

Trend Analysis Using Bibliometric Study on Digital Literacy in Education

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Abstract

Digital literacy has emerged as a critical skillset in response to the rapid evolution of digital technology. The COVID-19 pandemic has notably accentuated its significance, particularly in educational settings. In this study, a bibliometric analysis using VoS Viewer was conducted on 725 articles retrieved from the Google Scholar database, covering the period from 2013 to 2023. Employing qualitative methods, this research aims to comprehensively analyze the research trends in Digital Literacy in Education, focusing specifically on its practical applications and outcomes. The findings of the study provide multifaceted insights into the use of digital literacy in education. Through cluster analysis, prominent themes and interrelationships within the field have been identified and interpreted. Notably, the results shed light on the actual implementation and observed outcomes of digital literacy initiatives in educational contexts. The analysis discerns the practical implications and tangible effects of digital literacy on learning outcomes, pedagogical strategies, and student engagement. This study emphasizes the need for a nuanced approach to digital literacy, moving beyond mere technical competence. It underlines the importance of integrating responsible use, critical thinking, and digital citizenship within educational curricula and pedagogical practices. The research findings assert the necessity of aligning digital literacy initiatives with evolving educational needs to equip students with essential skills for navigating the digital landscape effectively. The implications of this study extend to policymakers, educators, and researchers involved in digital literacy initiatives. Highlighting the actual utilization and impact of digital literacy in education, the study urges stakeholders to refine educational practices and policies. Furthermore, it underscores the significance of continuous integration and adaptation of digital literacy within educational frameworks, aiming to harness its potential for enriching learning experiences and preparing students for the demands of the digital age. This research contributes to an in-depth understanding of the practical application of digital literacy in educational settings. It accentuates the pressing need to observe, assess, and adapt digital literacy initiatives to foster comprehensive learning outcomes.

Keywords: Digital Literacy, Education, Bibliometric

INTRODUCTION

The rapid advancement of technology, particularly the Web 2.0 model, generates profound societal transformations (Hinojo-Lucena et al., 2019). Information and communication technologies have become integral to people's everyday lives, corporate environments, and more, reshaping all aspects of interaction and socialization (Morimoto & Friedland, 2011). Information and communication technologies has also affected specialized domains such as education (Stopar & Bartol, 2019). As a result, the educational system must adapt to these new circumstances, both in terms of methodology, by adjusting teaching and learning processes and in terms of educational objectives to meet the needs of students (Hash Salem Aljohani , Khushbu Agarwal, 2023). Consequently, it is crucial to incorporate digital literacy into training processes and provide students with the knowledge and skills to effectively leverage technologies.

The digital age has revolutionized communication, learning, and social interaction. As a result, digital literacy research has gained considerable prominence in recent years, fueled by the

widespread adoption of digital technologies. Understanding the multifaceted nature of digital literacy is of utmost importance for individuals, organizations, and society. Digital literacy encompasses effectively utilizing digital technology, communication tools, and networks to locate, assess, utilize, and generate information (Martzoukou & Elliott, 2016). It serves as a critical area of study within the field of information science, addressing pertinent issues such as information overload, lifelong learning, knowledge management, and the advancement of the information society. According to Wang & Si (2023) as digital technology advances, the concept of digital literacy evolves alongside it, necessitating ongoing exploration and research. Starting from, digital literacy encompasses a range of definitions, spanning from basic technical proficiency to applying information literacy skills within a digital environment. This involves locating, extracting, organizing, managing, presenting, and evaluating information. Digital literacy is further expanded in a framework incorporating various skills, understandings, norms, and practices (Meyers et al., 2013).

Referring to the EU and OECD policy documents, defines digital literacy as an individual's capacity to navigate and engage in a digital society, making informed decisions and achieving goals (Spante et al., 2018). However Pangrazio et al. (2020) comparative review of publication pairs in different language contexts reveals challenges in conceptualizing and applying the concept of digital literacy universally. The concept of digital literacy in education is dynamic and continuously evolving alongside the progress of information technology. The primary aim of this research is to examine the Digital Literacy Trends in education, focusing on describing the existing literature through bibliometric analysis.

RESEARCH METHODS

This study uses a qualitative descriptive method that describes the research data. The study reviewed articles in international scientific journals indexed by Google Scholar with the search keywords "digital literacy" and "education" in the last decade, namely 2013-2023, and then the data obtained was processed using VOSviewer.

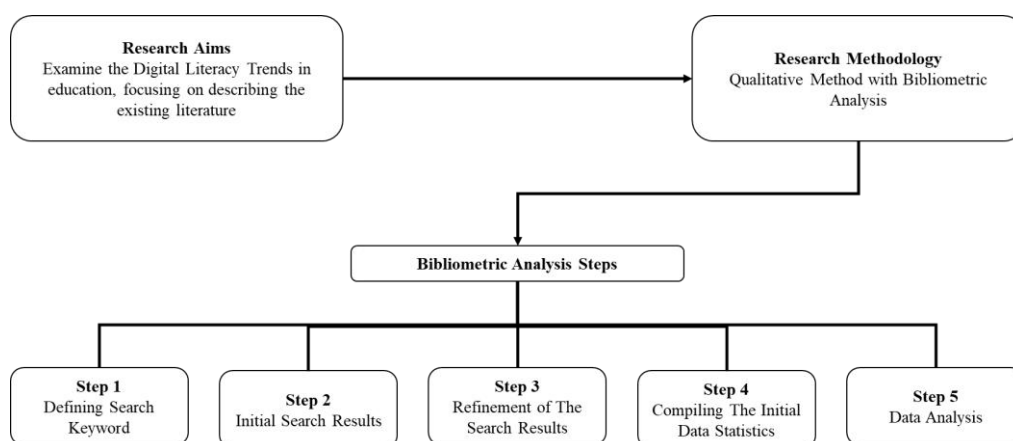


Figure1. Stages of Bibliometric Analysis

RESULT AND DISCUSSION

Based on data from searches using the Publish and Perish software, 725 articles were found with the search keywords "digital literacy" and "education" published in journals in the last ten years, namely 2013-2023. As seen in Figure 2, the number of publications around the 2020s has decreased. Many factors have caused the number of publications to decrease, one of the most important being the COVID-19 pandemic.

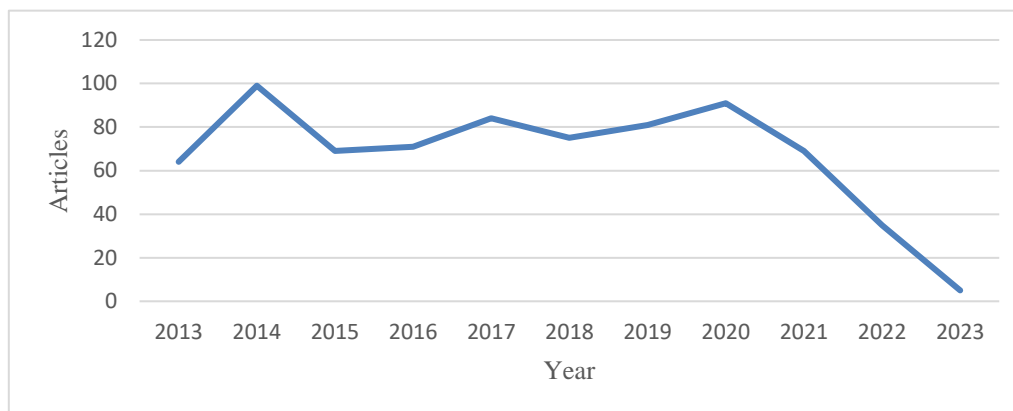


Figure 2. Number of Publications Each Year

Table 1, presented below, encompasses 15 articles that have garnered substantial attention and citation rates in Digital Literacy in Education over the past ten years. These highly influential articles delve into the crucial role of Digital Literacy in Education, addressing its significance in tackling the multifaceted challenges of the 21st century (Grover & Pea, 2013; van Laar et al., 2017; Voogt et al., 2013). The global landscape has undergone a seismic shift with the advent of the COVID-19 pandemic, leading to an unprecedented acceleration in the importance and integration of Digital Literacy in Education. As classrooms migrated to virtual environments and remote learning became the norm, teachers and students were compelled to harness technology in their educational endeavors, both within traditional classrooms and in their immediate surroundings (Beaunoyer et al., 2020; Greenhow & Lewin, 2016; Kong, 2014; König et al., 2020; Mohammadyari & Singh, 2015). Further examination of these highly cited articles reveals that they underscore the significance of not just utilizing technology but also comprehending and effectively employing it within learning practices. More than merely incorporating technology into education is required, teachers and students must develop a comprehensive understanding of leveraging technology to enhance the learning experience (Falloon, 2020; Ilomäki et al., 2016; Kirschner & Bruyckere, 2017; Krumsvik, 2014; Meyers et al., 2013; Scheerder et al., 2017; Spante et al., 2018).

Table 1. The Most Cited Article on Digital Literacy in Education

No	Title	Year	Citation	Journal	Author
1	Computational thinking in K–12: A review of the state of the field	2013	2559	Educational Researcher	(Grover & Pea, 2013)
2	The relation between 21st-century skills and digital skills: A systematic literature review	2017	1710	Computers in Human Behavior	(van Laar et al., 2017)
3	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	2020	1310	European Journal of Teacher Education	(König et al., 2020)
4	COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies	2020	998	Computers in Human Behavior	(Beaunoyer et al., 2020)

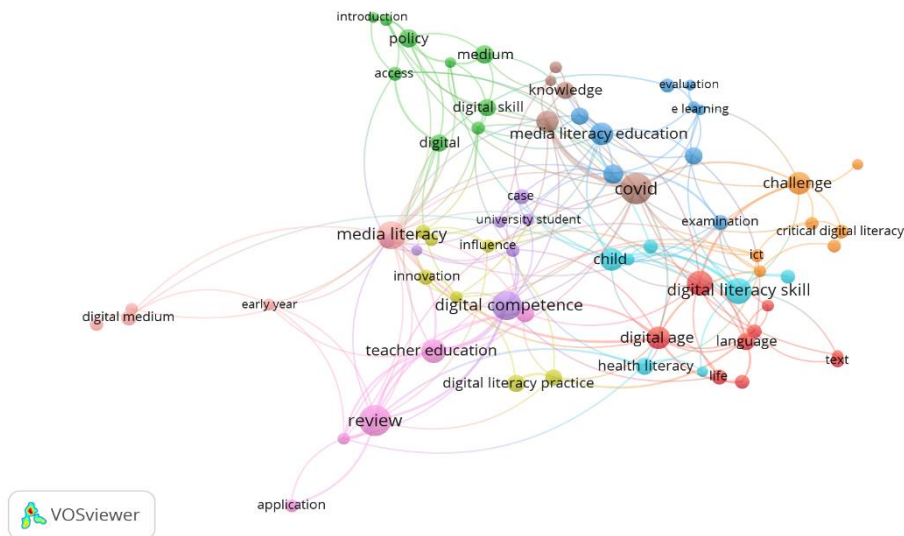
5	Determinants of Internet skills, uses and outcomes. A systematic review of the second-and third-level digital divide	2017	899	Telematics and Informatics	(Scheerder et al., 2017)
6	The myths of the digital native and the multitasker	2017	899	Teaching and Teacher Education	(Kirschner & Bruyckere, 2017)
7	Challenges to learning and schooling in the digital networked world of the 21st century	2013	792	Journal of Computer Assisted Learning	(Voogt et al., 2013)
8	Social media and education: Reconceptualizing the boundaries of formal and informal learning	2015	765	Learning, Media and Technology	(Greenhow & Lewin, 2016)
9	Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy	2014	710	Computers & Education	(Kong, 2014)
10	Digital competence—an emergent boundary concept for policy and educational research	2016	636	Computers & Education Education and Information Technologies	(Ilomäki et al., 2016)
11	Digital literacy and informal learning environments: an introduction	2013	563	Learning, Media and Technology	(Meyers et al., 2013)
12	From digital literacy to digital competence: the teacher digital competency (TDC) framework	2020	551	Educational Technology Research and Development	(Falloon, 2020)
13	Teacher educators' digital competence	2014	523	Scandinavian Journal of Educational Research	(Krumsvik, 2014)
14	Understanding the effect of e-learning on individual performance: The role of digital literacy	2015	520	Computers & Education	(Mohammadyari & Singh, 2015)
15	Digital competence and digital literacy in higher education research: Systematic review of concept use	2018	505	Cogent Education	(Spante et al., 2018)

These articles shed light on various dimensions of Digital Literacy in Education, including its impact on pedagogical approaches, acquiring essential digital skills, developing critical thinking and problem-solving abilities, and cultivating digital citizenship and responsible online behaviour. By exploring the research findings and insights within these articles, researchers and practitioners can better understand the complexities and nuances associated with Digital Literacy in Education, enabling them to design effective strategies, curricula, and interventions that promote its integration and application in educational contexts. In the visualization of Figure 3, according to (Al Husaeni et al., 2023) an essential aspect of understanding complex systems lies in the interrelationships between various components within the system. In the context of their study, these interrelationships are represented through networks or lines that connect one term to another, thereby establishing connections and associations between them.

By visualizing the interrelationships through networks, researchers can gain insights into a system's underlying structure and dynamics. Each term in the network represents a concept,

and the lines connecting them represent the relationships between these concepts. This visual representation provides a powerful tool for analyzing and comprehending the complex web of interdependencies and influences within the system. The network approach allows researchers to explore how terms are connected and how information flows between them. It enables the identification of critical terms that serve as central nodes within the network, indicating their significance and potential impact on the overall system. Additionally, the strength and nature of the connections between terms can be assessed, offering insights into the intensity or proximity of the relationships.

Figure 3. Network Visualization – Digital Literacy in Education



Using network analysis techniques, researchers can uncover patterns, clusters, and communities within the network, revealing hidden structures and groupings of related terms. This analysis can contribute to a deeper understanding of the relationships between concepts and their implications within the studied domain. The approach emphasizes the importance of representing the interrelationships between terms through networks. This approach provides a valuable means of visualizing and analyzing complex systems, enabling researchers to gain a more comprehensive understanding of the connections, influences, and dynamics within the network of terms. The Literacy Digital in Education research area analysis shows 10 clusters, which can be seen in the table. 2.

Table 2. Results of Literacy Digital in Education Cluster Analysis

Cluster	Cluster Network	Explanation
Cluster 1	Digital age, digital literacy development, identity, language, life, literacy education, literacy practice, text, and time	Cluster 1 focuses on the broad themes of the digital age and digital literacy development. It includes terms such as identity, language, life, literacy education, literacy practice, text, and time. These terms reflect the multifaceted nature of digital literacy and its significance in contemporary society.
Cluster 2	Access, digital, digital skill, equity, evidence, Europe, introduction, medium, and policy	Cluster 2 revolves around the concept of access and digital skills. It includes digital, digital skill, equity, evidence, Europe, introduction, medium, and policy. These terms highlight the importance of ensuring equal access to digital resources and the need for policies that support digital inclusion.
Cluster 3	Case study, digital citizenship, e-learning, evaluation, examination, fake news, insight, media literacy education, and students' digital literacy	Cluster 3 pertains to case studies and various aspects of digital citizenship and media literacy education. It includes e-learning, evaluation, examination, fake news, insight, media literacy education, and students' digital literacy. These terms emphasize the critical role of digital citizenship and media literacy in navigating the digital landscape.

Cluster 4	Ability, digital literacy practice, importance, influence, innovation, self-efficacy, and young child	Cluster 4 focuses on the importance and influence of digital literacy practice. It includes terms such as ability, digital literacy practice, importance, influence, innovation, self-efficacy, and young child. These terms highlight the developmental aspects of digital literacy and its impact on young learners.
Cluster 5	Case, digital competence, digital literacy education, digital transformation, problem, systematic literature review, and university student	Cluster 5 centres around digital competence and transformation in educational contexts. It includes terms such as case, digital competence, digital literacy education, digital transformation, problem, systematic literature review, and university student. These terms highlight the need to integrate digital literacy into educational settings and understand its impact on students' learning outcomes.
Cluster 6	Child, competence, digital literacy skill, health literacy, India, part, and media education	Cluster 6 explores digital literacy skills concerning children and media education. It includes terms such as child, competence, digital literacy skill, health literacy, India, part, and media education. These terms highlight the importance of fostering digital literacy skills in children and promoting media literacy for their well-being.
Cluster 7	21 st Century, challenge, critical digital literacy, ict, new literacy, older adult, and web	Cluster 7 focuses on the challenges and opportunities of the digital age. It includes terms such as 21st Century, challenge, critical digital literacy, Information and Communication Technologies (ICT), new literacy, older adult, and web. These terms reflect the evolving nature of literacy in the digital era and the need for critical engagement with digital technologies.
Cluster 8	Covid, digital media literacy, Indonesia, knowledge, and pandemic	Cluster 8 centres around digital media literacy and the COVID-19 pandemic. It includes terms such as COVID, digital media literacy, Indonesia, knowledge, and pandemic. These terms highlight the role of digital media literacy in navigating and understanding information during the pandemic.
Cluster 9	Application, literature, need, review, and teacher education	Cluster 9 pertains to the application and need for literature reviews in digital literacy. It includes terms such as application, literature, need, review, and teacher education. These terms emphasize the importance of research and evidence-based practices in advancing digital literacy education.
Cluster 10	Digital medium, early year, elementary school, media literacy, and young person	Cluster 10 focuses on digital media literacy in early years and elementary school contexts. It includes digital media, early years, elementary school, media literacy, and young people. These terms highlight the need for early development of digital media literacy skills and their relevance in educational settings.

Based on the provided clusters, we can categorize them into the following three groups:

1. Group 1: Digital Literacy and Education (Cluster 1, 3, 5, 6)
2. Group 2: Access and Policy (Cluster 2, 7, 8)
3. Group 3: Research and Application (Cluster 4, 9, 10)

By visualizing the interrelationships through networks, researchers can gain insights into a system's underlying structure and dynamics. Each term in the network represents a concept, and the lines Group 1, which focuses on digital literacy and education, highlights several key aspects of understanding the significance of digital literacy in the modern era. Firstly, Cluster 1 brings attention to the transformative impact of the digital age on various facets of life. It underscores the need for individuals to develop digital literacy skills to navigate the digital landscape effectively. Including terms like identity, language, and literacy education emphasizes the importance of understanding how digital technologies shape our identities and communication practices and the role of education in fostering digital literacy. Secondly, Cluster 3 sheds light on the practical application of digital literacy in educational contexts. The cluster emphasizes the importance of digital citizenship, the evaluation of digital resources, and media literacy education for students. These terms highlight the need to equip learners with the skills

to navigate the digital world responsibly, critically analyze information, and engage with media effectively.

Group 2, which focuses on access and policy, highlights critical aspects related to the availability of digital resources and the role of policies in promoting equitable access to technology. Cluster 2 emphasizes the importance of access, digital skills, and equity in digital literacy. Including access, digital skill, and equity underscores the need to bridge the digital divide and ensure equal opportunities for individuals to acquire and utilize digital resources. Evidence, Europe, and policy also highlight the significance of evidence-based policies and European initiatives in promoting digital literacy and ensuring access to digital technologies. Cluster 7 further highlights the challenges and opportunities presented by the digital age. The terms 21st century, challenge, critical digital literacy, ICT, and new literacy emphasize the need for individuals to develop essential skills and competencies in the digital era. Including terms like an older adult and web also recognizes the importance of catering to diverse age groups and understanding the impact of digital technologies on different generations. This cluster highlights the evolving nature of literacy in the digital age and the need to address the challenges posed by technological advancements through innovative approaches and critical digital literacy skills.

Group 3 focuses on the intersection of digital literacy and specific contexts such as case studies, digital citizenship, e-learning, and media literacy education. Cluster 3 highlights the importance of case studies and examinations in understanding the application of digital literacy in different scenarios. It also emphasizes the significance of digital citizenship, which involves digital technologies' responsible and ethical use. Terms like e-learning, evaluation, and media literacy education further emphasize the role of technology in enhancing learning experiences and the need to evaluate digital content critically. This cluster emphasizes the practical implementation and evaluation of digital literacy initiatives within educational settings. Cluster 5 expands on the concept of digital competence and digital literacy education in the context of digital transformation. It includes digital competence, digital literacy education, digital transformation, and systematic literature review. This cluster highlights the need to develop digital competence among individuals, particularly within education, to adapt to the changing digital landscape. It also underscores the significance of conducting systematic literature reviews to gain insights into effective practices and approaches in digital literacy education. Including terms like a university student and problem further highlights the relevance of digital literacy education in higher education and the importance of problem-solving skills in the digital age.

CONCLUSION

Based on VOS Viewer analysis, we can draw several conclusions about the trends of Digital Literacy in Education. This research finds the overall trend observed, which is the integration of digital literacy into education. This research indicates a shift in focus from solely acquiring digital technical skills to a more holistic approach encompassing a comprehensive understanding of the digital landscape, including promoting responsible use of technology, developing critical thinking skills, and fostering digital citizenship among learners. The findings underscore the importance of educational institutions, policymakers, and educators prioritizing digital literacy initiatives. It is crucial to effectively integrate digital literacy into curricula and pedagogical practices to ensure that students are equipped with the necessary skills to navigate the complexities of the digital world. Students can actively participate in digital environments, make informed decisions, and contribute positively to society.

Recognizing the significance of digital literacy in the digital age, educational stakeholders must prioritize the development of digital literacy skills to empower students. By providing them with the tools and knowledge needed to navigate and thrive in the digital age, we can prepare them for future challenges and opportunities. Ultimately, integrating digital literacy into education can have a transformative impact, enabling individuals to become active participants in the digital society and harness the benefits of technology while also being responsible digital citizens.

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