Digital Literacy and Its Influence on Instructional Design for Online Education

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Abstract. This study systematically explores the influence of digital literacy on instructional design for online education through a Systematic Literature Review (SLR). Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, the review employed a structured four-stage process: identification, screening, eligibility, and inclusion. The search was conducted across platforms such as Mendeley, Google Scholar, and R Discovery, with inclusion and exclusion criteria focused on publications from 2018 to 2024, English-language articles, and peer-reviewed journals, conference proceedings, and books. Out of an initial 3,000 articles identified, a thorough screening process resulted in a final selection of studies that contributed to a comprehensive analysis of digital literacy's role in enhancing instructional design for online education. The review highlights that teachers' digital literacy significantly impacts their ability to integrate technology effectively in online learning environments. However, challenges such as limited training and resource disparities were also identified. The study underscores the need for continuous professional development to strengthen digital literacy among educators, thereby improving online instructional design and supporting student engagement and achievement in the digital age.

Keywords: digital literacy, instructional design, online education, systematic literature review.

1 Introduction

In an ever-evolving digital era, digital literacy has become an essential skill for lecturers in fulfilling their educational responsibilities. Digital literacy encompasses the ability to effectively use information and communication technology, as well as skills in searching, evaluating, and critically utilizing information [1], [2]. In the context of distance learning, which has become increasingly prevalent, especially since the COVID-19 pandemic, digital literacy is vital not only for students but also for lecturers to design effective and relevant learning experiences [3], [4], [5]. Distance learning compels lec-

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turers to adapt their teaching methods by integrating technology into instructional design. In this regard, digital literacy is crucial for lecturers to leverage various digital platforms and tools to deliver content, interact with students, and assess learning progress. With adequate digital literacy skills, lecturers can create a learning environment that is inclusive, allowing all students, regardless of their technological backgrounds, to participate fully.

The success of distance learning heavily relies on lecturers' ability to understand and address the challenges students face in accessing and using technology [6], [7]. By enhancing their digital literacy, lecturers can design engaging and interactive teaching materials that increase student involvement and motivation in the learning process. Additionally, digital literacy aids lecturers in equipping students with the skills necessary to succeed in an increasingly digitalized world. Therefore, research on the role of digital literacy in instructional design for distance learning is crucial, not only to enhance teaching quality but also to prepare students to face future challenges.

This systematic review aims to identify and analyze the role of digital literacy in instructional design for distance learning. In the context of education increasingly influenced by advances in information technology, a profound understanding of digital literacy becomes crucial for lecturers. This research focuses on the integration of digital literacy into the instructional design process, with the expectation of providing significant insights into the relevant components of digital literacy. Additionally, the objectives of this study include evaluating the impact of digital literacy on the effectiveness of students' learning experiences, thereby supporting lecturers in formulating more effective and responsive teaching strategies to meet the needs of students in the digital era.

2 Methodology

In this Systematic Literature Review (SLR), a structured and methodical approach was applied to systematically identify, select, evaluate, and synthesize relevant studies[8], [9] . The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which consist of four key stages: identification, screening, eligibility, and inclusion. This framework ensures a thorough and organized process for capturing pertinent literature. The search for relevant studies was conducted using several well-established platforms, including Mendeley, Google Scholar, and R Discovery. These databases, known for their extensive collections of academic work, provided a comprehensive foundation for identifying research within the educational domain. Google Scholar and R Discovery were particularly valuable in offering access to a broad range of studies, allowing for an in-depth exploration of literature related to the research focus.

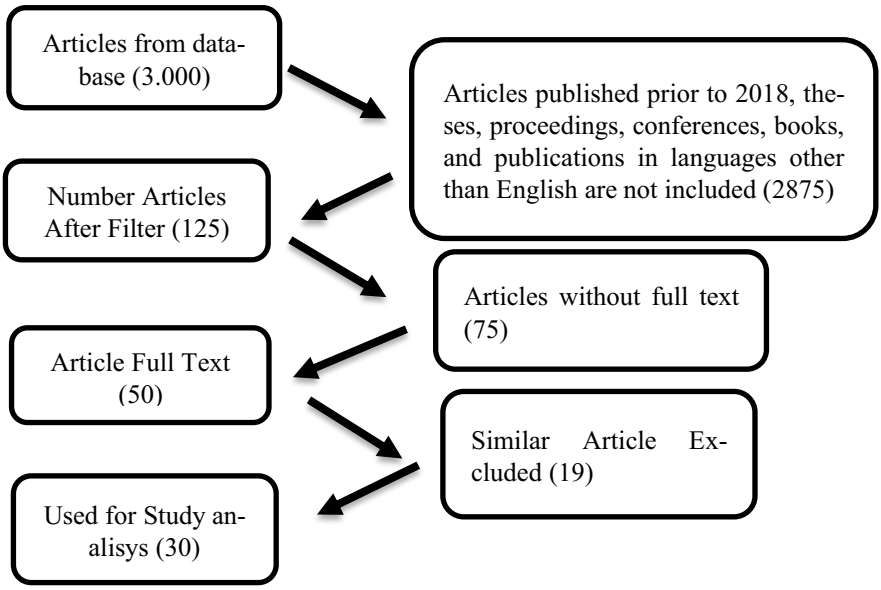
Specific inclusion and exclusion criteria were applied to ensure the selection of relevant and high-quality articles. First, only publications from 2018 to 2024 were considered, as this six-year period reflects the most current and ongoing debates. Second, only English-language articles were included due to the predominance of English content within the selected databases, which helps maintain consistency in the analysis.

Third, the review focused exclusively on peer-reviewed journal articles, conference proceedings, books, excluding brief research highlights. This decision ensured that the selected references provided in-depth, reliable, and peer-reviewed academic insights, contributing to a more comprehensive analysis. By following this systematic approach, the review aims to deliver a thorough understanding of the role of digital literacy in instructional design for distance learning while ensuring the quality and relevance of the studies included.

Table 1. Acceptance and Rejection Criteria

Criteria	Acceptance	Rejection
Publication Year	2018-2024	Before 2018
Language	English	Non-English
Type of Reference	Journal article. proceedings, book	Thesis, Reports etc

The meticulous process of curating articles for the literature spotlight followed rigorous and established procedures. A modified PRISMA flow diagram, as depicted in Figure 1 by Tawfik et al. (2019), visually represents the article selection process. A total of 3.000 papers were initially identified through comprehensive database searches and formed the basis of this study. These articles underwent a meticulous screening process, meticulously adhering to pre-established criteria to ensure a thorough analysis.



Four additional criteria for eliminating articles before inclusion in the SLR study are derived from the accompanying article selection process flow diagram. Firstly, articles lacking the full text are excluded. Secondly, articles with inappropriate titles are eliminated. Thirdly, articles failing to meet the acceptance criteria are discarded. Lastly,

duplicate articles pulled from the database are removed. To fulfill the additional acceptance criteria, an article must possess the full text, have a relevant title, meet the study's acceptance criteria, and avoid duplication. Furthermore, it should contain empirical data rather than reviews.

During the data collection phase for this study, a total of 31 research papers were gathered from two primary databases, with Mendeley being a notable source. Key details from each article, including the title, author, publication year, focus on digital literacy, and its influence on instructional design in online education, were systematically extracted and organized in a table using Microsoft Word. A second table was created to categorize the strategies and approaches related to digital literacy integration and instructional design mentioned in each article, which facilitated the subsequent analysis. The results of this analysis will be presented in tabular form, following the predefined acceptance and rejection criteria to ensure the relevance and quality of the selected studies.

3 Findings and Discussion

The primary objective of this Systematic Literature Review (SLR) was to identify the most employed strategies related to digital literacy and their influence on instructional design for online education. After a comprehensive review of prior research articles, 31 publications met the established inclusion criteria. Table 2 presents the authors referenced in the study, along with a summary of the analyzed research publications.

Table 2. the authors referenced in the study

Author	Findings
Alakrashand Razak [10]	digital literacy is not just a side skill but a core competency for both EFL teachers and students in the 21st century. It directly impacts their ability to utilize technology effectively for language learning and teaching
Hamidah[11]	Teachers recognize the benefits of technology for student engagement, particularly for struggling readers and writers, but face barriers such as inadequate training, varying access to resources, and challenges related to their own digital literacy skills. To successfully integrate digital literacy into the classroom, providing teachers with sufficient training and resources is essential.
Sánchez-Cruzado et al., (Sánchez-Cruzado et al., 2021)	Digital literacy for teachers extends beyond basic technical skills and includes pedagogical knowledge for effectively integrating technology into teaching. Continuous professional development is essential for teachers to remain relevant with technological advancements and to enhance their students' digital competence.
Rusydiyah et a [13]	The study emphasizes the importance of integrating digital literacy into university curricula and providing instructional support to ensure teacher candidates maintain and enhance these skills throughout their studies and into their teaching careers. They also need to be adaptable and able to use digital learning resources effectively, given the increasing reliance on technology in education.

Author	Findings
Blau et al., [14]	emphasizes the importance of teachers understanding and implementing pedagogical approaches that effectively integrate technology to support collaboration, communication, and self-regulation in digital learning environments.
Záhorec et al [15]	the importance of teachers' digital literacy, focusing on the need for continuous professional development in this area. The study found that digital resources can support various educational goals, including increased attainment, addressing inequalities, and promoting inclusion
Liu et al [16]	the importance of digital literacy for teachers in developing new learning models and adapting to the changing educational landscape. It discusses a model for developing digital literacy based on a learning didactic triangle that considers real, virtual, and neurocognitive environments.
Marín & Castañeda [17]	Teachers play a crucial role in developing students' digital literacy, which is a multifaceted skill encompassing technical proficiency, critical thinking, and reflective practice in digital environments. Developing "digital teaching competence" requires specialized training and professional development focused on pedagogical integration of technology, subject matter instruction, communication, and collaboration. While there are challenges like varying definitions of digital literacy and the digital divide, focusing on these key areas can help teachers effectively foster digital literacy in their students.
Quaicoe & Pata [18]	The study in emphasizes the vital role of teachers' digital literacy in integrating technology effectively into education. Key findings include: TDL is crucial for both individual teacher practice and overall school ICT status; continuous professional development is essential for teachers to enhance and maintain their digital literacy; and TDL is a multifaceted concept encompassing knowledge, skills, and a positive attitude towards technology.
Alfia et al [19]	The open PDF indicates that teachers' understanding of digital literacy is often limited to using digital devices like computers and smartphones for delivering materials. It highlights that research tends to focus on how teachers apply digital literacy rather than how students integrate it into their learning. The authors of also emphasize the need for more research on student integration of digital literacy in EFL classrooms.
Agustini et al [20]	Teachers require substantial professional development in digital literacy to effectively utilize technology in education. While interaction with technology is common, true digital literacy requires a deeper understanding, which is often lacking even among frequent technology users. This highlights the need for focused training and development programs for teachers to enhance their digital competencies
Falloon [21]	that a shift is needed from a narrow focus on teachers' technical digital literacy to a broader understanding of digital competence. This expanded view encompasses pedagogical knowledge, critical thinking, and an understanding of the ethical and social implications of technology use, better equipping teachers to prepare students for a digitally-driven world. Teacher training programs must adapt to reflect this broader perspective.

Author	Findings
Yu [22]	digital literacy among teachers is crucial for effective online teaching, particularly during crises like the COVID-19 pandemic. It enables them to adapt their teaching methods, utilize online resources, manage technical issues and risks, and facilitate various aspects of online learning, including communication and assessment. Digitally proficient teachers are also more likely to embrace new opportunities for innovation in education.
Gutiérrez-Ángel et al [23]	Future teachers demonstrate strengths in digital communication and collaboration but often lack skills in creating digital content, especially multimedia. Therefore, teacher training programs need to be reevaluated to address these gaps and integrate digital literacy training across the curriculum. It's also important to assess teachers' self-perception of their digital literacy to inform effective training, as their digital literacy is a strong indicator of how well they will utilize technology in their teaching.
Nguyen & Habók,[24]	Teacher digital literacy is increasingly important due to the growing role of technology in education and society. Assessing this literacy requires comprehensive tools that account for its multifaceted nature, as current definitions and applications vary widely. The development and effective use of such tools are crucial for successful technology integration in education and broader societal progress.
Audrin & Audrin [25]	regarding digital literacy from a teacher's perspective are: inconsistent terminology usage of "digital literacy," "skills," and "competence"; a strong emphasis on teachers developing students' digital literacy within the classroom; and a question of the field's long-term relevance given the rapid pace of technological change.
Aydın & Çelik [26]	Teachers need these skills to create engaging learning environments, foster critical thinking in students about digital content, and prepare students for active participation in a digital society. The study highlights the importance of digital literacy for teachers to be effective educators and role models in the digital age.
Damanik & Widodo [27]	found a positive causal relationship between digital literacy, grit, instructional quality, and teachers' professional performance, mediated by teaching creativity. This suggests that digitally literate teachers who possess grit and provide high-quality instruction are more likely to be creative in their teaching, which in turn enhances their overall professional performance
Emidar et al [28]	Digital literacy is essential for teachers to create and utilize digital teaching materials effectively, cater to student needs, foster lifelong learning, and achieve their instructional goals. It's also a core skill that strengthens a teacher's overall pedagogical and professional abilities.
Oktaviani et al [29]	It brought various advantages to developing teachers' creativity, learning materials, and motivation. It encouraged them to improve their knowledge and skills in digital technologies
Ismail at al [30]	the crucial link between teachers' digital competencies and their ability to effectively integrate technology into the learning process
Ismail et al [30]	It's not enough for teachers to simply know how to use technology; they need to understand how to use it effectively and responsibly, incorporating critical thinking and information evaluation skills

Author	Findings
Priyank Kumar Shivam & Priyan K. M, [31]	Digitally proficient teachers are more likely to adopt innovative teaching methods, creating richer learning experiences
Chansa Chanda et al., [32]	Teachers' owns digital literacy skills directly impact their students' ability to develop these crucial skills. A lack of digitally proficient teachers can limit students' access to and understanding of digital tools and resources. Furthermore, information literacy, the ability to find, evaluate, and use information effectively, is a vital skill for both teachers and students in the digital age.
Digal et al [33]	Digital literacy crucial not only for effective teaching in the 21st century but also for the successful implementation of the K-12 curriculum and compliance with cybercrime and data privacy laws. Ultimately, improving teachers' digital literacy will better equip them to facilitate student learning and guide students in navigating the digital world
Jung et al., [34]	Teachers need support in developing comprehensive digital literacy skills, encompassing diverse device usage, online collaboration, effective digital pedagogy, and problem-solving, to enhance their teaching practices and better support student learning in the digital age
(Getenet et al [35]	preservice teachers require enhanced digital literacy, encompassing not just technical skills but also critical thinking and ethical considerations within specific digital contexts. This underscores the need for teacher education programs to prioritize and cultivate comprehensive digital literacy development.
Lo et al. [36]	suggest a strong positive relationship between service learning and critical digital literacy, and a moderating effect of online social capital on this relationship. Specifically, higher levels of SL and OSC are associated with higher levels of CDL, with the interaction between SL and OSC further enhancing CDL development.
[37]	According to the results of the study, both distance education perceptions and online learning readiness can be partly explained by digital skills. By integrating qualitative measures, a thorough examination of the impact of variables other than digital skills can be carried out in future studies
Nataliia & Khrystyna [38]	This system is well integrated with the work of universities, especially pedagogical departments that train future teachers of higher education institutions. Theoretical and practical study of media will allow students to understand the manipulative component of modern media
Indah [39]	The teacher's high level of digital literacy is strength to produce students with a high level of digital literacy as well

In today's rapidly evolving digital landscape, digital literacy has emerged as a fundamental competency for educators, particularly in the context of online instructional design [40]. This study systematically explores the influence of digital literacy on instructional design for online education, emphasizing its critical role in creating effective and engaging learning experiences. Digital literacy encompasses not only the ability to use information and communication technology but also the skills necessary to search, evaluate, and critically utilize information. As distance learning becomes increasingly

prevalent—especially since the COVID-19 pandemic—digital literacy is vital for both students and educators in designing relevant and effective learning experiences [41], [42]. Digital literacy is defined as the ability to effectively navigate and utilize digital technologies to access, evaluate, and create information. It includes a range of skills, from basic technical proficiency to advanced critical thinking and problem-solving abilities. For educators, digital literacy extends beyond mere technical skills; it involves pedagogical knowledge about how to integrate technology into teaching practices to foster collaboration, communication, and self-regulation among students[43]. This multifaceted nature of digital literacy is essential for teachers to create inclusive learning environments that accommodate diverse student needs.

Research indicates that teachers with strong digital literacy skills are better equipped to design interactive and collaborative learning experiences [44] . These experiences are crucial in online education, particularly in the post-pandemic era, where the rapid advancement of educational technology has transformed traditional teaching methods. Digitally literate teachers can effectively leverage various digital platforms and tools to deliver content, interact with students, and assess learning progress. By enhancing their digital literacy, educators can create engaging instructional materials that increase student involvement and motivation in the learning process[45]. However, the study also highlights several challenges that educators face when integrating technology into their instructional design. These challenges include a lack of comprehensive digital literacy training, disparities in access to technological resources, and insufficient preparedness among teachers to develop pedagogical strategies that align with modern technological demands [46]. Many educators may feel overwhelmed by the rapid pace of technological change and may lack the confidence to effectively incorporate new tools into their teaching practices.

One of the primary challenges faced by educators is the lack of comprehensive training in digital literacy. While many teachers may possess basic technical skills, they often lack the pedagogical knowledge necessary to effectively integrate technology into their instructional design [47], [48]. Professional development programs that focus on digital literacy are essential to equip educators with the skills and knowledge needed to navigate the complexities of online teaching. These programs should not only provide technical training but also emphasize the pedagogical implications of using technology in the classroom. Additionally, disparities in access to technological resources can hinder teachers' ability to implement effective online instruction. In many regions, schools may lack the necessary infrastructure, such as reliable internet access and up-to-date devices, which can create significant barriers to effective teaching and learning[49]. Educators in under-resourced schools may struggle to provide equitable learning opportunities for their students, further exacerbating existing educational inequalities.

Moreover, teachers often report feeling insufficiently prepared to develop pedagogical strategies that align with modern technological demands. The rapid pace of technological change can leave educators feeling unprepared to adapt their teaching methods to new tools and platforms [48], [50]. This lack of preparedness can lead to frustration and disengagement among both teachers and students, ultimately impacting the quality of online instruction. As a key element in online instructional design, digital literacy extends beyond technical skills to encompass pedagogical knowledge about how technology can be utilized to support collaboration, communication, and self-reg-

ulation in digital learning [51], [52]. The study found that continuous professional development for teachers is essential to ensure they can keep pace with technological advancements, thus enhancing their ability to foster students' digital literacy. In the context of online instructional design, a teacher's digital literacy impacts not only the selection and use of digital tools but also how they design learning experiences that are responsive and adaptive to students' needs [53], [54]. The literature review emphasizes that teachers' digital skills are closely linked to innovation in instructional design, where those with higher levels of digital literacy are more likely to adopt creative and innovative teaching methods. This connection underscores the importance of equipping educators with the necessary skills to navigate the digital landscape effectively.

4 Conclusion

This study highlights the critical role of digital literacy in shaping effective instructional design for online education. Digital literacy is not just a supplementary skill, but a fundamental competency that enables teachers to create engaging, interactive, and adaptive learning environments. Teachers who possess strong digital literacy are better equipped to integrate technology into their pedagogy, foster student collaboration, communication, and self-regulation in online learning. The literature reveals that continuous professional development in digital literacy is essential for teachers to stay current with technological advancements and effectively enhance their students' digital skills. Furthermore, digitally proficient teachers are more likely to innovate and adopt creative teaching strategies, ultimately improving the quality of online instruction.

However, challenges such as limited access to technology, inadequate digital literacy training, and gaps in pedagogical knowledge present significant barriers to successful technological integration. Addressing these challenges through comprehensive and sustained professional development is crucial for improving online instructional design. strengthening teachers' digital literacy is vital for enhancing the quality of online education. Educational institutions must prioritize ongoing digital literacy training, equipping teachers with the necessary skills and knowledge to adapt to the evolving technological landscape and improve learning outcomes for students in the digital age.

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