

Digital Literacy of Teachers and Students in Learning Transformation

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ABSTRACT

Digital transformation in education requires teachers and students to possess digital literacy as a fundamental competence in responding to changes in learning environments. Digital literacy is not limited to the ability to operate technological devices but also includes the ability to access, evaluate, manage, and utilize digital information critically, ethically, and responsibly. This article aims to analyze the role of teachers' and students' digital literacy in supporting learning quality improvement in the digital era. This study employed a library research method by examining scientific literature published over the last five years related to digital literacy, teachers' digital competence, and technology-based learning. The findings indicate that teachers' digital competence plays an essential role in integrating technology pedagogically, while students' digital literacy supports independent learning, critical thinking skills, and productive technology utilization. However, the implementation of digital literacy still faces several challenges, including competency gaps, human resource readiness, and the need to strengthen digital culture within educational environments. Therefore, sustainable strategies are required through teacher competency development, digital literacy integration into learning processes, and systematic educational policy support.

Keywords: *Digital Culture, Digital Competence, Digital Literacy, Digital Learning; Educational Transformation.*

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ARTICLE HISTORY

Received : July 4, 2024

Final Revised : August 23, 2024

Accepted : October 25, 2024

Published : December 30, 2024

1. | INTRODUCTION

The development of information and communication technology has brought significant changes to various aspects of life, including the education sector. The integration of digital technology in the learning process is no longer seen as an option, but rather as a need to support the creation of adaptive, innovative, and competency-oriented learning in the 21st century. These changes require teachers and students to have the ability to use technology effectively, critically, and responsibly. Therefore, digital literacy is one of the fundamental competencies that must be possessed by all school residents so that the learning process is able to answer the challenges of educational transformation in the digital era (Pérez-Escoda et al., 2019; Wohlfart & Wagner, 2023).

Digital literacy is not only interpreted as the ability to operate technological devices, but also includes the skills to access, evaluate, manage, produce, and communicate information through digital media in an ethical and responsible manner. This concept is developing along with the increasing complexity of the digital ecosystem which requires individuals to have the ability to think critically about information obtained from various digital platforms. In the context of education, digital literacy plays an important role in shaping students' ability to learn independently, solve problems, collaborate, and produce innovations through optimal use of technology (Achmad & Utami, 2022; Audrin & Audrin, 2022).

On the other hand, the success of the implementation of digital literacy in schools is greatly influenced by the digital competence of teachers. Teachers not only function as conveyors of learning materials, but also as facilitators who are able to design technology-based learning experiences according to the characteristics of students. Mastery of digital competencies allows teachers to choose the right learning media, utilize learning management systems, develop digital assessments, and build a collaborative learning environment. Various studies show that teachers' digital competencies have a close relationship with the quality of technology-based learning implementation and the effectiveness of online and blended learning (Göksel & İstifçi, 2022; Sappaile et al., 2023; Cabero-Almenara et al., 2021).

In addition to teachers, students are also required to have adequate digital literacy skills as a provision in dealing with the rapid flow of information in the digital space. The ease of obtaining information through the internet presents a great opportunity to expand knowledge, but at the same time it also increases the risk of spreading invalid information, hoaxes, plagiarism, digital ethics violations, and cyberbullying. Therefore, strengthening students' digital literacy must be directed not only at the aspect of technical skills, but also at the development of critical thinking skills, digital ethics, digital security, and responsibility in utilizing technology for the benefit of learning (Castellví et al., 2020; Zhang, 2023).

Various studies over the past five-year period have shown that strengthening digital literacy can improve the quality of learning, student involvement, independent learning

ability, and collaboration skills. The implementation of various digital learning platforms, such as learning management systems and internet-based learning applications, has been proven to contribute to increasing the effectiveness of the learning process if supported by adequate digital competence of teachers. On the contrary, low digital literacy skills are one of the factors that hinder the optimization of the use of technology in education (Mannan et al., 2023; Sadieda & Sutini, 2023; Teichert et al., 2023).

Although various efforts to strengthen digital literacy have been carried out through the integration of technology in learning, teacher training, and curriculum development oriented towards digital transformation, the implementation still faces various challenges. These challenges include the digital competency gap between teachers, differences in students' ability to utilize technology, limitations in the use of digital learning resources pedagogically, and the lack of optimal integration of digital literacy into the learning process systematically. In addition, the rapid development of technology requires continuous competency improvement so that teachers and students are able to adapt to changes in the digital learning environment (Hasanah et al., 2022; Alberola-Mulet et al., 2021).

Based on these conditions, digital literacy needs to be understood as an integral part of improving the quality of education, not just the ability to use digital devices. Strengthening digital literacy must be done through collaboration between teachers, students, schools, and education policy support that encourages the creation of a healthy, safe, and productive digital learning culture. Thus, the learning process not only produces students who are able to utilize technology, but also individuals who have the ability to think critically, creatively, collaboratively, and responsibly in dealing with the dynamics of digital society. In line with this, this article aims to analyze the urgency of digital literacy for teachers and students in supporting learning transformation, identify various implementation challenges, and examine strategies to strengthen digital literacy as an effort to improve the quality of learning in the digital education era.

2. | RESEARCH METHOD

This research uses a library research approach with the aim of obtaining a comprehensive understanding of the digital literacy of teachers and students in the context of education. Literature studies were chosen because they allow researchers to identify, review, compare, and synthesize various concepts, theories, empirical research results, and policies related to strengthening digital literacy in the educational environment. This approach does not involve collecting field data, but rather focuses on critical analysis of various scientific sources that have relevance to the research topic. Through literature studies, researchers can compile scientific arguments based on previous research findings so that a complete picture of the development of digital literacy, the challenges of its implementation, and strategies to strengthen the digital

competence of teachers and students in supporting learning transformation (Achmad & Utami, 2022).

The data sources used in this study consist of secondary data derived from national and international scientific articles, academic books, and policy documents related to digital literacy and education. Scientific articles are selected based on the criteria of thematic relevance, publisher credibility, and year of publication, which is the last five-year span, so that it is able to represent the latest developments regarding digital literacy in the world of education. Literature search is carried out through a scientific database indexed on Google Scholar using keywords such as digital literacy, teacher digital competence, student digital literacy, digital pedagogy, educational technology, and digital learning. All sources obtained were then selected based on the suitability of the substance with the research focus so that only literature had a direct relationship with teachers' digital competence, students' digital literacy, the implementation of technology-based learning, and educational transformation which were used as analysis materials (Hasanah et al., 2022).

The data collection technique is carried out through documentation of various library sources that have met the inclusion criteria. Each reference is read in depth to identify the research objectives, approaches used, key findings, and their implications for the development of digital literacy in education. Furthermore, the information obtained is classified based on the main themes, such as the concept of digital literacy, teachers' digital competence, students' digital literacy, implementation challenges, and strategies to strengthen digital literacy. The grouping aims to facilitate the synthesis process so that relationships between findings from various complementary studies are obtained.

Data analysis uses content analysis techniques that are carried out systematically through the stages of data reduction, information organization, interpretation, and conclusion drawn. In the reduction stage, various information that is not relevant to the research objectives is eliminated so that only data related to the focus of the study are retained. The next stage is to group data based on similarities in concepts and research results, then compare to find patterns, tendencies, similarities, and differences between research results. The results of the synthesis are then interpreted critically to produce a comprehensive understanding of the urgency of digital literacy for teachers and students in improving the quality of learning in the digital era. This analytical approach allows research to produce conclusions based on the integration of various empirical findings so that it has a strong academic basis and can be a reference for the development of educational policies and practices in the future (Wohlfart & Wagner, 2023).

3. | RESULTS AND DISCUSSION

The results of the literature review show that digital literacy has developed into one of the main competencies that determine the success of education implementation in the era of digital transformation. Various studies have emphasized that digital literacy is no longer understood as being limited to the ability to use technological devices, but

includes the ability to access, evaluate, manage, create, and distribute information through digital media in a critical, ethical, and responsible manner. These developments show a paradigm shift from mastery of technology to the ability to utilize technology as a means to build knowledge, solve problems, and improve the quality of learning. Pérez-Escoda et al. (2019) explained that digital literacy is a multidimensional competence that involves technical, cognitive, social, and ethical aspects in the use of digital technology. These findings are strengthened by Achmad and Utami (2022) who stated that digital literacy is the main foundation in building a learning ecosystem that is adaptive to technological developments and the needs of an information-based society.

In educational practice, the success of the implementation of digital literacy is greatly influenced by the digital competence of teachers. Teachers have a strategic position as learning designers, facilitators, and mentors in shaping a positive digital culture in the school environment. Learning transformation cannot run optimally if teachers only master the use of digital devices without being able to integrate technology into effective pedagogical strategies. Therefore, teachers' digital competencies must include the ability to choose learning media, develop digital teaching materials, utilize online learning platforms, prepare digital assessments, and evaluate technology-based learning outcomes. Göksel and İstifçi (2022) emphasized that the development of teachers' digital competencies must be an integral part of teacher education and professional development. This view is in line with the digital competency framework of educators put forward by Cabero-Almenara et al. (2021), which places digital pedagogic competence as the main indicator of the success of technology-based learning.

Other studies show that the quality of digital learning is not only determined by the availability of technology, but also by the readiness of teachers to use it pedagogically. Teachers who have high digital literacy tend to be better able to create interactive, collaborative, and student-centered learning. On the contrary, the limitations of digital competence cause technology to be only used as a medium for delivering material without providing a meaningful learning experience. The findings of Wohlfart and Wagner (2023) show that the digital transformation of education is highly dependent on changing the role of teachers from informants to learning facilitators who are able to utilize technology to develop students' critical thinking, creativity, communication, and collaboration skills. The results of Teichert et al.'s (2023) research also show that teachers who have digital competence are better able to manage virtual classrooms effectively, increase student participation, and create more dynamic learning interactions.

In addition to teacher competence, students' digital literacy is a factor that determines the success of learning in the digital era. Students are exposed to a learning environment that provides access to a huge amount of information through various digital platforms. This condition provides an opportunity to expand knowledge while

presenting challenges in the form of the dissemination of invalid information, hoaxes, plagiarism, and misuse of technology. Therefore, the ability to think critically is an integral part of digital literacy. Castellví et al. (2020) affirm that critical digital literacy helps learners analyze the credibility of information before using it in the learning process. In line with that, Zhang (2023) stated that the development of digital literacy should be directed at the ability to evaluate information, make rational decisions, and use technology responsibly in various academic activities.

Strengthening students' digital literacy also contributes to improving independent learning skills. The use of various digital learning resources allows students to obtain a more flexible learning experience according to their needs and characteristics. Mannan et al. (2023) found that digital literacy has a positive relationship with the heutagogy approach, which is learning that places students as the main subject in managing their own learning process. Students who have high digital literacy tend to be more able to find relevant learning resources, develop problem-solving skills, and utilize technology as a means of improving academic competence. These findings are strengthened by Sadieda and Sutini (2023) who show that the appropriate use of digital learning platforms can improve digital literacy skills while encouraging students' learning independence.

However, the results of the synthesis of various studies show that the implementation of digital literacy in the educational environment still faces a number of challenges. One of the main challenges is the digital competency gap among teachers and students. Not all teachers have the same level of mastery of technology, so the quality of digital learning still varies. Similarly, learners have different backgrounds of digital experiences so the ability to utilize technology for academic purposes is not evenly distributed. Hasanah et al. (2022) in their systematic study revealed that improving teachers' digital competencies still requires a continuous training program to be able to keep up with very fast developments in educational technology. Alberola-Mulet et al. (2021) also emphasized that teachers' belief in the benefits of technology has a direct effect on the intensity and quality of its use in the learning process.

Other findings show that the success of strengthening digital literacy is not enough only supported by the provision of technological infrastructure. This success requires a change in the learning culture that encourages the use of technology in a productive, creative, and responsible manner. Teachers and students must be aware that technology is not just a learning tool, but also a means of building 21st century competencies that include critical thinking skills, creativity, communication, collaboration, and lifelong learning. Therefore, digital literacy needs to be integrated into the entire learning process through activities that encourage students to process information, produce digital works, solve real problems, and work together in a technology-based learning environment. This approach is in line with the results of research by Achmad and Mulyati (2023) which shows that the positive perception of teachers and students of

digital literacy contributes to increasing learning motivation, technology utilization, and readiness to face changes in the digital education environment.

The success of the implementation of digital literacy is also influenced by the ability of educational institutions to develop a learning ecosystem that supports innovation and collaboration. A learning environment that utilizes technology in a planned manner allows teachers and students to build more active interactions through the use of various digital platforms, open learning resources, and communication media that support synchronous and asynchronous learning. In this context, technology functions as an instrument to expand access to knowledge while improving the quality of the learning experience. Beltrán-Sánchez et al. (2019) explained that the successful integration of digital literacy programs in schools is influenced by institutional policy support, human resource readiness, and the availability of sustainable implementation strategies. The findings show that strengthening digital literacy should be part of the school organizational culture, not just incidental programs.

The development of digital technology has also encouraged the emergence of various learning innovations that are more flexible and student-centered. The use of digital learning platforms, collaborative applications, interactive media, and internet-based learning resources provides opportunities for students to have a more meaningful learning experience. However, these innovations will only have a positive impact if teachers are able to design learning activities that integrate learning objectives, pedagogical strategies, and the use of technology in a balanced manner. Research by Iriyani et al. (2023) shows that the trend of digital literacy research in education continues to increase because this competence is seen as one of the factors that determine the quality of learning in the future. This shows that digital literacy has developed into one of the main focuses in the development of educational policies and practices at various levels.

In addition to being oriented towards improving academic skills, digital literacy also has an important role in shaping the character of students as responsible digital citizens. The ability to use technology must be accompanied by awareness of communication ethics, personal data protection, respect for intellectual property rights, and the ability to interact politely in the digital space. Students who have good digital literacy will be better able to distinguish valid and invalid information, avoid the spread of false information, and utilize digital media for productive activities. Audrin and Audrin (2022) emphasized that the digital media literacy program in schools has a positive impact on students' ability to think critically, evaluate information, and make decisions responsibly when interacting in a digital environment.

On the other hand, teachers also have a responsibility to be role models in the professional use of technology. Teachers are required not only to master digital devices, but also to demonstrate ethical, safe, and ethical technology use practices in accordance with educational goals. These competencies are becoming increasingly important as the use of various learning applications, social media, and artificial intelligence-based

technology in the teaching and learning process increases. Göksel and İstifçi (2022) explained that the development of digital literacy in teacher education must be directed at improving pedagogical skills as well as reflective skills on the use of technology. This opinion is strengthened by Pérez-Escoda et al. (2019) who stated that digital literacy includes social and ethical dimensions so that its development cannot be separated from the formation of digital characters of educators and students.

The results of the synthesis of various studies also show that continuous professional training is an effective strategy to improve teachers' digital competence. Training not only focuses on mastering certain applications or software, but also on the ability to design innovative learning, conduct digital assessments, utilize learning outcome data, and develop learning media that suits the needs of students. Wohlfart and Wagner (2023) emphasized that the success of the digital transformation of education requires long-term investment in teacher competency development through systematic training. In line with this, Hasanah et al. (2022) stated that strengthening teachers' digital competencies needs to be carried out on a sustainable basis because the development of educational technology is taking place very quickly and continues to present new challenges.

Strengthening students' digital literacy also requires a learning strategy that provides them with opportunities to learn through hands-on experience. Project-based learning, collaborative learning, problem-solving, and the use of digital learning resources have been proven to be able to improve students' critical thinking skills as well as creativity in producing digital works. Research by Mannan et al. (2023) shows that learners who are used to using technology independently have better lifelong learning abilities. These findings are supported by Sadieda and Sutini (2023) who found that the integration of digital platforms in learning can increase active participation, collaboration skills, and student learning independence if designed systematically by teachers.

Furthermore, the implementation of digital literacy requires support for education policies that encourage the integration of technology into the curriculum, learning process, and evaluation system. Schools need to develop a structured digital literacy program through curriculum development, provision of supporting facilities, development of teacher learning communities, and periodic evaluations of the digital competencies of all school residents. Cabero-Almenara et al. (2021) emphasized that the educator digital competency framework can be used as a reference in designing systematic teacher capacity building programs. Meanwhile, Beltrán-Sánchez et al. (2019) show that the successful implementation of digital literacy programs is influenced by the institution's commitment to providing consistent policies, management support, and continuous evaluation of program implementation.

Overall, the results of the literature study show that digital literacy is an important foundation in realizing quality learning in the era of digital transformation. The digital competencies of teachers and students complement each other in creating an innovative,

collaborative, and skill-development-oriented learning process for the 21st century. Teachers play the role of the main driving force in integrating technology into pedagogical practices, while students become active learning subjects in utilizing technology to acquire, process, and produce knowledge. Therefore, strengthening digital literacy must be carried out comprehensively through improving teacher competence, familiarizing students' digital literacy, developing technology-based school culture, and sustainable policy support. Thus, digital transformation in education not only increases the effectiveness of the learning process, but also produces human resources who have the ability to think critically, creatively, collaboratively, communicatively, and responsibly in facing the dynamics of the future digital society (Achmad & Mulyati, 2023; Teichert et al., 2023; Zhang, 2023; Alberola-Mulet et al., 2021).

4. | CONCLUSION

Digital literacy is an important competency in supporting educational transformation in the digital era because it is directly related to the ability of teachers and students to utilize technology effectively, critically, creatively, and responsibly. Based on the results of the literature review, digital literacy is not only limited to technical skills in using digital devices, but also includes the ability to access, evaluate, process, produce, and communicate information through technology by considering ethical and digital security aspects.

Teachers have a central role in the success of strengthening digital literacy because they are the main drivers in integrating technology into the learning process. Teachers' digital competence is needed so that the use of technology is not just a tool for delivering material, but is able to create an interactive, collaborative, and skill-development-oriented learning experience for the 21st century. On the other hand, students need to be equipped with digital literacy in order to be able to utilize technology as a source of learning, develop independence, and face various information challenges in the digital space wisely.

Strengthening digital literacy still faces various challenges, such as differences in digital competencies, readiness of human resources, non-optimal use of technology, and the need for a positive digital culture in the educational environment. Therefore, a sustainable strategy is needed through improving teacher competence, integrating digital literacy in learning, developing technology-based school programs, and supporting consistent education policies.

Thus, digital literacy needs to be positioned as an integral part of improving the quality of education. Collaboration between teachers, students, schools, and policy makers is the key to creating a digital education ecosystem that is adaptive, inclusive, and oriented towards the formation of a generation that is able to face technological changes and future societal challenges.

Acknowledgment

We gratefully acknowledge the contributions of individuals who supported the completion of this article.

Funding Information

This research did not receive any funding.

Conflict of Interest Statement

The authors declare that there is no conflict of interest.

Ethical Approval and Originality Statement

Ethical approval was obtained for this study. The manuscript represents original work and has not been previously published, nor is it under consideration by another journal.

Data Disclosure Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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