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Digital Literacy in Education: A Bibliometric Mapping of Trends, Themes, and Research Development

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Abstract. This study aims to analyze the research landscape of digital literacy in the context of learning and education using a bibliometric approach. Data were collected from Google Scholar through the Publish or Perish (PoP) software, resulting in 300 selected articles published between 2018 and 2023. The data were then analyzed and visualized using VOSviewer to identify publication trends, citation patterns, and keyword relationships. The findings indicate that research on digital literacy has shown a consistent increase, with a peak in 2022, highlighting its growing importance in educational discourse. Citation analysis reveals that digital literacy contributes positively to learning processes and the development of competencies among students and educators. Furthermore, keyword network analysis identifies "digital" as the most dominant term, with five thematic clusters emerging, reflecting diverse yet interconnected research focuses. The study also highlights the role of e-learning as an effective approach to enhancing digital literacy, particularly in higher education. Overall, this research provides a comprehensive overview of trends, thematic structures, and the academic significance of digital literacy, offering valuable insights for future studies in the field.

Keywords: Bibliometric Analysis; Digital Literacy; E-Learning; Vosviewer; Research Trends.

1. INTRODUCTION

The continuous evolution of information technology has significantly transformed various aspects of modern life. At present, society is transitioning toward the concept of Society 5.0, a framework in which technological advancement is not solely directed at efficiency, but also at enhancing human potential and encouraging sustainable innovation across different sectors (Fukuyama, 2018; Yuniarto & Yudha, 2021). Within this context, key domains such as education, industry, and governance increasingly depend on digital technologies to facilitate, expand, and accelerate human interaction (Muliastrini & Handayani, 2021).

In the educational domain, this transformation has far-reaching consequences. It increasingly requires teachers and students to strengthen their digital capabilities as a fundamental element of effective instructional practices. One clear example of this shift can be seen in the adoption of e-learning, which represents technological progress while simultaneously serving as an important platform to support the development of digital literacy (Dhawan, 2020; Jessica et al., 2020).

Digital literacy has been formally integrated into the educational system, particularly following the implementation of the 2013 Curriculum. This curriculum promotes competency-based learning through thematic approaches, encouraging learners to independently build their understanding by utilizing various digital resources (Mulyasa, 2014; Putri et al., 2024). In this

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regard, digital literacy activities play a crucial role in equipping learners with both cognitive and technical skills required to effectively engage with information and communication technologies (Kajin, 2018; Ng, 2012).

As articulated by Paul Gilster, digital literacy encompasses the ability to utilize information technology to address academic, professional, and everyday life needs (Rohmah, 2019). In educational contexts, this concept extends beyond operational skills, involving the capacity to access, understand, evaluate, and actively participate in digital environments. It also requires critical thinking, ethical awareness, and responsible engagement with information in increasingly complex digital ecosystems (Eshet, 2004; Iriyani et al., 2023).

Furthermore, digital learning refers to instructional processes that leverage digital technologies, incorporating various forms of media such as text and images to facilitate meaningful knowledge construction (Holzberger et al., 2013). When effectively implemented, digital learning environments can enhance instructional quality, improve learning outcomes, and foster more engaging learning experiences. The integration of technology not only supports content delivery but also contributes to creating interactive and student-centered learning environments (Mayer, 2014).

Alongside these developments, scholarly attention to digital literacy in education has grown substantially. A wide range of studies has examined its relationship with learning outcomes, instructional design, and learner characteristics. However, despite this expanding body of literature, existing research tends to be fragmented and lacks a comprehensive mapping of its intellectual structure, thematic evolution, and research trends over time (Donthu et al., 2021; Zupic & Čater, 2015). In particular, there remains limited effort to systematically synthesize how digital literacy has been positioned within the broader discourse of teaching and learning (Irsanti & Umi Kalsum, 2024).

In response to this gap, a bibliometric approach offers a robust and systematic means of analyzing large volumes of scholarly publications, enabling the identification of research patterns, dominant themes, and emerging directions within a field (Aria & Cuccurullo, 2017). By employing bibliometric analysis, it becomes possible to move beyond isolated findings and develop a more holistic understanding of the development of digital literacy research in educational contexts.

Accordingly, this study is designed to examine and map the development of digital literacy research within educational settings using a bibliometric approach. Drawing on data from Google Scholar, the analysis focuses on identifying publication patterns, major themes, and the structural relationships within the field. The findings are expected to provide a clearer

understanding of the research landscape and offer valuable insights for advancing future studies on digital literacy in education.

2. METHODS

The present study examines research on digital literacy within the context of learning and education through a bibliometric approach, with findings presented in the form of visualized data. Bibliometric analysis is a research method that applies statistical and mathematical techniques to systematically evaluate scientific publications and map the structure of knowledge within a particular field (Ariyani et al., 2022; Donthu et al., 2021). This approach enables the identification of publication patterns, citation relationships, and thematic developments across a body of literature (Zupic & Čater, 2015).

Data collection was conducted by retrieving relevant scholarly articles using the Publish or Perish (PoP) software, which is widely utilized for extracting academic metadata from databases such as Google Scholar. To ensure both relevance and manageability of the dataset, the search was limited to 300 articles published within the period 2018–2023. This timeframe was selected to capture recent developments and emerging trends in digital literacy research, particularly in relation to educational practices.

Following the data collection stage, the dataset was analyzed and visualized using VOSviewer, a tool specifically designed for constructing and visualizing bibliometric networks, including co-authorship, co-occurrence of keywords, and citation relationships (van Eck & Waltman, 2010). The use of visualization techniques allows for a clearer interpretation of complex bibliographic data, facilitating the identification of dominant themes, research clusters, and interconnections among studies.

The results of the bibliometric analysis and network visualization are then interpreted using a descriptive approach. This involves explaining the characteristics of the bibliographic data, as well as examining citation patterns to provide insights into the intellectual structure and development of research on digital literacy in education. Through this combined analytical process, the study aims to offer a comprehensive and systematic overview of the field.

3. RESULTS AND DISCUSSION

The analysis was conducted based on a dataset of 300 selected documents retrieved from Google Scholar using the keyword “digital literacy” within the 2018–2023 timeframe. From an initial pool of more than 500 articles, the data were refined through several screening procedures to ensure relevance and consistency. Visualization was employed as a central

component in presenting the bibliometric findings, as it enhances clarity and facilitates the interpretation of complex relationships within the dataset (Ellili, 2023). The distribution of publications by year is presented in Table 1.

Table 1. Number and Percentage of Digital Literacy Publications

No	Year of Publication	Number of Publication	Percentage
1	2023	27	9%
2	2022	79	26.3%
3	2021	77	25.7%
4	2020	59	19.7%
5	2019	42	14%
6	2018	16	5.3%
Total		300	100%

The findings indicate that the highest number of publications occurred in 2022, with 79 articles (26.3%), followed closely by 2021 with 77 publications. The minimal difference between these two years suggests a sustained and increasing scholarly interest in digital literacy. This trend reflects the growing recognition of digital literacy as a critical component in education, particularly in response to rapid technological advancements and the expansion of digital learning environments. The majority of the selected works were published in indexed journals and conference proceedings, indicating that the topic has gained considerable academic legitimacy.

Further analysis identified six highly cited articles or journals related to digital literacy. Citation frequency is commonly used as an indicator of scholarly impact, as highly cited works tend to shape the development of a research field (Kriyantono, 2016). These influential publications consistently highlight the positive role of digital literacy in enhancing learning processes and supporting the development of digital competencies among both students and educators.

Table 2. Citation Counts of Selected Articles

No	Author	Title	Year	Number of Citations
1	Idhartono, A. R.	Literasi digital pada Kurikulum Merdeka belajar bagi anak.	2023	24
2	Novitasari, Y., & Fauziddin, M.	Analisis literasi digital tenaga pendidik pada pendidikan anak usia dini.	2022	124
3	Dewi, D. A., Hamid, S. I., Annisa, F., Oktafianti, M., & Genika, P. R.	Menumbuhkan karakter siswa melalui pemanfaatan literasi digital.	2021	128
4	Nahdi, D. S., & Jatisunda, M. G	Analisis literasi digital calon guru SD dalam pembelajaran berbasis virtual classroom di masa pandemi covid-19.	2020	222
5	Setyaningsih, R., Abdullah, A., Prihantoro, E., & Hustinawaty, H.	Model penguatan literasi digital melalui pemanfaatan e-learning.	2023	256
6	Silvana, H., & Darmawan, C	Pendidikan literasi digital di kalangan usia muda di kota bandung.	2020	156

One notable study, “Model Penguatan Literasi Digital melalui Pemanfaatan E-Learning,” proposes a model that effectively improves digital literacy skills at the university level. This finding underscores the practical urgency of strengthening digital literacy within educational systems. As noted by Dewi et al. (2021), digital literacy can function as a catalyst for integrating various technological tools, thereby expanding access and facilitating both teaching and learning activities.

In addition, the implementation of digital literacy contributes to several educational benefits, including increased knowledge acquisition through information exploration, enhanced critical thinking, improved verbal communication, stronger concentration, and the development of reading and writing skills (Sumiati & Wijonarko, 2020). These findings reinforce the argument that digital literacy is not merely a technical skill but a multidimensional competency essential for meaningful learning.

The use of Publish or Perish (PoP) software proved instrumental in the data collection process. This tool enables researchers to retrieve and analyze citation data from Google Scholar and other databases, providing metrics such as total citations, citations per year, and author impact (Saputro, 2022). Its compatibility across multiple operating systems further enhances its practicality for bibliometric studies (Aulianto et al., 2019).

The study also examined the distribution of publications across journals, particularly those indexed in SINTA and conference proceedings. A minimum threshold of two articles per journal was applied, and citation indicators were used to ensure the scientific credibility of the sources (Aini et al., 2019).

Table 3. Citation Distribution in Indexed Journals

Journal Name	Number of Document	Number of Citation
SINTA 2		
Interaksi : Jurnal Ilmu Komunikasi	3	143
Journal of Educational Technology	3	28
Jurnal SMART (Studi Masyarakat, Religi, dan Tradisi)	2	37
SINTA 3		
JMM – Jurnal Masyarakat Mandiri	2	68
Jurnal Cakrawala Pendas	2	243
Pustakaloka	2	94
SINTA 4		
Edukatif: Jurnal Ilmu Pendidikan	6	69
JIIP – Jurnal Ilmiah Ilmu Kependidikan	2	29
SINTA 5		
Jurnal Basicedu	9	212
Jurnal Didaktika Pendidikan Dasar	2	61
PROCEEDING		
Seminar Nasional Riksa Bahasa	4	190
Proceedings of the ICECRS	2	26

The results show a diverse range of SINTA-indexed journals contributing to digital literacy research. Among them, Jurnal Basicedu recorded the highest number of publications. However, the overall distribution indicates that most articles are concentrated in journals ranked SINTA 4 and SINTA 5. This suggests that while digital literacy is widely studied, its presence in higher-ranked journals remains relatively limited. At the same time, the alignment between digital literacy topics and the scope of these journals indicates strong relevance and accessibility for researchers aiming to publish in this area.

For bibliometric mapping, the dataset was further analyzed using VOSviewer. Bibliometric analysis applies quantitative techniques to examine patterns in scientific communication (Bakkalbasi et al., 2006). In this study, a minimum threshold of five co-occurrences was set for keyword analysis.

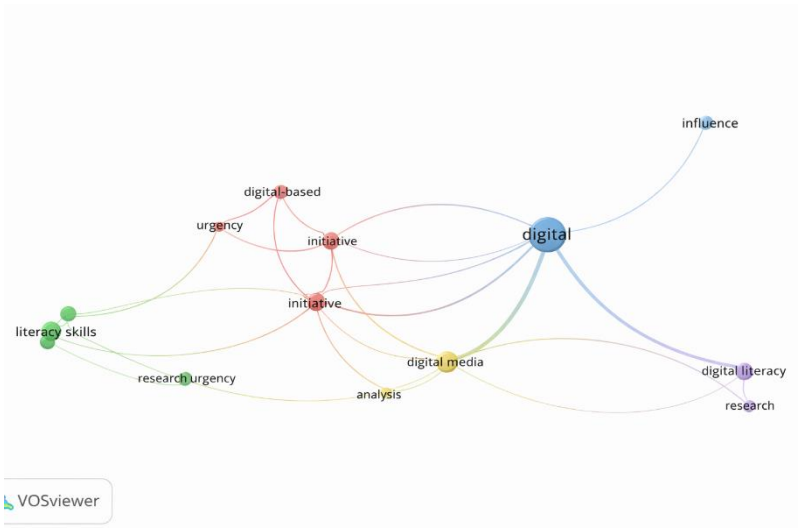


Figure 1. Network Visualization of "Digital Literacy"

The network visualization reveals that the keyword "digital" has the highest frequency, with seven co-occurrences, as indicated by the largest node. Five clusters comprising 13 items were identified, each representing distinct thematic groupings within the research field. These clusters reflect the diversity of topics associated with digital literacy, with the central focus remaining on digital-related competencies and applications in education. The clustering pattern provides insight into how research themes are interconnected and highlights potential areas for further exploration.

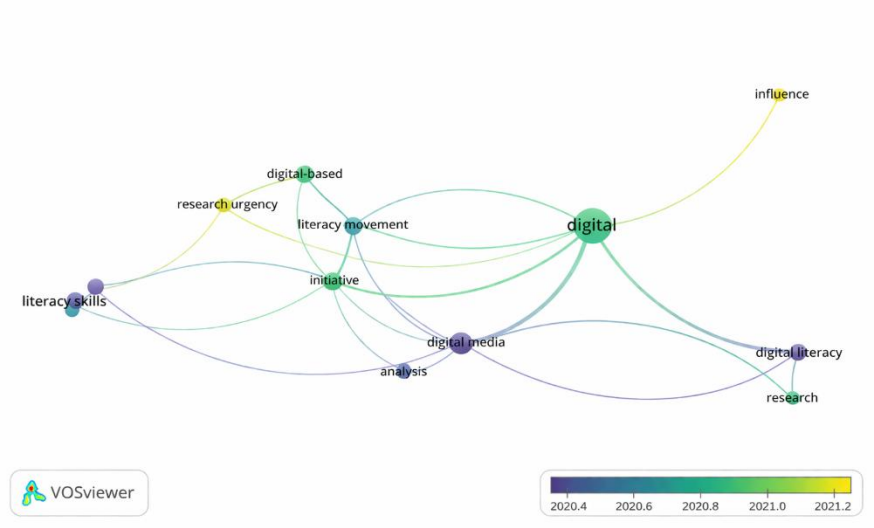


Figure 2. Overlay Visualization of "Digital Literacy"

The overlay visualization illustrates the temporal evolution of keyword usage. The dominant color range indicates that many keywords were actively used between 2020 and 2021, a period marked by a significant increase in publications. This surge may be associated with the global shift toward digital and online learning environments. Emerging keywords such as "influence" and "urgency" suggest a shift in research focus toward examining the impact and necessity of digital literacy in educational contexts.

While the findings demonstrate a clear increase in research output and highlight the growing importance of digital literacy, several critical observations should be noted. First, the concentration of publications in mid-tier journals (SINTA 4 and 5) suggests that although the topic is widely explored, it may not yet be fully established in higher-impact academic discourse. This could indicate the need for more rigorous methodologies, theoretical contributions, or broader international collaboration to elevate the quality and visibility of research in this field.

Second, the dominance of certain keywords, particularly "digital," reflects a general focus that may still be conceptually broad. This raises questions about the depth of specialization within the field, as more nuanced or emerging aspects of digital literacy, such as digital ethics, data literacy, or algorithmic awareness, appear less prominently. Future research may benefit from exploring these more specific dimensions to enrich the discourse.

Third, the reliance on Google Scholar as the primary data source, while advantageous in terms of coverage, may also introduce limitations related to data consistency and indexing quality. Although tools such as Publish or Perish help manage and analyze the data, the inclusion of non-peer-reviewed sources or inconsistent metadata could affect the robustness of the analysis.

Finally, the temporal concentration of publications around 2020–2021 suggests that external factors, such as the rapid transition to online learning, may have significantly influenced research trends. While this reflects responsiveness to global challenges, it also raises the possibility that some studies are context-dependent and may require further validation in more stable educational settings.

Overall, the results highlight both the expansion and the evolving complexity of digital literacy research in education. At the same time, they point to opportunities for strengthening methodological rigor, diversifying research themes, and enhancing the academic impact of future studies.

4. CONCLUSION

Based on a bibliometric analysis of 300 selected articles on digital literacy from 2018 to 2023 indexed in Google Scholar, this study reveals the diversity of SINTA-indexed journal rankings within the field. Although the initial dataset included more than 500 articles, it was refined to ensure analytical focus and consistency.

The results show that publications peaked in 2022 (26.3%), with relatively stable output in adjacent years, indicating that digital literacy remains a sustained research trend. Citation analysis of six leading journals highlights the positive role of digital literacy in enhancing learning processes and supporting the development of competencies among students and educators. Notably, the integration of e-learning emerges as an effective model for strengthening digital literacy, particularly at the university level.

Keyword network analysis identifies “digital” as the dominant term, with cluster visualization revealing five thematic groupings, where the “digital” cluster is the most prominent. Overall, these findings provide a concise overview of research trends, thematic focus, and the academic significance of digital literacy in contemporary educational studies.

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