

Technology-Based Learning in the Post-COVID-19 Era

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ABSTRACT

The COVID-19 pandemic accelerated digital transformation in education and encouraged the integration of technology as an essential component of the learning process. This study aims to analyze technology-based learning in the post-COVID-19 era by identifying its opportunities, challenges, and strengthening strategies within the education system. The study employed a descriptive qualitative approach using library research. Data were collected from relevant scientific literature, including books, research articles, and academic documents published over the last five years. The data were analyzed using descriptive qualitative techniques through data reduction, data presentation, and conclusion drawing. The findings indicate that technology-based learning offers several opportunities, including increased learning flexibility, broader access to learning resources, strengthened digital competencies, and enhanced instructional innovation. However, its implementation still faces challenges related to human resource readiness, digital literacy, the quality of learning interactions, and sustainable learning management. Therefore, strengthening digital competencies and developing adaptive learning strategies are necessary to support a more modern and inclusive educational transformation.

Keywords: COVID-19; Digital Competence; Digital Transformation; Education; Technology-Based Learning.

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1. | INTRODUCTION

The development of information and communication technology has brought significant changes to various aspects of life, including the field of education. The integration of technology in the learning process is getting more attention because it is considered to be able to increase the effectiveness, flexibility, and accessibility of learning. The use of technology is no longer seen as a complementary instrument, but has become one of the important components in the implementation of modern education. In line with these developments, the concept of technology-based learning is developing towards the use of various digital platforms, interactive media, and online learning systems that support the teaching and learning process in a more adaptive and student-centered manner (Dhawan, 2020).

The COVID-19 pandemic then became a momentum that accelerated digital transformation in the world of education. The closure of educational institutions in various countries requires the learning process to be transferred quickly through the use of digital technology. This condition encourages educators and students to adapt to various online learning platforms as a solution in maintaining the sustainability of the educational process. Pokhrel and Chhetri (2021) explained that the pandemic has created major changes to the global education system and encouraged the acceleration of technology adoption in learning activities.

However, the implementation of learning during the pandemic is basically more emergency than a form of online learning that is systematically designed. Hodges et al. (2020) emphasized that learning carried out during the pandemic is a form of emergency remote teaching, which is a temporary move of the learning process to online mode in response to a crisis situation. This condition shows that the use of technology in education still needs to be strengthened in terms of planning, learning design, and the development of digital competencies of education actors.

On the other hand, the learning experience during the pandemic provides important lessons about the potential of technology in supporting the educational process. Various digital platforms allow the learning process to take place more flexibly, not limited by space and time, and provide wider access to learning resources. Rapanta et al. (2020) stated that the use of technology in learning is able to encourage a change in the role of educators from just conveying information to being a facilitator who directs learning activities in a more interactive and collaborative manner.

The acceleration of education digitalization also encourages the birth of various technology-based learning innovations. Various learning models such as e-learning, blended learning, hybrid learning, and mobile learning are increasingly being used to improve the quality of the learning process. According to Bozkurt and Sharma (2020), the pandemic situation has become a catalyst for the transformation of digital education and opens up opportunities to develop a more flexible and sustainable learning system in the future.

However, the implementation of technology-based learning still faces various challenges. Some of the problems that are often found include the limitations of educators' digital competence, the readiness of students to utilize technology productively, the quality of learning interactions, and the need to develop more effective learning strategies. Whalen (2020) emphasized that experience during the pandemic shows the importance of strengthening educators' competencies in designing and managing technology-based learning optimally.

In addition, the use of technology in education also needs to be balanced with strengthening digital literacy and managing planned learning. Bond (2021) shows that the success of digital learning is not only determined by the availability of technology, but also influenced by learning design, student involvement, and the ability of educators to facilitate the learning process effectively. Therefore, the digital transformation of post-pandemic education needs to be seen as a long-term effort that places technology as a means to create more innovative and sustainable learning.

Based on this description, technology-based learning in the post-COVID-19 pandemic era is an important issue to be studied comprehensively. This study aims to analyze the transformation of technology-based learning after the COVID-19 pandemic, identify emerging opportunities and challenges, and formulate various strategies that can be carried out to strengthen the implementation of sustainable digital learning in the education system.

2. | RESEARCH METHOD

This study uses a descriptive qualitative approach. The qualitative approach was chosen because this study aims to comprehensively understand and describe the phenomenon of technology-based learning in the post-COVID-19 pandemic era, especially related to learning transformation, opportunities, challenges, and strategies to strengthen the implementation of technology in education. Descriptive qualitative research allows researchers to examine a phenomenon in depth through tracing various sources of information and interpreting the facts found so that they can produce a complete picture of the object being studied.

The type of research used is library research. Literature research was carried out by collecting and analyzing various literature relevant to the theme of technology-based learning after the COVID-19 pandemic. The research data source consists of secondary data obtained from books, scientific articles, previous research results, proceedings, research reports, and various academic documents related to the digital transformation of education, online learning, e-learning, blended learning, hybrid learning, and the use of technology in the learning process. The literature used in this study is limited to scientific publications in the range of 2018–2022 to be in line with the development of studies on technology-based learning and educational dynamics during and ahead of the post-pandemic period.

The data collection process is carried out through documentation study techniques. The researcher identified, inventoried, and collected various literature sources that were related to the research focus. Furthermore, each literature obtained was selected based on the relevance of the theme, the suitability of the substance of the discussion, and its contribution to the development of the research analysis framework. This stage is carried out systematically to ensure that the data used has an adequate level of validity and relevance in explaining the phenomenon of technology-based learning in the post-COVID-19 pandemic era.

The data that has been collected is then analyzed using qualitative descriptive analysis techniques. The analysis is carried out through several stages, namely data reduction, data presentation, and drawing conclusions. At the data reduction stage, the researcher grouped various information obtained based on the main themes of the research, including the concept of technology-based learning, learning transformation due to the COVID-19 pandemic, opportunities for the implementation of digital learning, challenges faced, and strategies to strengthen technology-based learning in the post-pandemic era. The next stage is the presentation of data, which is to organize various literature findings into a systematic and logical description so that the relationship between phenomena can be comprehensively understood. The last stage in the form of drawing conclusions is carried out through an interpretation process of all data that has been analyzed to gain a deep understanding of the conditions and direction of technology-based learning development after the COVID-19 pandemic.

Through the descriptive qualitative approach and literature research, this research is expected to be able to provide a comprehensive description of the development of technology-based learning in the post-COVID-19 pandemic era and produce an analysis that can be the basis for understanding various opportunities, challenges, and strategies to strengthen the digital transformation of education in a sustainable manner.

3. | RESULTS AND DISCUSSION

The development of information and communication technology has changed the educational paradigm from a conventional learning system to a more open, flexible, and oriented learning based on the use of digital technology. These changes have become more pronounced since the COVID-19 pandemic which forced all components of education to adapt quickly to the use of various media and digital platforms. The pandemic situation is a turning point for educational transformation because technology that was previously positioned more as a means of supporting learning has now turned into a major component in the implementation of the teaching and learning process. This condition shows that technology-based learning is no longer just an alternative, but has become a necessity that cannot be separated from the modern education system (Dhawan, 2020).

The acceleration of digital transformation of education during the pandemic has encouraged the emergence of various forms of technology-based learning, such as e-learning, blended learning, hybrid learning, and mobile learning. These various models

provide opportunities for students to obtain a more flexible learning experience because the learning process is no longer limited by space and time. The use of technology also allows students to access various learning resources independently through digital platforms, learning videos, electronic libraries, and various other interactive media. According to Pokhrel and Chhetri (2021), the pandemic has accelerated the transformation of the global education system and encouraged the birth of various learning innovations that had not previously been widely implemented.

However, the learning experience during the pandemic shows that most educational institutions are not fully ready to implement online learning systematically at first. Many learning processes are carried out in the form of temporary shifts from face-to-face learning to online learning in response to emergency situations. Hodges et al. (2020) explained that this condition is more appropriately referred to as emergency remote teaching than online learning that is designed in a planned manner. Therefore, the experience during the pandemic provides an important lesson about the need for careful planning in developing quality and sustainable technology-based learning.

Technology-based learning in the post-pandemic era presents various opportunities that can support improving the quality of education. One of the key opportunities is the increased flexibility of the learning process. Students have the opportunity to access learning materials anytime and from anywhere through a variety of digital devices. This flexibility allows for a learning process that is more adaptive to the needs and characteristics of students. In addition, the use of technology also provides opportunities to implement student-centered learning, where students play a more active role in managing their own learning process (Rapanta et al., 2020).

The use of technology in learning also contributes to improving the digital competence of students and educators. The use of various learning applications, video conferencing platforms, and learning management systems encourages all components of education to improve the ability to access, manage, and utilize information effectively. Bozkurt and Sharma (2020) stated that the pandemic has been a catalyst for the acceleration of digital transformation of education and opened up opportunities for the creation of a more innovative learning system oriented towards the development of competencies in the 21st century.

In addition to improving digital competence, technology-based learning also provides opportunities for educators to innovate in the learning process. Various digital media allow educators to develop more interactive learning methods through the use of learning videos, animation media, digital simulations, and game-based learning applications. Bond (2021) explained that technology can increase student engagement if integrated through appropriate learning design and oriented to meaningful learning activities.

On the other hand, the digital transformation of education also presents a number of challenges that need attention. One of the main challenges is the readiness of human resources in managing technology-based learning. The use of technology in learning

not only requires the ability to operate digital devices but also requires pedagogical competence in designing, implementing, and evaluating the learning process effectively. Whalen (2020) emphasized that experience during the pandemic shows the importance of strengthening educators' competencies in managing technology-based learning so that the learning process can take place optimally.

The next challenge has to do with the quality of interaction in digital learning. Technology-based learning has different characteristics from face-to-face learning because most interactions are done through digital media. This condition has the potential to reduce the intensity of communication and social interaction if the learning process is not designed properly. Therefore, technology-based learning needs to be supported by a learning strategy that is able to create active student involvement and build effective communication between educators and students. Rapanta et al. (2020) explained that the success of digital learning is greatly influenced by the presence of educators in facilitating learning activities and maintaining the quality of interaction during the learning process.

The use of various digital learning platforms during the pandemic also shows that technology can provide significant benefits if used appropriately. The use of Learning Management Systems (LMS), video conferencing applications, and various online learning platforms allows the learning process to take place in a more structured manner. Research by Affandi et al. (2020) shows that the use of e-learning contributes to increasing the effectiveness of learning because it is able to provide learning materials systematically and support independent learning activities.

Similar findings are also shown through the use of the Google Classroom platform in learning. The use of the platform allows educators to distribute materials, assign assignments, and evaluate learning more efficiently. Abidin and Saputro (2020) explained that Google Classroom has great potential in supporting the learning process because it provides various features that can make it easier to manage learning activities. In addition, the use of digital platforms also encourages students to be more independent in accessing and managing learning resources.

The development of digital learning implementation during the 2018–2022 period shows an increase in the use of various electronic and digital media in the learning process. Kamaliya and Indana (2022) stated that digital media-based learning has undergone significant development, both in terms of the use of learning platforms and learning media innovations implemented by educators. This condition shows that the digital transformation of education does not stop during the pandemic, but continues to develop as part of efforts to improve the quality of education in the post-pandemic era.

In addition to the various opportunities that exist, technology-based learning still faces challenges in its implementation. The results of Neswary's (2022) research show that the effectiveness of using digital learning platforms is greatly influenced by user readiness, learning design, and educators' ability to manage the learning process. Meanwhile, Tobing et al. (2021) explained that technology-based learning management

requires an integrated strategy through the optimal use of various learning platforms so that learning goals can be achieved effectively.

Other studies show that the use of technology in learning still faces various obstacles, such as different levels of digital literacy, adaptability to technology, and the need to strengthen competence in using digital media productively. Nur et al. (2022) found that the success of online learning is greatly influenced by the ability of users to use information technology appropriately. In addition, Watini (2022) emphasized that technology-based learning requires good management so that various obstacles in the implementation of digital learning can be minimized.

The effectiveness of technology-based learning is ultimately not only determined by the existence of technology itself, but also influenced by the ability of all components of education to integrate technology into the learning process in a planned and sustainable manner. The results of the research of Nopriyeni et al. (2022) show that the use of digital platforms in learning can increase learning effectiveness if supported by the readiness of educators and students and designed in accordance with the learning goals to be achieved.

Based on these findings, technology-based learning in the post-COVID-19 pandemic era has great potential to support improving the quality of education. Experience during the pandemic has shown that technology is able to create learning that is more flexible, innovative, and adaptive to the times. However, the success of digital transformation of education requires strengthening digital competencies, developing effective learning strategies, and a commitment to make technology an integral part of a sustainable education system. Thus, technology-based learning in the post-pandemic era is not only seen as a response to crisis situations, but also as a foundation for the development of more modern, inclusive, and needs-oriented education in the future.

4. | CONCLUSION

Technology-based learning in the post-COVID-19 pandemic era shows that digital transformation has become an important part of the implementation of modern education. The COVID-19 pandemic has not only changed the mechanism of learning implementation, but also accelerated the adoption of various digital technologies in the teaching and learning process. Experience during the pandemic provides an understanding that technology has a strategic role in creating learning that is more flexible, adaptive, and able to reach increasingly diverse learning needs.

The implementation of technology-based learning presents various opportunities for improving the quality of education. The use of technology allows students to gain wider access to learning resources, encourages the formation of student-centered learning, and improves digital competencies needed in the era of information technology development. On the other hand, technology also provides space for

educators to develop learning innovations through the use of various media and digital platforms that are more interactive and collaborative.

However, technology-based learning still faces a number of challenges, including the readiness of human resources, digital literacy skills, the quality of learning interactions, and the need for more systematic learning planning and management. These various challenges show that the success of educational digital transformation is not only determined by the availability of technology, but also influenced by the ability of all components of education to integrate technology effectively and sustainably.

Therefore, strengthening technology-based learning in the post-pandemic era needs to be directed at improving the digital competence of educators and students, developing innovative learning strategies, and optimizing the use of various digital platforms in the learning process. Thus, technology-based learning can be the foundation for the realization of a more modern, inclusive, and responsive education system to the development of science and technology in the future.

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The authors declare that there is no conflict of interest.

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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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