to avoid misrepresentation of the research field. After applying these restrictive research criteria, this study selected 2,218 articles for further bibliometric analysis. Figure 1 shows the entire methodological process followed in this research.

Figure 1: Data collection design

• **Step 1: Establish the research question.**	What are the research trends of digital literacy?
• **Step 2: Database selection**	Web of Science
• **Step 3: Research criteria adjustment**	Keywords: 'digital literacy.' From 2005 to May 2023 Articles and proceeding paper Only English
• **Step 4: Tool of analysis**	Bibliometric- R package
• **Step 5: Examination of information**	Analysis and discussion of results

2.1 Data analysis

Bibliometric analysis is a quantitative method that applies mathematical and statistical techniques to a specific discipline or research field (Pritchard, 1969), used to review and investigate the development of existing literature (Abramo et al., 2011). It can present detailed information about authors, keywords, journals, countries, institutions, and references, enabling researchers to gain an overview of a research topic in a short period (Hood & Wilson, 2001). With the aid of modern technology, knowledge maps can be drawn to clearly display the results of documents analysis through graphs and visual effects. Visualized co-citation analysis helps authors interpret data, making the results more comprehensive and assisting in uncovering deeper information and the intrinsic connections between information (Ma & Xi, 1992). This also makes it easier for readers to understand the analysis content.

The bibliometric methods adopted in this research investigate the growth trends, research productivity, and knowledge structure of digital literacy research through frequency counts, citation analysis, co-citation analysis, bibliographic coupling, and keyword co-occurrence analysis. The dataset retrieved from WoS was exported to visualize the temporal changes, dynamic progress, and knowledge structure of xxx digital literacy journal articles. The total number of papers (TP), the average total citations per paper (TC/TP), and centrality scores (degree, betweenness centrality, closeness centrality) were used as indicators to describe the results of this study.

3 Results

3.1 The growth trend of journal articles

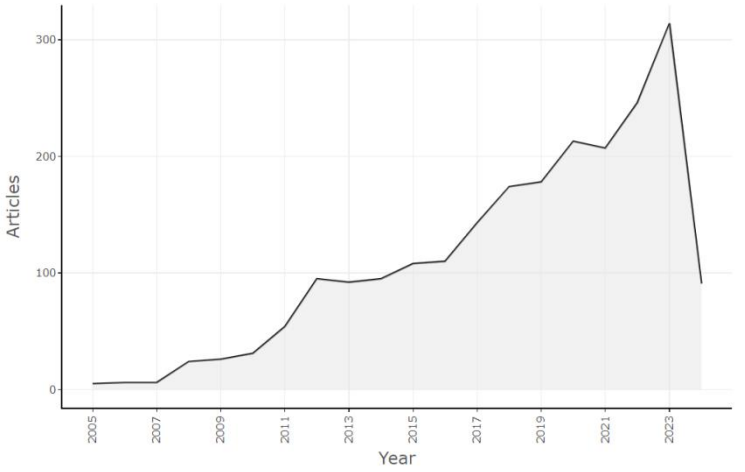
Table 1 provides a description of the documents related to digital literacy from 2005 to May 2024. This study ultimately identified 2,218 documents, with an annual growth rate of 17.24%. The authors' keywords totaled 5,175, involving 4,224 authors. Of the 2,218 documents, only 616 were single-author documents. The number of co-authors per document was as high as 2.5, indicating that collaboration with others is more efficient for conducting research on digital literacy.

Table 1: Main Information on multilingualism in digital literacy research

Main information about data	
Timespan	2005:2024
Sources (Journals, Books, etc)	292
Documents	2218
Annual Growth Rate %	16.5
Document Average Age	5.58
Average citations per doc	17.24
References	76067
Document contents	
Keywords Plus (ID)	1863
Author's Keywords (DE)	5175
AUTHORS	
Authors	4224
Authors of single-authored docs	501
Authors collaboration	
Single-authored docs	616
Co-Authors per Doc	2.5
International co-authorships %	16.37
Document types	
article	2053
article; book chapter	3
article; early access	153
article; proceedings paper	7
article; retracted publication	2

The annual publication trend helps to understand the progress, literature accumulation, and research level in the field. Figure 2 shows the annual distribution of research on digital literacy from 2005 to May 2024. As seen in Figure 2, there is an overall upward trend, reflecting the increasing attention of scholars worldwide on digital literacy, with the number of publications now exceeding 300 per year. Figure 1 highlights three significant peaks in 2012, 2020, and 2023. From 2005 to 2007, scholarly attention to digital literacy was relatively low, with only 32 articles published each year. Starting in 2007, international scholars' focus on digital literacy significantly increased, reaching nearly 100 articles published in 2012. For the next four years, the research on digital literacy developed relatively slowly. Since 2016, the number of published articles has shown rapid growth, especially after 2019, with two notable peaks in 2020 and 2023.

Figure 2: Annual scientific production



This paper posits that there are three main reasons leading to the above development trends. Firstly, the development of the global knowledge society and the rapid integration of information and communication technology have made digital skills essential for obtaining employment and participating in society (van Laar et al., 2017). Secondly, the outbreak of the COVID-19 pandemic at the end of 2019 impacted workplaces and learning environments, bringing a series of issues. For instance, remote work led to communication disconnects due to the lack of physical space (Lloyd & Hicks, 2023); emotional issues arose from working from home (Lloyd & Hicks, 2023); and the educational divide was exacerbated in online classrooms due to varying education levels, domestic and international backgrounds, and different conditions for teachers and students participating in online learning (Sofie Otto et al., 2024). These issues have prompted global reflection on digitalization, especially regarding the role of digital technology in facilitating or limiting the information literacy practices necessary for work operations. Consequently, from 2020, scholarly research on digital literacy has seen a sharp increase worldwide.

3.2 The most relevant source, authors, countries and journal articles

Table 2 lists the top 10 authoritative international journals that publish the most on digital literacy. These 10 journals all support open-access publishing, indicating that the promotion of open access in recent years has, to some extent, facilitated the development of research in this field. Although there is still debate about the best approach to open access, the idea of open access has gained widespread recognition. Among them, the Journal of Adolescent and Adult Literacy has the highest total number of publications, with 194 articles mainly in the category of

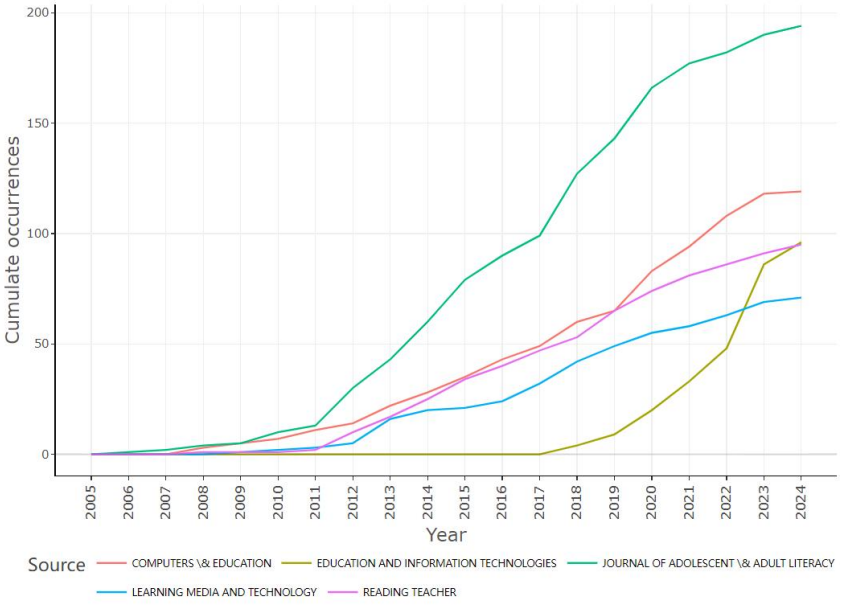
education & educational research. This indicates that many researchers believe digital literacy should be connected with education. Analyzing the citation situation of journals, it was found that among the journals in Figure 3, Journal of Adolescent and Adult Literacy is the most cited journal. This indicates that the journal is of high quality and has significant influence in the field of digital literacy.

Figure 3: Most relevant sources of digital literacy

Journal	Zone	Number of Articles
Journal of Adolescent and Adult Literacy	1	194
Computers and Education	1	119
Education and Information Technologies	1	96
Reading Teacher	1	95
Learning Media and Technology	1	71
Literacy	1	59
Comunicar	1	52
British Journal of Educational Technology	1	50
Reading Research Quarterly	2	45
English Teaching-Practice and Critique	2	44

Additionally, Figure 4 shows that the Journal of Adolescent and Adult Literacy has consistently been the most influential journal, leading in the number of publications each year. Notably, Education and Information Technologies has gradually become a more popular journal in this field in recent years. Although it started publishing related articles since 2007, its annual growth rate has been rapid. Before 2023, it consistently ranked fifth, but in 2023, it surpassed the fourth rank and came very close to the third-ranked Reading Teacher. This year, it has already surpassed Reading Teacher. Therefore, this paper considers this journal to be promising.

Figure 4: Source Dynamics



Analyzing authors helps to identify the most representative scholars in the field, recognize their research influences, and understand their central position (Hirsch, 2005). Table 2 shows the top 10 authors by the number of related articles published. Introducing the representative authors' article content and analyzing them helps to understand the research situation in the field. The most prolific author is Guy Merchant (14 articles, 452 citations), who dominates the publications. Analyzing his papers, it is evident that he focuses on digital literacy in education, emphasizing the integration of digital literacy into educational environments using digital technology, digital tools, social media, multimodal methods, etc. (Merchant, 2009; Merchant, 2012). He also advocates for critical digital literacy and addresses issues like the digital divide. His research subjects mainly include children, adolescents, and teachers. His work provides significant practical implications and suggestions for curriculum design, teacher education, and policy formulation (Merchant, 2009; Merchant, 2012).

Table 2: Most relevant authors' information

Rank	**Authors**	**NP (Number of publications)**
1	Merchant G	14
2	Burnett C	13

Rank	Authors	NP (Number of publications)
3	Jiang L	12
4	Mills KA	12
5	Smith BE	12
6	Hu]	11
7	Hutchison A	11
8	Kucirkova N	11
9	Rowsell]	11
10	Stornaiuolo A	11

Analyzing countries could assess the effectiveness of their research programs and projects in specific fields, thereby identifying high-impact research teams and contributions. This study analyzed the citation counts of articles from 16 countries and listed the top 10 countries (Table 3). It can be seen that the United States has the highest research quality in the field of digital literacy, with a total of 12,611 citations, far surpassing other countries. Following are Australia, China, the United Kingdom, and Spain.

Table 3: Most relevant countries' information

Rank	Countries	NP (Number of publications)	TC (Total citations)	Average TC/NP
1	USA		12611	
2	Australia		4023	
3	China		3857	
4	UK		3827	
5	Spain		2438	
6	Canada		1759	
7	Norway		1738	
8	Israel		717	
9	Netherlands		687	
10	Sweden		665	

Citation analysis of articles helps readers identify key research and leading scholars in the specific field, understand research hotspots and trends, and guide

future research directions. Table 3 analyzes the Top 10 cited references during the period from 2005 to May 2024. The analysis revealed that, despite these 10 references exploring different aspects of digital literacy, including critical thinking, social media literacy, and ICT technologies, they all discuss how to cultivate students' digital literacy through various educational methods and strategies. Most of the references focus on the application of digital technologies in education and their impact on learning models, which is of significant importance to modern educational strategies (Figure 5).

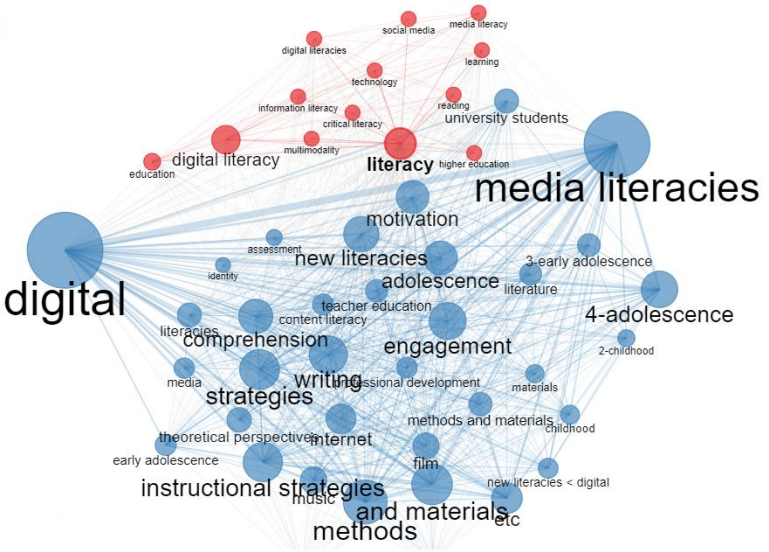
Figure 5: Most global cited documents

Paper	Data	Title	DOI	Total Citations	TC per Year	Normalized TC	Sources	Affiliations
Ng, W	2012	Can we teach digital natives digital literacy?	10.1016/j.compedu.2012.04.016	388	29.85	10.39	Computer and Education	
Livingstone S	2012	Critical reflections on the benefits of ICT in education	10.1080/03054985.2011.577938	284	21.85	7.61	Oxford Review of Education	
Saljo R	2010	Digital tools and challenges to institutional traditions of learning: technologies, social memory and the performative nature of learning	10.1111/j.1365-2729.2009.00341.x	229	15.27	6.34	Journal of Computer Assisted Learning	
Goldman SR et al.	2012	Comprehending and Learning From Internet Sources: Processing Patterns of Better and Poorer Learners	10.1002/RRQ.027	223	17.15	5.97	Reading Research Quarterly	
Kong SC	2014	Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy	10.1016/j.compedu.2014.05.009	222	20.18	8.56	Computer and Education	
Huh GA,	2006	Crafting an agentive self: Case studies of digital storytelling	NA	220	11.58	4.13	Research in The Teaching of English	
Lewis C & Fabos, B	2005	Instant messaging, literacies, and social identities	10.1598/RRQ.40.4.5	219	10.95	3.28	Reading Research Quarterly	
Kahne J & Bowyer, B	2017	Educating for Democracy in a Partisan Age: Confronting the Challenges of Motivated Reasoning and Misinformation	10.3102/0002831216679817	215	26.88	8.17	American Educational Research Journal	
Voogt J et al	2013	Challenges to learning and schooling in the digital networked world of the 21st century	10.1111/jcal.12029	196	16.33	6.10	Journal of Computer Assisted Learning	
Mcgrew S, 2018,	2018	Can Students Evaluate Online Sources? Learning From Assessments of Civic Online Reasoning	10.1080/00933104.2017.1416320	196	28.00	9.45	Theory And Research In Social Education	

3.3 The most frequently explored themes and topics

Keywords represent the core and essence of an article. The analysis of keyword co-occurrence can provide fundamental information and domain space for the development of the field from the perspective of major themes. This study mapped the keywords of 2,218 documents in Figure 6. The dots represent the cited keywords, and the size of the dots indicates the frequency of keyword occurrences, with larger dots representing research hotspots. Colors indicate different clusters of keywords. The lines between the nodes represent the strength of the associations, with thicker lines indicating a higher frequency of co-occurrence of two keywords in the same article.

Figure 6: Co-occurrence of authors' keywords



According to the analysis, Figure 6 shows two clusters. Cluster 1 is based on literacy and digital literacy, centered around social media, critical literacy, technology, multimodality, learning, and reading, and also involves the fields of education and higher education. Cluster 2 includes digital, media literacy, new literacy, motivation, adolescence, engagement, comprehension, strategies, instructional strategies and materials, and methods. In Figure 3, the two largest nodes are digital and media literacies. Based on the connectivity of these keywords, it is evident that digital is more closely linked with strategies, instructional strategies and materials, methods, and motivation. This indicates that articles in this cluster are mostly related to strategies and methods for improving digital literacy. For instance, Saljo (2010) described the challenges that digital tools pose to traditional educational institutions, including the technological, social memory, and expressive nature of learning, revealing the dynamic processes of learning and knowledge construction in the digital age. Voogt et al. (2013) discussed the challenges that learning and school education face in the 21st-century digital network world, emphasizing the profound impact of technology on educational methods. Hull (2006) explored how students shape their autonomy during the process of digital storytelling through case studies, highlighting the potential of digital storytelling in education, particularly in fostering students' autonomy and creativity.

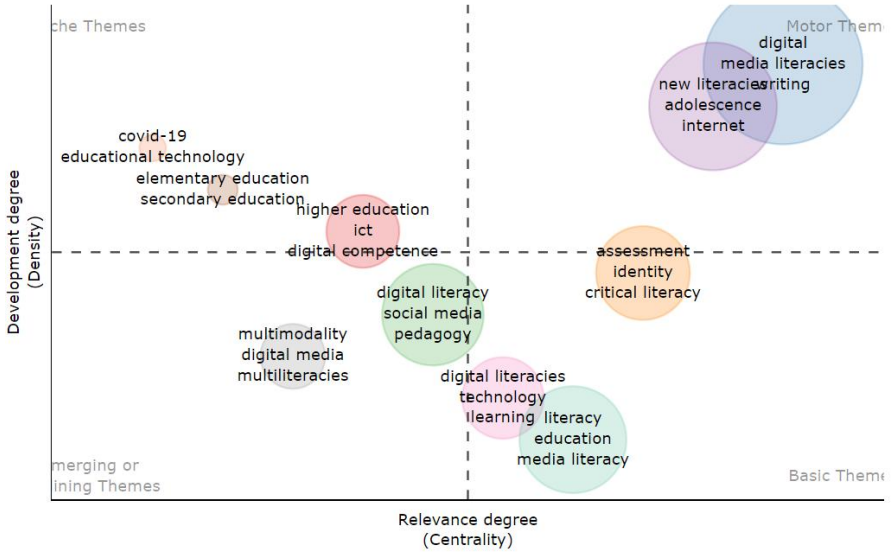
Media literacies are more closely linked with adolescence and new literacies. Lewis and Fabos (2005) studied the impact of instant messaging on students,

especially adolescents' digital literacy and social identity, exploring how digital communication shapes students' social behaviors and identity. This paper emphasized the importance of digital communication tools in modern student life and called for educators to pay attention to the potential impacts of these tools on students' literacy and social development. McGrew (2020) empirically examined whether students can assess the reliability of online information sources and drew lessons from evaluating civic online reasoning. Ng (2012) discussed strategies for integrating digital technologies and tools to enhance the digital literacy of "digital native" students in the digital age. This indicates that strategies and methods for improving digital literacy remain promising and crucial research topics, especially concerning adolescents' media literacy abilities in the information-overloaded era.

3.4 The potential trends in the field

Figure 7 illustrates the current state of different themes in digital literacy research. As shown in Figure 7, different colors represent different themes, and the keywords within the clusters indicate their relevance. These themes are divided into four quadrants based on their density and centrality. The top-right quadrant (or Motor Themes) represents themes with high density and centrality, typically current research hotspots and core areas. The bottom-right quadrant (or Basic Themes) contains themes with high Centrality but low Density, is generally foundational research themes. These themes is the basis of digital literacy research. Although they are less developed, they have important theoretical basis and application value in research. The top-left quadrant (or Niche Themes) indicates niche research themes or specific fields with high density but low centrality. While these themes show good development prospects, they have a limited overall impact on the research field. They may have in-depth research in specific areas and represent potential growth points for future research. The bottom-left quadrant (or Emerging or Declining Themes) has both low centrality and low density, typically representing emerging research directions that are in the early stages of development or declining research hotspots that need further observation to determine their development trends.

Figure 7: Thematic map of Digital Literacy research



As shown in Figure 7, the top-right quadrant includes two clusters, indicating that core themes like digital literacy and media literacy are relatively mature and receive widespread attention. In the bottom-right quadrant, technology, learning, and education related to digital literacy remain foundational research themes. The top-left quadrant includes three clusters, among which the development of educational technology has gained significant attention during the pandemic, with related research rapidly evolving, highlighting its critical role in addressing global challenges. This suggests that the development of educational technology post-pandemic could be a potential growth point for future research. The other two theme clusters are elementary education, secondary education, and higher education, which have consistently maintained good development. In the bottom-left quadrant, the low-density and low-centrality themes like multimodality and multiliteracies might be new topics, showing potential for future research. On the other hand, themes such as social media and pedagogy have been developing for many years, and their future prospects are not clearly defined.

4 Discussion

The aforementioned findings answer the four questions posed by this study. The following part will further explore the development directions of digital literacy. Firstly, the investigation shows a continuous increase trend in research within the field of digital literacy, confirming that interest in digital literacy is on the rise. This answers the first question of this study. The most popular journals and prolific authors in this field mostly belong to the education category, indicating

that the field places education at the forefront (Pinto et al., 2020). However, digital literacy actually involves multiple fields, such as economics, management, and financial technology (Shui, 2009; van Laar et al., 2017; Xu & Shang, 2017). We anticipate that more journals from other categories will expand their focus and readership. In terms of national influence, the United States has the highest quality articles in this field. Notably, not only developed countries (USA, Australia, UK, Spain, Canada, Norway, Netherlands, Sweden) are focused on this field, but emerging economies and developing countries are also starting to make an impact. Particularly, China has a certain level of influence in this field. This answers our second research question.

Regarding research directions, this study predicts that research on educational technology related to digital literacy remains worth exploring. Due to the pandemic, online education, remote work, and other factors have promoted the development of digital platforms. Although the travel restrictions due to the pandemic have now been lifted, the impact on the digital field, especially related to technologies, tools, and strategies, is still developing. We expect that research on digital technologies, tools, and strategies will continue to interest scholars. Additionally, media literacy, particularly adolescent media literacy, is also a research hotspot. McGrew (2020) and Ng (2012) have both demonstrated the significant role of media in students' digital literacy. However, Livingstone (2012) critically reflected on the benefits of ICT in education. This study believes that acquiring information through various media is crucial, but students need the ability to distinguish between true and false data, relevant and irrelevant information, and critical and useless data. Only then can they face the challenges of a rich digital information world. Furthermore, digital literacy is situated within broader political, economic, and cultural contexts (Shui, 2009; van Laar et al., 2017; Xu & Shang, 2017) and is also related to issues such as social media, gender (Hargittai & Shaw, 2015), health (McGrew, 2020), the digital divide (Voogt et al., 2013), and partisan controversies (Kahne & Bowyer, 2017). Therefore, policies need to address its importance.

5 Conclusion

In summary, this study conducted a bibliometric analysis of digital literacy research from 2005 to May 2024, summarizing the development in this field. It validated the applicability of Price's Law and Bradford's Law in this area, and organized the key journals, core authors, high-impact countries, and keyword analysis. The specific results are as follows:

(1) The number of related journals in the field of digital literacy has shown an overall upward trend, with a rapid growth rate in the past 10 years.
(2) Core journals in the field of digital literacy include the Journal of Adolescent and Adult Literacy, Computers and Education, Education and Information Technologies, Reading Teacher, Learning Media and Technology, etc.

(3) In this field, authors such as Merchant G, Burnett C, Jiang L, Mills KA, and Smith BE are relatively prolific.
(4) In this field, the works of American scholars are more widely recognized, with a total of 12,611 citations, far surpassing other countries.
(5) Highly cited literature mostly focuses on the application of digital technology in education.
(6) Keyword co-occurrence analysis found that several stable research themes have formed in this field, such as digital; media literacies; instructional strategies and materials; critical literacy, etc.

This study provides a comprehensive review of the field of digital literacy through a combination of bibliometric and descriptive analyses. To some extent, it offers a reference for related scholars in choosing journals for submission, referencing literature, collaborating with authors, and selecting research directions. It provides scholars interested in this field with a clear framework of existing research. However, this study has certain limitations. First, the data for the paper was obtained from the Web of Science database, without considering other databases, which may lead to a lack of comprehensiveness in the data. Additionally, as a quantitative study based on bibliometric analysis, the focus is on organizing the overall situation of the field. Therefore, this study did not conduct an in-depth analysis of the content of a large number of documents. Future research can include more databases and expand the selection range to provide a more comprehensive analysis for the field of digital literacy.

Project funding:

Collaborative Project Funding of XJTLU：Opportunities and Challenges for the Development of Primary and Secondary Education in the Rural Areas during the Age of Digitization
RDH10120220065

References:

Abramo, G., D ' Angelo, C. A., & Di Costa, F. (2011). National research assessment exercises: A comparison of peer review and bibliometrics rankings. *Scientometrics*, *89*(3), 929-941.

Baber, H., Fanea-Ivanovici, M., Lee, Y.-T., & Tinmaz, H. (2022). A bibliometric analysis of digital literacy research and emerging themes pre-during COVID-19 Pandemic. *Information and Learning Sciences*, *123*(3-4), 214-232.

Boyack, K. W., Klavans, R., & Börner, K. (2005). Mapping the backbone of science. *Scientometrics*, *64*(3), 351-374.

Doiz, A., Lasagabaster, D., & Sierra, J. M. (2011). Internationalisation, multilingualism and English- medium instruction. *World Englishes*, *30*(3), 345-359.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285-296.

European Commission. (2021). DigComp 2.1: The digital competence framework for citizens. Publications Office of the European Union.

Hargittai, E., & Shaw, A. (2015). Mind the skills gap: The role of Internet know-how and gender in differentiated contributions to Wikipedia. Information, *Communication & Society*, *18*(4), 424-442.

Hirsch, J. E. (2005). An index to quantify an individual ' s scientific research output. *Proceedings of the National Academy of Sciences*, *102*(46), 16569-16572.

Hood, W. W., & Wilson, C. S. (2001). The literature of bibliometrics, scientometrics, and informetrics. *Scientometrics: An International Journal for All Quantitative Aspects of the Science of Science, Communication in Science and Science Policy*, *52*(2), 291-314.

Hull, G. A., & Katz, M. L. (2006). Crafting an agentive self: Case studies of digital storytelling. *Research in the Teaching of English*, *41*(1), 43-81.

Kahne, J., & Bowyer, B. (2017). Educating for democracy in a partisan age: Confronting the challenges of motivated reasoning and misinformation. *American Educational Research Journal*, *54*(1), 3-34.

Lewis, C., & Fabos, B. (2005). Instant messaging, literacies, and social identities. *Reading Research Quarterly*, *40*(4), 470-501.

Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. *Oxford Review of Education*, *38*(1), 9-24.

Lloyd, A., & Hicks, A. (2023). Fractured academic space: Digital literacy and the COVID-19 pandemic. *Journal of Documentation*, *79*(6), 1309-1324.

Ma, Z., & Xi, Y. (1992). Status and trends of bibliometric. *Journal of Information Science*, *13*(5), 7-17.

Martínez-Bravo, M.-C., Sádaba-Chalezquer, C., & Serrano-Puche, J. (2020). Fifty years of digital literacy studies: A meta-research for interdisciplinary and conceptual convergence. *El Profesional de La Información*, *29*(4), 1-15.

Mas-Tur, A., Kraus, S., Brandtner, M., Ewert, R., & Kürsten, W. (2020). Advances in management research: A bibliometric overview of the Review of Managerial Science. *Review of Managerial Science*, *14*(5), 933-958.

McGrew, S. (2020). Learning to evaluate: An intervention in civic online reasoning. *Computers & Education*, *145*, 103711.

Merchant, G. (2009). *Learning for the future: Emerging technologies and social participation* (Vol. 1). Hershey, PA: IGI Global.

Merchant, G. (2012). Mobile practices in everyday life: Popular digital technologies and schooling revisited. *British Journal of Educational Technology*, *43*(5), 770-782.

Ng, W. (2012). Can we teach digital natives digital literacy?. *Computers & Education*, *59*(3), 1065-1078.

Pinto, M., Fernández-Pascual, R., Caballero-Mariscal, D., & Sales, D. (2020). Information literacy trends in higher education (2006–2019): Visualizing the emerging field of mobile information literacy. *Scientometrics*, *124*(2), 1479-1510.

Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of Documentation*, *25*, 348.

Saljo, R. (2010). Digital Tools and Challenges to Institutional Traditions of Learning: Technologies, Social Memory and the Performative Nature of Learning. *Journal of Computer Assisted Learning*, *26*(1), 53-64.

Shui Bing. (2009). Gridlock and Solutions: China ' s Private Education in the Period of Social Transformation. *Chinese Education & Society*, *42*(6), 3-5.

Sousa, M. J., & Rocha, á. (2019). Skills for Disruptive Digital Business. *Journal of Business Research*, *94*, 257-263.

van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, *72*, 577-588.

Voogt, J., Erstad, O., & Dede, C. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of Computer Assisted Learning*, *29*(5), 403-413.

Wu, J. F., & Tsai, H. L. (2022). Research trends in English as a medium of instruction: A bibliometric analysis. *Journal of Multilingual and Multicultural Development*, 1-18.

Xu, H., & Shang, W. (2017). A review of the development of digital literacy training models in the United States, Europe, Japan and China. *Library and Information Service,* (16), 98-106.