



The role of teachers in improving students' digital literacy in the 21st century learning era

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ABSTRACT

This research aims to examine the role of teachers in improving students' digital literacy in the 21st-century learning era through the library research method. The results of the study show that teachers play an important role as facilitators, motivators, and supervisors in developing students' ability to access, evaluate, and use digital information critically and ethically. Strategies such as blended learning and the use of digital media have proven effective in increasing student engagement. However, challenges such as limited infrastructure and a lack of teacher training remain major obstacles. This study recommends the need for cross-sectoral collaboration to support the strengthening of digital literacy through systematic integration in the educational curriculum.

1. Introduction

The rapid development of information and communication technology has brought significant changes in various aspects of life, including in the world of education. In the 21st century, the concept of literacy is no longer limited to reading, writing, and arithmetic, but also includes skills in understanding, evaluating, and using information from various digital sources wisely. This ability is known as digital literacy. According to Paul Gilster in his book entitled Digital Literacy, digital literacy is the ability to understand and use information in various formats from various sources conveyed through computers (Gilster, 1997). This is in line with the framework from UNESCO (2018), which emphasizes that digital literacy includes not only technical skills but also critical thinking skills, digital communication, and ethical understanding of the use of technology in the context of learning. The 21st-century generation, often referred to as digital natives, has unique characteristics. They grew up in a technology-laden environment and are used to accessing information instantly. However, exposure to technology is not always accompanied by the ability to evaluate and utilize information critically and responsibly (Nurlina et al., 2021).

In facing these dynamics, the world of education emphasizes the importance of mastering 21st-century skills known as the 4Cs: Critical Thinking, Communication, Collaboration, and Creativity. These four skills not only support students' cognitive abilities in solving complex problems but also strengthen their capacity to interact and innovate in the ever-evolving global world of work (Trisnawati & Sari, 2019). With mastery of the 4Cs, students are expected to be able to adapt to change, work in teams, convey ideas effectively, and produce creative solutions that are relevant to the challenges of the times. The OECD (2021) also underlines the importance of developing digital skills as part of 21st-century competencies that include problem-solving, collaboration, and information literacy in a dynamic global context.

Along with the importance of digital literacy, the role of teachers is becoming increasingly crucial in facilitating the modern learning process. Hakim (2021) emphasized that teachers need to develop a digital literacy framework that includes the ability to communicate, collaborate, maintain digital security, and solve problems using technology. Positive attitudes towards technology and the availability of adequate access are also important factors in enhancing teachers' digital competence. However, teaching experience and educational level are not necessarily the primary determinants.



Furthermore, Fitriyani & Teguh Nugroho (2022) stated that digital literacy is not only limited to technical skills in operating devices, but also includes broad life skills, such as social interaction, independent and collaborative learning, critical thinking, and creativity in a digital environment. Therefore, the integration of technology in learning must be accompanied by strengthening basic literacy so that digital literacy can develop comprehensively and meaningfully. This includes the ability to assess the validity of information, behave ethically in the digital space, and utilize technology to support learning outcomes. In this context, teachers no longer only act as conveyors of information, but also as facilitators, motivators, and guides in the digital learning process (Rahayu et al., 2023). They are responsible for equipping students with relevant digital literacy skills to be able to participate actively and responsibly in the digital society.

Therefore, this study aims to examine in depth the role of teachers in improving students' digital literacy in the 21st-century learning era. This study uses a literature review approach by examining various academic sources and previous research to provide a comprehensive understanding and practical recommendations on the issues discussed.

2. Method

This research uses a library research approach, with the aim of analyzing the role of teachers in improving students' digital literacy in the 21st-century learning era. The data analyzed in this study came from the results of a literature review that included books and scientific articles. Data processing is carried out in a descriptive manner, namely by compiling the information and facts that have been collected, then systematically analyzing them to produce relevant information and support the research objectives (Nurlita, 2016). The literature selection criteria include sources published in the last ten years (2014–2024), with priority on peer-reviewed publications and focusing on digital literacy issues, the role of teachers, and 21st-century learning strategies. The analysis approach used is thematic, by grouping data based on main themes, such as: (1) the definition and dimensions of digital literacy; (2) the role and competence of teachers; (3) technology-based learning strategies; and (4) implementation challenges and solutions in various contexts. With this approach, the research not only describes the existing findings but also compiles a critical synthesis of the literature studied, resulting in a deeper and contextual understanding of improving digital literacy through the role of teachers in the Indonesian education system.

3. Result

The Role of Teachers as Digital Literacy Facilitators

Teachers in the 21st-century learning era not only play the role of conveying information, but also as facilitators who guide students in developing digital literacy. This role includes the ability of teachers to design learning that utilizes digital technology, such as the use of e-learning platforms, educational social media, and interactive learning applications. Through this approach, teachers not only assist students in accessing various digital sources of information, but also guide them to analyze, evaluate, and use them critically and ethically responsibly. This is in line with the findings of Handiyani & Yunus Abidin (2023), which emphasize the importance of teachers' adaptation to technological developments to support effective learning.

In the 21st-century learning era, teachers are required to have mastery of technological literacy as an integral part of the learning process. In the implementation of teaching and learning activities, teachers need to integrate the use of technology along with mastery of materials and teaching skills (Akhwani & Rahayu, 2021).

Professional teachers are not only required to master subject matter and teaching methods, but also to be able to motivate students and understand their character and development. This understanding includes psychological and social aspects that are important in supporting learning success. Teacher professionalism is the foundation for creating knowledge-based education. For this reason, professional competence is very important so that teachers are able to carry out their roles optimally, especially in delivering material broadly, in-depth, and according to the development needs of students (Safitri, 2019).

In line with the demand for teacher professionalism and technological literacy, collaboration and continuous professional development become crucial. Teachers need to engage in reflective practices, peer discussions, and training that focus not only on pedagogy but also on digital transformation in education. As emphasized by Susilawati et al. (2022), continuous teacher training that integrates technology can enhance their ability to implement adaptive, student-centered learning. Therefore, creating a supportive ecosystem for teacher learning is essential to ensure they remain responsive, innovative, and effective in facing the dynamics of 21st-century education.

**Table 1.** The Role of Teachers as Digital Literacy Facilitators

No	The Role of the Teacher	Role Description	Implementation in Learning	Source
1	Access Information Providers	Teachers play the role of main facilitators in providing access to valid and relevant digital learning resources. This role is important so that students can learn independently and responsibly.	Provide access to e-learning platforms, online journals, educational videos, and multimedia content that supports the subject matter.	(Purba & Ain, 2024)
2	Information Evaluation Supervisor	Teachers guide students in evaluating the credibility of the digital information they encounter, so that they are not easily influenced by hoaxes or misleading information.	Train students to use information verification techniques, recognize trusted sites, and familiarize themselves with correct citations from digital sources.	(Khairany et al., 2024)
3	Director of Digital Ethics	Teachers instill ethical principles in the use of technology, including awareness of digital security and social media ethics.	Provide learning on digital ethics, cybersecurity, and digital footprint management through discussions and case studies.	(Nurjannah & Susilo, 2025)
4	Drivers of Digital Collaboration	Teachers facilitate digital-based collaborative learning to increase cooperation between students in completing assignments/projects.	Use collaborative tools like Google Workspace, Canva for Education, Padlet, and online discussion forums for group work.	(Nisa et al., 2023)
5	Digital Learning Strategy Innovator	Teachers develop technology-based learning approaches that are innovative and adaptive to the needs of digital native students.	Implementing strategies such as blended learning, flipped classroom, and digital-based project-based learning.	(Zunidar, 2019)

Technology-Based Learning Strategies

The implementation of technology-based learning strategies by teachers has been proven to increase students' digital literacy. These strategies include the use of digital learning media such as learning videos, infographics, and interactive quiz applications that can increase student engagement in the learning process. In addition, the application of learning models such as flipped classroom and blended learning allows students to learn independently and collaboratively, thereby strengthening their critical and creative thinking skills. Research by Pambudi & Windasari (2022) shows that changes in learning methods and media carried out by teachers can significantly increase students' digital literacy. Digital literacy brings various benefits as well as challenges. For example, the internet makes it easier to find information, but it also contains content that is less educational and useful. Therefore, students need to be critical when



searching for information online, be able to filter the data received, and apply it appropriately in daily life, especially in the learning process.

Learning strategies function as supporting elements that contribute to increasing students' enthusiasm for learning. This increase in motivation directly affects the effectiveness of the learning process and the achievement of student learning outcomes (Savitri et al., 2022). In today's digital era, students have the convenience of accessing technology and information. Therefore, the implementation of learning strategies that are in harmony with the digital context, such as the use of online learning media, interactive simulations, educational games, and various digital sources, can increase learning motivation. This is because the method is considered more interesting, and by the learning styles and interests of today's students. Learning strategies play an important role in improving teachers' teaching skills. In today's digital age, it is important for teachers to continue to develop their knowledge of various technology-based learning methods. A good understanding of various learning strategies allows teachers to deliver material more efficiently, interactively, and interestingly. This includes the use of online learning platforms, educational applications, and various digital devices to enrich students' learning experiences (Savitri et al., 2022).

Strategies that are adaptive and aligned with the characteristics of students also encourage active engagement in learning. In schools with good access, the use of virtual learning environments (VLEs) or mobile learning allows students to learn flexibly. In contrast, in the 3T region, digital strategies need to be combined with local approaches, such as the use of offline teaching materials or micro-teaching with simple tools, to remain inclusive and relevant.

Therefore, learning strategies remain the main foundation in the modern education system. Teachers are required to combine conventional methods with available technological innovations to create a relevant and engaging learning process. The focus remains on achieving learning goals and increasing student motivation, so that the learning process becomes more effective and meaningful.

Table 2. Technology-Based Learning Strategies

No	Learning Strategies	Description	Functions in Supporting Digital Literacy
1	Blended Learning	Combining in-person and online learning, it provides flexibility for students to learn independently and in a structured manner.	Increase access to digital learning resources and familiarize students with using various learning platforms.
2	Distance Learning	Face-to-face learning by utilizing media such as video calls, LMS, and two-way online communication.	Encourage students' independence in managing learning time, as well as getting used to the productive use of digital communication tools.
3	Mobile Learning	The use of mobile devices (smartphones/tablets) to access learning materials anytime and anywhere.	Forming daily digital literacy habits through mobile-based educational applications.
4	Virtual Learning Environment (VLE)	A web-based learning system that provides a virtual space for materials, assignments, attendance, and evaluation.	Facilitate a complete and structured digital learning experience, improving the competence of using the LMS.
5	Learning Innovation	The use of various digital platforms such as Google Sites, WhatsApp, Google Drive, and Google Forms.	Develop collaborative digital skills and online communication between students and teachers.

Challenges in Improving Digital Literacy

Although the role of teachers is vital in improving students' digital literacy, there are several challenges faced. One of them is the limitations of technology infrastructure in schools, such as the lack of computer devices and adequate internet access. In addition, not all teachers have enough digital competence to integrate technology into learning. This is exacerbated by a lack of training and support from educational institutions. According to Zuhri et al. (2024),



strengthening digital literacy requires a holistic approach that includes teacher training, infrastructure improvement, and curriculum integration that supports digital literacy. Here are some of the challenges in improving digital literacy (Fajri & Irwan Padli Nasution, 2023):

Limited Technology Access

The main challenge in improving digital literacy is the gap in access to devices and internet connectivity, especially in the 3T (disadvantaged, frontier, and outermost) areas. Many schools in rural or island areas do not have adequate infrastructure, such as a stable internet connection, the availability of ICT devices, and consistent power sources. As a result, digital learning becomes uneven; students in urban areas are exposed to technology faster than students in remote areas. This inequality not only has an impact on the quality of learning but also widens the digital divide between regions. The long-term solution includes government investment in digital education infrastructure as well as the provision of device subsidies for students and teachers.

Lack of Teacher Training

Digital learning transformation will not succeed without the readiness of teachers. Unfortunately, many teachers still do not receive adequate training in integrating technology pedagogically in teaching and learning activities. This challenge causes teachers to only use technology as a presentation tool (such as PowerPoint) without touching on the participatory or collaborative aspects of digital literacy. The role of teachers is crucial in guiding students to evaluate digital information and use it ethically. Training programs based on the TPACK (Technological Pedagogical Content Knowledge) and DigCompEdu approaches need to be expanded to systematically strengthen educators' digital competencies.

Information Overload and Disinformation

In the internet age, students have easy access to various information, but not all of it is true and useful. Excessive exposure to digital content makes students vulnerable to information overload, confusion in sorting out relevant information, and even believing in hoaxes or conspiracy theories. This challenge is exacerbated by the lack of media literacy among students and teachers. The impact is not only on learning, but also on the formation of students' character and morals. Therefore, digital literacy must be complemented by information literacy and media literacy, so that students have critical thinking skills in dealing with the rapid flow of information.

Curriculum Not Yet Integrated

Many schools still consider digital literacy as an additional skill, rather than as part of a core competency that students must master. As a result, digital literacy is not structured in the syllabus or in daily learning activities. The national curriculum, although it has begun to adopt the concept of "Pancasila Student Profile" and Freedom of Learning, has not fully described the indicators of digital literacy achievement in a concrete manner for each level of education. Without clear integration, digital learning tends to become an incidental activity or a mere formality. Strengthening digital literacy in the curriculum must include the development of teaching modules, digital literacy-based assessments, and strengthening the digital dimension in formative and summative assessments.

In addition to the issue of limited access to technology and a curriculum that is not yet supportive, another significant challenge is the rapid change in digital technology. Teachers need to keep updating their abilities and understanding of educational technology innovations. Without these updates, teachers' competencies are not in line with the needs of students in dealing with rapidly evolving digital information (Astuti & Artawan, 2023). In addition, the problem of information overload and disinformation is a major obstacle. This leaves students vulnerable to receiving uneducational content or hoaxes due to a lack of filtering and evaluating information skills. Therefore, teachers must be equipped with information and digital literacy skills to help students choose quality and useful information (Zuhri et al., 2024).

Collaborative Strategy as a Solution

To overcome the challenges of improving students' digital literacy in the 21st-century learning era, collaborative efforts are needed between teachers, schools, the government, and external parties. Here are some collaborative strategies as workable solutions:

1. Teacher Training and Professional Development



One of the main steps is to strengthen teacher training and professional development on an ongoing basis. Improving teachers' digital competence is a crucial step in supporting students' digital literacy. Continuous and targeted training can help teachers integrate technology into the learning process effectively. According to Zahara Salma et al. (2024), the development of teacher professionalism in the digital era requires a competency improvement strategy that involves thorough monitoring of aspects of learning and the use of technology. This training should not be one-off but must be continuous so that teachers can keep up with the rapid changes in educational technology.

2. Provision of Technology Infrastructure in Schools

The availability of adequate technological infrastructure, such as stable internet access and sufficient hardware, is essential in supporting digital-based learning. Fattah et al. (2023) emphasized that the availability of technological infrastructure plays an important role in supporting the success of digital literacy teaching. In many regions, especially the 3T (frontier, outermost, and disadvantaged) areas, this limited access is a major obstacle that needs to be resolved through policy interventions from the central and regional governments.

3. Integration of Digital Literacy in the Curriculum

Integrating digital literacy into the educational curriculum can help students develop the skills necessary to actively participate in the digital society. Research by Hadiani et al. (2024) shows that the integration of digital literacy in the curriculum can improve students' skills and character, as well as create creative and innovative learning methods.

4. Partnerships with External Parties

Partnering with educational institutions, technology companies, and non-governmental organizations can support digital literacy programs in schools through the provision of tools, training, and other resources. Wasilah et al. (2025) state that it is important for library managers to collaborate with external parties, such as technology service providers or educational organizations, to support the provision of the necessary infrastructure and training.

The role of teachers in improving students' digital literacy in the 21st-century learning era shows a paradigm shift from traditional roles as teachers to facilitators, mentors, and innovators of technology-based learning. This is in accordance with the opinion of Handiyani & Yunus Abidin (2023), who stated that teachers need to actively adapt to technological developments in order to be able to create a learning environment that is relevant to the needs of today's students. Teachers are not only required to deliver subject matter, but also must equip students with critical thinking skills, the ability to evaluate information, and the ethics of using technology responsibly (Handiyani & Yunus Abidin, 2023).

Teachers' ability to integrate technology-based learning strategies directly affects the effectiveness of students' digital literacy development. Strategies such as blended learning and flipped classroom allow for flexible, interactive, and collaborative learning that is more in line with students' learning styles in the digital era. The findings of Pambudi & Windasari (2022) show that the systematic use of digital interactive media can increase students' motivation and participation in learning, which in turn strengthens their digital literacy skills.

However, efforts to improve students' digital literacy cannot be separated from various complex challenges. One of the main challenges is the limited infrastructure in many schools, especially in remote areas, which hinders equitable access to digital learning. Fajri & Irwan Padli Nasution (2023) stated that the lack of technological devices and internet connections causes inequality in the quality of digital education between schools. In addition, there are still many teachers who do not have adequate digital competence, due to the lack of continuous training and mentoring. In fact, students' digital literacy is highly dependent on the capacity of teachers to model the use of technology effectively and wisely. Another challenge that is also significant is the phenomenon of information overload and disinformation, where students are faced with a flood of information that is not necessarily accurate. According to Zuhri et al. (2024), this condition requires strengthening information literacy and digital filtering skills, which are not only the responsibility of students but also require active assistance from teachers.

Therefore, strategic and collaborative solutions are needed to overcome these challenges. Continuous professional training for teachers is a crucial first step. Zahara Salma et al. (2024) underline the need to strengthen teachers' abilities in aspects of technology and digital learning as a strategic step in supporting educational transformation in the digital era. In addition, the integration of digital literacy in primary and secondary education curricula can be a systemic approach to equip students with 21st-century skills across the board. Finally, partnerships between schools and external parties such as technology institutions, educational communities, and non-governmental organizations can strengthen the provision of resources, training, and programs to support digital literacy. Wasilah et al. (2025) show that cross-sector collaboration can accelerate digital transformation in the educational environment, especially in the provision of relevant infrastructure and training. Thus, improving students' digital literacy requires a holistic approach that involves the active role of teachers, school policies, government support, and community participation. The change in the educational



paradigm towards the digital era is not only about the use of technology, but also about building a critical, collaborative, and ethical literacy culture among students.

4. Conclusion

Digital literacy is an important skill that students must have in the 21st-century learning era. This ability allows students to think critically, evaluate information, and actively participate amid rapid technological developments. In this context, teachers have a strategic role, not only as teachers but also as facilitators, mentors, and role models in the wise and ethical use of technology. The application of technology-based learning strategies, such as blended learning, flipped classrooms, and the use of interactive digital media, has been proven to be able to significantly increase students' digital literacy. However, challenges such as limited infrastructure, lack of teacher training, and the risk of disinformation and information overload remain obstacles that need to be systematically addressed. As a practical implication, teachers need to be equipped with continuous digital literacy training based on field needs. On the other hand, the integration of digital literacy into the curriculum is explicitly an important step so that learning not only focuses on content, but also on strengthening 21st-century skills. In terms of policy, the government and education stakeholders need to accelerate the equitable distribution of digital infrastructure in schools, especially in disadvantaged areas. In addition, collaboration with the private sector and educational organizations is also needed to strengthen technical support and resources in the implementation of digital learning. With this collaborative approach, an education ecosystem that is conducive, adaptive, and inclusive to digital development can be realized.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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