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A Comparative Study of Students' Digital Literacy Between the Pandemic Era (2021-2022) and the Post-Pandemic Era (2024-2026)

Mohamad Adis Syauqi Nayif [1]*, Firdausi Nurharini[2]
Elementary School Teacher Education Study Program, Faculty of Teacher Training and Education, Trunodjoyo University, Madura
Email:
230611100094@student.trunojoyo.ac.id*; firdausi.nurharini@trunojoyo.ac.id

Key Words:

Digital literacy, hybrid learning, elementary school, post-pandemic, educational transformation.

Abstract: The development of digital literacy in hybrid learning has undergone significant changes from the COVID-19 pandemic period to the post-pandemic era. This study aims to analyze the development of digital literacy among elementary school teachers and students through a comparative literature study between the pandemic phase (2021-2022) and the post-pandemic phase (2024-2026). The study employed a qualitative approach using a comparative literature review method on various academic journals discussing hybrid learning, digital competence, and the transformation of educational technology.

The findings reveal that during the pandemic phase, digital literacy was primarily oriented toward emergency adaptation to the use of basic digital platforms such as Zoom, Google Classroom, and WhatsApp Groups. Teachers and students encountered various challenges, including limited infrastructure, low levels of digital competence, and high levels of digital fatigue caused by the intensity of online learning. Meanwhile, in the post-pandemic phase, digital literacy developed into a more advanced stage through the integration of Learning Management Systems (LMS), Artificial Intelligence (AI)-based learning, the use of interactive media, and the improvement of digital pedagogical competencies among elementary school teachers.

This transformation indicates that hybrid learning is no longer viewed as a temporary solution, but rather as an adaptive learning model that supports flexibility, collaboration, and personalized learning. The study concludes that the development of digital literacy in the post-pandemic era demonstrates significant improvements in technological competence, digital pedagogy, and collaborative skills among elementary school students compared to the pandemic phase. Therefore, strengthening digital education policies, providing continuous teacher training, and ensuring equal access to technological infrastructure are necessary to support inclusive and sustainable hybrid learning.

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INTRODUCTION

The development of digital technology has brought significant changes to the education system, particularly in the implementation of learning in elementary schools. The integration of technology in learning encourages teachers and students to develop better digital literacy skills in order to adapt to the demands of 21st-century education. According to Gilster (1997) and Jannah, digital literacy is not only related to the ability to use technology, but also the ability to understand, evaluate, and utilize digital information effectively.

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The COVID-19 pandemic became one of the factors that accelerated digital transformation in the field of education. Learning, which had previously been dominated by face-to-face instruction, rapidly shifted to online and hybrid learning. This condition required elementary school teachers to adjust their teaching strategies by utilizing various digital platforms to maintain the continuity of the learning process (Dhawan, 2020). In addition, students were also required to become accustomed to using digital devices in their daily learning activities.

During the pandemic phase in 2021-2022, the implementation of hybrid learning was still in the stage of emergency adaptation, resulting in various challenges in its implementation. Teachers experienced limitations in digital pedagogical competence, while students faced obstacles such as limited internet access and inadequate digital learning devices. Trust and Whalen (2020) explained that most teachers still experienced difficulties in developing interactive and effective digital learning. This situation caused the quality of hybrid learning during the pandemic to be less than optimal.

Nevertheless, the pandemic also had a positive impact on the development of digital literacy in elementary education. The intensive use of technology during the pandemic encouraged teachers and students to become more familiar with using digital platforms in the learning process. Moorhouse and Kohnke (2021) explained that learning experiences during the pandemic became the starting point for the establishment of a digital learning culture at various levels of education, including elementary schools.

Entering the post-pandemic era of 2024-2026, the development of hybrid learning has shown progress toward a more mature and integrated stage. Technology is no longer used solely as a communication tool in learning, but has also been utilized to support students' creativity, collaboration, and learning flexibility. According to Holmes and Tuomi (2022), the development of educational technology in the post-pandemic era has begun to lead toward the integration of Artificial Intelligence (AI), Learning Management Systems (LMS), and interactive learning media in the learning process.

These changes indicate that the development of digital literacy in hybrid learning has improved not only in terms of technology use, but also in terms of the quality of digital learning. Teachers have begun to develop more innovative digital pedagogical competencies, while students have demonstrated better independent learning and digital collaboration skills. This condition shows that hybrid learning has started to evolve into an essential part of the modern education system in elementary schools (Falloon, 2024).

Based on these conditions, this study aims to analyze the development of digital literacy in hybrid learning through a comparative literature study between the pandemic era of 2021-2022 and the post-pandemic era of 2024-2026. This research is important to provide an overview of changes in the digital competencies of elementary school teachers and students, as well as the development of hybrid learning implementation in elementary education.

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METHODS

This study employed a qualitative approach using the comparative literature review method to analyze the development of digital literacy in hybrid learning during the pandemic and post-pandemic eras. This method was used to compare changes in the implementation of digital learning based on findings from previous studies. According to Creswell (2021), a qualitative approach is used to understand social phenomena in depth based on data interpretation and research context.

The data sources were obtained from various national and international scientific journals discussing digital literacy, hybrid learning, and the transformation of educational technology in elementary schools. The articles used were published during 2021-2022 as a representation of the pandemic phase and 2024-2026 as a representation of the post-pandemic phase. The selection of these time periods aimed to identify changes in the development of digital literacy between the emergency adaptation phase and the maturity phase of educational technology.

The data collection process was conducted through searches of scientific articles in databases such as Google Scholar, Scopus, and ScienceDirect using keywords including "digital literacy," "hybrid learning," "elementary school," "post-pandemic education," and "technology-based learning." The selected articles were journals relevant to the focus of the study and related to the development of digital literacy among elementary school teachers and students.

The stages of data analysis were carried out through the processes of identification, classification, comparison, and interpretation of findings from previous studies. The researcher grouped the literature into two main phases, namely the pandemic phase (2021-2022) and the post-pandemic phase (2024-2026). Furthermore, the data were analyzed to examine changes in the use of learning technology, the development of digital literacy competencies, and the transformation of hybrid learning implementation in elementary schools.

Through the comparative literature review method, this study is expected to provide an analytical overview of the development of digital literacy in hybrid learning as well as changes in the quality of digital learning in elementary education. This method also assists researchers in identifying challenges and opportunities for the development of technology-based learning in the post-pandemic era.

This study also employed a qualitative approach using the comparative literature review method to analyze the development of digital literacy in hybrid learning across two different phases, namely the pandemic era of 2021-2022 and the post-pandemic era of 2024-2026. The comparative literature review method was chosen because it is capable of providing an in-depth analysis of changes in concepts, implementation, and the development of digital literacy based on various previous studies (Kraus et al., 2022). This approach enables researchers to systematically and critically compare the characteristics of hybrid learning across the two periods (Snyder & Boell, 2020).

The research data sources consisted of reputable national and international journal articles discussing digital literacy, hybrid learning, teachers' digital competencies, and digital educational transformation in elementary schools (Bond et al., 2021). The articles were obtained from academic databases such as Google Scholar, Scopus, ScienceDirect, and ERIC using the keywords "digital literacy," "hybrid learning," "elementary education," "post-pandemic learning," and "digital pedagogy." According to Kraus et al. (2022), selecting relevant and structured literature sources is an important step in maintaining the quality of scientific literature reviews. The inclusion criteria in this study included articles published between 2021 and 2026, discussing the context of elementary education, and having relevance to the development of digital literacy in hybrid learning. In addition, Creswell (2011) explained that selecting data sources that align with the research focus plays an important role in improving the validity of qualitative research analysis.

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The data analysis technique was conducted through stages of data reduction, theme categorization, literature comparison, and interpretation of research findings. The researcher grouped the findings into two main categories, namely the pandemic phase of 2021-2022 and the post-pandemic phase of 2024-2026, to facilitate the comparison process. Furthermore, the researcher analyzed changes in teachers' digital competencies, students' digital skills, the use of learning technologies, and the effectiveness of hybrid learning implementation across both phases. According to Creswell (2011), data validity was ensured through source triangulation by comparing findings from various studies with similar themes in order to obtain more objective and reliable conclusions.

RESULTS

1. Analysis of the 2021-2022 Phase: Digital Literacy during the Emergency Adaptation Period

During the pandemic phase of 2021-2022, hybrid learning developed as a form of emergency adaptation to social restrictions caused by the COVID-19 pandemic. Elementary school teachers during this period mainly used basic digital platforms such as Zoom, Google Meet, and WhatsApp Groups to maintain the continuity of learning. According to Dhawan (2020), the use of technology during the pandemic was primarily oriented toward maintaining the continuity of the learning process. This condition also indicated that elementary schools were still in the early stages of adapting to digital learning (Moorhouse & Kohnke, 2021).

In addition, teachers' digital literacy was still dominated by basic technical and operational skills in using online learning media. Teachers tended to use digital media only as a means of delivering materials and communicating in the learning process. This condition showed that technological adaptation during the pandemic was still at the initial stage of digital learning development. Kim et al. (2021) explained that most teachers still experienced limitations in mastering digital pedagogy. This situation caused online learning to be more one-way and less interactive for elementary school students (Besser et al., 2022).

From the students' perspective, various challenges were still encountered during the implementation of hybrid learning during the pandemic. Limited internet access, inadequate digital devices, and low levels of independent learning became major obstacles in the online learning process. This situation resulted in less varied learning interactions and limited opportunities to create interactive learning experiences for elementary school students (Besser et al., 2022).

Nevertheless, the pandemic also had a positive impact on the development of digital literacy in elementary education. Many teachers began learning independently how to use digital learning platforms and attempted to develop technology-based learning media. On the other hand, students became increasingly accustomed to using digital devices to participate in learning and search for supporting learning resources. Moorhouse and Kohnke (2021) explained that learning experiences during the pandemic became the initial stage in the formation of a digital learning culture in elementary schools.

2. Transformation of the 2024-2026 Phase: Digital Literacy in the Era of Educational Technology Maturity

In the post-pandemic era of 2024-2026, hybrid learning began to develop into a more flexible system integrated with digital technology. According to Kraus et al. (2022), this development can be seen from the increasing use of digital learning platforms and interactive media in elementary school learning processes. Teachers began utilizing Learning Management Systems (LMS), interactive videos, and various learning applications to support students' learning activities.

These changes indicate that technology is no longer used merely as a communication tool in learning, as it was during the pandemic. Teachers have started to develop project-based learning, digital assessments, and collaborative activities that increase student engagement in the learning process. Holmes and Tuomi (2022) explained that the development of teachers' digital pedagogy has become one of the key factors in the success of hybrid learning in the post-pandemic era. In addition, the use of interactive learning media has also increased student participation in learning activities (Sulaiman et al., 2023).

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Furthermore, hybrid learning in the post-pandemic era demonstrates greater flexibility in the implementation of learning. Students can access learning materials anytime and anywhere through digital platforms provided by schools. This condition gives students opportunities to learn according to their own abilities and learning pace. According to Huljanah and Zai (2025), the flexibility of digital learning helps elementary school students become more independent in the learning process.

From the students' perspective, the development of digital literacy can also be seen through improvements in virtual communication skills, digital information searching, and the completion of technology-based assignments. Students have become accustomed not only to using digital devices for participating in learning but also for independently exploring various learning resources. This development indicates that the use of technology in elementary education has started to become part of students' daily learning culture (Ng et al., 2021).

On the other hand, various educational institutions have begun paying greater attention to the development of teachers' digital competencies through training in educational technology and the development of digital learning media. This condition demonstrates that digital education transformation in the post-pandemic era is progressing toward a more mature and sustainable stage. However, Sulaiman et al. (2023) explained that disparities in technology access and teachers' digital abilities still remain challenges in the implementation of hybrid learning in several elementary education regions.

3. Comparative Synthesis of Digital Literacy Development during the Pandemic and Post-Pandemic Eras

The results of the literature comparison indicate significant differences between the pandemic phase of 2021-2022 and the post-pandemic phase of 2024-2026 in the development of digital literacy in hybrid learning. During the pandemic phase, the use of educational technology was still focused on emergency adaptation to online learning. In contrast, in the post-pandemic phase, hybrid learning developed toward a more innovative and structured integration of technology (Cahyani & Aminudin, 2025).

These differences can be observed in the changes in the use of digital learning media in elementary schools. During the pandemic phase, teachers mostly used simple communication applications to deliver materials and assignments to students. However, in the post-pandemic era, the use of technology has evolved toward the utilization of LMS, interactive learning media, digital assessments, and Artificial Intelligence (AI)-based platforms. According to Holmes and Tuomi (2022), this development indicates improvements in the quality of technology integration within the learning process.

The development of teachers' digital literacy also shows significant changes between the two phases. During the pandemic, teachers were still focused on mastering basic technological skills for learning. However, in the post-pandemic era, teachers have become more capable of developing project-based learning, collaborative learning, and more creative and interactive digital learning media. This condition demonstrates that teachers' digital pedagogical competencies have developed into a more mature stage.

In addition to teachers, the digital literacy of elementary school students has also improved. During the pandemic, students still depended heavily on parental assistance in using digital devices and participating in online learning. However, in the post-pandemic era, students have begun to demonstrate better independent learning skills, virtual communication, and digital collaboration abilities. Cahyani and Aminudin (2025) explained that this development indicates the formation of a digital learning culture among elementary school students. On the other hand, Kim et al. (2021) emphasized that experiences with technology use since the pandemic have contributed to shaping students' digital learning habits in daily life.

Overall, these developments demonstrate that hybrid learning has transformed from an emergency learning model into a more flexible modern learning model oriented toward the development of 21st-century competencies. Nevertheless, challenges related to equitable technology access and teachers' digital readiness remain important factors that need to be addressed in the development of hybrid learning in elementary schools (Sulaiman et al., 2023).

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DISCUSSION

The development of digital literacy in hybrid learning has shown a significant transformation between the pandemic and post-pandemic phases. During the pandemic phase of 2021-2022, hybrid learning was still in the stage of emergency adaptation, so the use of educational technology was more oriented toward maintaining the continuity of learning rather than innovating digital learning. Kim et al. (2021) explained that this condition represented a rapid response of the education sector to the limitations of face-to-face learning during the pandemic.

Elementary school teachers during this period still experienced limitations in digital pedagogical competence, causing the learning process to tend to be one-way and less interactive. Learning activities were still largely centered on assigning tasks and delivering materials online. This condition indicates that technological adaptation during the pandemic emphasized the continuity of learning more than the quality of student learning interactions (Kim et al., 2021).

In addition, limited internet access and digital devices became major factors affecting the effectiveness of hybrid learning during the pandemic phase. Disparities in technology access between urban and rural areas resulted in gaps in digital literacy among elementary school students. According to Spiteri and Chang Rundgren (2020), digital infrastructure readiness is an important factor in the successful implementation of technology-based learning.

Entering the post-pandemic era of 2024-2026, the development of digital literacy shifted toward a more mature and integrated stage. Hybrid learning began to be implemented as a long-term learning strategy that supports flexibility, collaboration, and personalized learning in elementary schools. These changes indicate that technology has started to be positioned as an important component in improving the quality of learning (Cahyani & Aminudin, 2025).

Teachers have begun developing digital pedagogical competencies through the use of Learning Management Systems (LMS), interactive learning media, and the integration of Artificial Intelligence (AI) in the learning process. Technology is no longer used solely as a communication tool in learning, but also as a medium for developing students' creativity and collaboration. Holmes and Tuomi (2022) explained that the development of teachers' digital competencies has become one of the key factors in the success of hybrid learning in the post-pandemic era.

From the students' perspective, the development of digital literacy demonstrates improvements in virtual communication skills, digital collaboration, and independent technology-based learning. Students have become more accustomed to using technology to search for information, engage in virtual discussions, and complete digital-based assignments independently. This condition shows that the use of technology in elementary education has begun to become part of students' daily learning culture (Ng et al., 2021).

Overall, these developments indicate that elementary education is moving toward a learning system that is more flexible, digital, and oriented toward students' future needs. Nevertheless, strengthening digital literacy still requires support through educational policies, teacher training, and equitable digital infrastructure to ensure that the implementation of hybrid learning can run optimally. Bozkurt et al. (2024) emphasized that digital education transformation requires continuous support in order to reach all educational regions equally.

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CONCLUSION

The development of digital literacy in hybrid learning has undergone significant changes between the pandemic and post-pandemic eras. During the pandemic phase, the use of technology in learning was still considered an emergency adaptation, so teachers and students focused mainly on basic digital media skills to maintain the continuity of learning. This condition caused hybrid learning to be less than optimal due to various challenges, such as limited internet access, low levels of digital competence, and the lack of digital pedagogical readiness among elementary school teachers.

In the post-pandemic era, the development of digital literacy has progressed toward a more mature and integrated stage. Teachers have become more capable of utilizing digital technology to create learning that is more interactive, flexible, and student-centered. In addition, elementary school students have shown improvements in digital collaboration, virtual communication, and independent technology-based learning skills. This transformation indicates that hybrid learning is no longer viewed as a temporary solution, but has evolved into an essential part of the modern education system.

Educational institutions need to strengthen digital literacy training programs for elementary school teachers in order to develop innovative hybrid learning that aligns with advancements in educational technology. The government also needs to improve the equal distribution of digital infrastructure and internet access, especially in remote areas, so that all students have equal opportunities to participate in technology-based learning. In addition, the continuous development of a digital literacy-based curriculum is necessary to equip elementary school students with critical thinking skills, digital collaboration abilities, and creativity that meet the demands of the 21st century. Future research is expected to develop empirical studies through field research in order to provide a more in-depth understanding of the implementation of hybrid learning in elementary schools.

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