International Journal of Teaching and Learning (INJOTEL) e-ISSN: 3025-8308
Vol. 1 No. 8, 2024, pages: 759~771

DIGITAL TRANSFORMATION IN EDUCATION: FACING THE TECHNOLOGY AGE

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Abstract

Digital transformation in education is one of the most significant and pressing topics in today's technological age. The research aims to dig out how educational institutions and related stakeholders respond to the challenges and take advantage of the opportunities brought by the digital age. Using a qualitative and quantitative approach, the study explores a variety of strategies applied by schools, universities, and other educational institutions in integrating digital technology into curricula, teaching methods, and learning processes. The results of the study show that digital transformation has brought significant changes in the way of teaching and learning, including improved accessibility of learning materials, personalization of the learning process, and the use of innovative digital tools. However, the research also identifies a number of challenges, such as digital gaps, the need for teacher training, and issues related to privacy and data security. In the face of the technology age, the study emphasizes the importance of collaboration between governments, educational institutions, the technology industry, and communities to ensure that digital transformation in education is implemented effectively and inclusive. The resulting advice aims to assist stakeholders in formulating policies, strategies, and practices that can improve the quality of education through the optimal use of digital technology.

Keyword: Transformation, Digital, Education, Technology.

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Introduction

Technology has brought such a meaningful history to human life, which is not only of social change but also covers all aspects including education (Sitopu et al., 2024). When technology has changed, so many educational benefits are felt by teachers, students and other stake holders, but so are its negative impacts, almost balanced between positive and negative, one of which teachers need creativity to create effective and efficient lessons.

Technological developments have not only had an impact on education but have undergone a massive transformation from learning media, learning tools, learning practices, more dynamic, adaptive, and personal learning methods, marking a significant shift from more traditional educational models to modern ones. (Wardiana, W. 2002; Hadisi, L., & Muna, W. 2015; Afni et al., 2024); Guna et al., 2024)

Initially, education was still a traditional one that was seen as a process limited to the classroom, now extending to the digital realm by leveraging a variety of innovative technology tools and platforms (Hawkridge, D. 2022; Nickerson, R. S., & Zodhiates, P. P. Eds.). 2013). The change also poses challenges on the one hand and offers opportunities for educational stakeholders, ranging from teachers, students, to governments and educational institutions themselves (Tubagus et al., 2023; Aslan & Shiong, 2023).

Education in today's digital age, has played an important role in the learning process, for example students no longer have limited access to educational and information resources, the presence of distance learning and collaboration among students in different locations, learning at their own pace, and gaining a richer and deeper educational experience than ever before. (Riady, A. 2021; Muharrom et al., 2023; Nurhayati et al., 2023). Distance learning has also been implemented which provides opportunities for students in remote and remote areas and a variety of other constraints to access quality education. In fact, it is now developing what is called the use of artificial intelligence and data analytics that can help educators better understand their students' needs and adapt the teaching methods taught. (Tsoraya et al., 2023).

However, not only that, the development of education not only extends access but also improves its quality, as already available in this era of technology such as digital tablets, learning applications, e-learning platforms, and online courses, have enabled educators to offer a more personalised approach to teaching. This means that students with a variety of learning styles and special needs can be given the resources they need to succeed.

However, these changes also require educators to continue to develop their skills in using technology as an effective learning tool.

Effective learning is the key to success in understanding and mastering a subject for a teacher (Hewitt, D. 2008; McTighe, J., & O'Connor, K. 2005). One effective learning

method is to use interesting and interactive learning media, such as learning videos, educational games, and group discussions, to create a conducive learning environment, where students feel comfortable and motivated to learn. (Dunlosky et al., 2013; Nurdiana et al., 2023; Erwan et al., 2023)

The digital transformation in education is an important revolutionary step in the face of the emerging era of technology (Sarmila et al., 2023; Sulastri et al., 2023). This process of transformation is not just about replacing tablets with digital devices, but about the way education is delivered, received, and perceived. (Andita, V., & Rafaela, D. 2024; Wau, F. T., & Kiton, M. A. 2024). At its core, digital transformation enables learning to be more personal, flexible, and inclusive, providing opportunities for all learners to access high-quality education from anywhere and anytime (Haddar et al., 2023; Aslan & Pong, 2023).

Thus, from the changes human beings are experiencing today in all aspects of life including education, technological developments offer many benefits, it also presents certain challenges, such as the digital access gap and the need to ensure that technology is used in ways that support effective and ethical learning. Therefore, stakeholders in education must continue to innovate and collaborate to maximize the potential of technology in educating future generations.

Research Method

The research method in this research is qualitative using literature studies (Zed, 2004; Eliyah & Aslan, 2024). Literature taken according to the topic of discussion is taken either from journals, books or other documents. Then, selected and selected to determine the results and the discussion to be studied from the discussion of this topic.

Result and Discussion

Concepts of Digital Transformation in Education

Digital transformation is the process of integrating digital technology into all aspects of a business or organization, which fundamentally changes the way it operates and delivers value to customers, involving rethinking business models, processes, and organizational strategies by using digital technology to improve efficiency, create new opportunities, and enhance interaction with customers and other stakeholders (Panggabean, A. N. 2021; Tuhuteru et al., 2023).

Digital transformations are fundamental changes in the way organizations use technology to create added value, and have changed almost every aspect of life, including education.

In the field of education, digital transformation has had a significant impact on learning and teaching systems, which can be seen from the use of digital media, such as computers, the Internet, and mobile devices, whose use has enabled easier access to extensive information and learning resources. Students can also learn independently by

using and accessing technology so that they can create more interactive and interesting learning. (Oliveira, K. K. D. S., & de SOUZA, R. A. 2022; Bilyalova et al., 2020).

The ease is also, with the presence of educational technology can be felt by teachers (Astuti et al., 2023). Teachers can use educational applications and software that enable students to actively interact with lesson materials, conduct virtual experiments, and participate in group discussions, so that in delivering lesson material can be as effective as possible and can even evaluate student progress more effectively. In addition, digitization has also enabled the formation of a broad learning community between teachers and students. These communities can share information, gain additional resources, and support each other in the learning process.

Among the educational transformations, aspects of educational technology include; first, Process Automation. Using technology to automate manual tasks, thereby increasing efficiency and reducing operating costs. Second, data analytics and artificial intelligence. Using big data and analytics to gain deeper insights that are not only for business but also used for education. Third, Digital Experience. Create richer and more personal interactions with customers through digital channels, such as social media, mobile apps, and websites, to enhance knowledge. Fourth, Collaboration and Productivity. Introducing digital collaboration tools and collaborative platforms that enable to learn new knowledge together from the community formed, whether teachers or students. Fifth, create a new model in teaching (Balyer, A., & Öz, Ö. 2018; Bogdandy et al., 2020).

Digital transformation requires commitment from the highest level of the organization and often involves profound cultural change. It's not just about adopting new technologies, it's also about adapting to changing ways of thinking and working, which require flexibility, sustainable learning, and willingness to take risks. Thus, digital transformation in education is everything changing in the scope of education by using and leveraging existing technologies in line with the developments of the times with the aim of creating effective and efficient learning.

The Role of Technology in Learning Processes

Technology has played an important role in the evolution of learning processes, changing the way students learn, teachers teach, and educational institutions operate (GİLLPATRİCK, T. 2020). The use of technology and electronic media has become crucial in supporting effective learning. Technology has played a significant role in expanding students' access to educational resources (Sepúlveda, A. 2020). With the Internet, students can access a wide range of information and learning resources from around the world and using interactive and multimedia learning software has also increased student involvement in the learning process. Students can also take advantage of technology for distance learning or online learning that allows students to study in flexible time and place.

Teachers can also create more engaging and interactive learning experiences by using a variety of learning tools and applications, such as e-learning platforms, learning games, and simulations, while applications used in the learning process can be more personalized as they can be tailored to individual needs, thereby improving learning effectiveness.

Here are some key aspects of the role of technology in the learning process: 1) Accessibility of Learning Materials. Technology allows access to extensive and diverse educational resources, including digital textbooks, journal articles, educational videos, and online courses. It makes it easy for students to find and use learning materials that fit their needs and learning styles, anytime and anywhere. 2) Personalized learning. With the help of analytical data and artificial intelligence, learning platforms can adapt content, speed, and learning styles to the individual needs of each student. It helps in identifying students' strengths and weaknesses, enabling more targeted interventions and improving learning outcomes. 3) Interactivity and Engagement. Technologies such as virtual reality (VR), augmented reality (AR), and educational games add interactive and exciting elements to the learning process. It not only makes learning more exciting but also improves conceptual understanding and information retention through practical simulations and immersive learning experiences. 4) Collaboration and Communication. Digital collaboration platforms and communication tools facilitate interaction between students and teachers, as well as between students, beyond geographical boundaries. It supports collaborative learning, group discussion, and fast feedback, enriching learning experiences and building teamwork and communication skills. 5) Flexibility and Remote Learning. Technology has enabled distance and online learning, providing flexibility for students to study according to their own schedules. This is important for adult learners, students who live in remote areas, or those who cannot attend physical classes for health reasons or other commitments. The use of technology in learning helps students develop digital skills that are essential for success in the 21st century, such as information literacy, critical thinking, and the ability to adapt to new tools and platforms. It prepares them for an increasingly digitized job market. 7) Assessment and Feedback. Technology enables more dynamic and sustainable assessment, with tools that can automatically evaluate tasks and provide instant feedback. It helps students understand areas that need improvement and allows teachers to monitor student progress in real time (Zain, S. 2021; Akour, M., & Alenezi, M. 2022).

Overall, technology has been a catalyst for education transformation, making it more inclusive, effective, and adaptive, so technology plays a crucial role in supporting modern learning processes, improving accessibility, student engagement, and overall learning effectiveness. However, it is also important to recognize the challenges that come with technology integration, including access issues, teacher training, andining a balance between the use of technology and traditional learning methods.

Digital Transformation Implementation Models

Implementing digital transformation involves applying strategies and technologies to transform education systems from traditional to modern. Therefore, a variety of models can be adopted by organizations depending on their specific objectives, resources, and needs, among others.;

First, the Agile Model. This model emphasizes fast literacy, cross-functional teams, and quick response to change. In the context of digital transformation, this means adopting a flexible and adaptive approach in the development of digital products and services, enabling organizations to experiment, learn, and adapt quickly based on market feedback and user experiences. Second, the DevOps model. It integrates development (Dev) and operations (Ops) to improve collaboration and productivity with the automation of software development, testing, and deployment processes. Implementation of this model in digital transformation focuses on improving the speed, quality, and reliability of delivery of digital applications and services. Third, the Platform Model. This model involves creating a digital base that can support services, applications, and data ecosystems. This platform enables integration and interaction between users, service providers, and developers, facilitating innovation and creating value through effects networks. Platforms such as the sharing economy, the digital market, and SaaS platforms are examples of this model. Fourth, the IT Bimodal Model. This model combines two operating modes: Mode 1 focuses on stability and efficiency for core systems that do not change quickly, while Mode 2 is experimental, emphasizing agility and speed for the development and implementation of innovative digital solutions. This approach allows organizations to maintain their core operations while experimenting with new technologies and business models. Fifth, the Customer-Centric Model. This model puts customers at the heart of digital transformation strategies. Organizations focus on an in-depth understanding of customer needs and behavior to develop solutions that enhance customer experience. It involves using big data, analytics, and technologies like AI to personalize services and create a smooth customer path. Sixth, the Digital Ecosystem Model. This model expands the concept of a platform by creating interconnected business networks, including partners, suppliers, and customers. This model relies on collaboration and data sharing to create shared value and cross-industry innovation. Seventh, the Open Innovation Model. This model invites new ideas and solutions from outside the organization, including startups, research institutes, and user communities. Through partnerships, crowdsourcing, and competition, organizations can accelerate innovation and the development of new digital products or services (Erickson, J., Lyytinen, K., & Siau, K. 2005; Srivastava et al., 2017).

Each implementation model has its own strengths and limitations, and organizations may find that hybrid approaches or adaptations of some of these models

are most effective in meeting their digital transformation goals. Success in implementation depends on clear strategies, leadership involvement, and organizational readiness to change.

The Challenges and Opportunities of Technology in the Scope of Education

Technological developments provide new challenges and opportunities in the field of education. These challenges include technology accessibility, teacher training, student engagement, digital gaps, and data security. Each has a significant impact on the effectiveness of the use of technology in education.

First, the technological challenge in education is the digital divide between individuals, communities, and countries. This can lead to inequalities in access to technology and limitations in optimizing educational potential, for example in terms of technology accessibility. These include hardware such as computers or tablets, as well as stable internet access. In many areas, especially in rural areas or for low-income families, this accessibility is often limited. Digital gaps refer to differences in access and ability to use technology among students. This can be caused by economic factors, geographical location, or educational policies. Overcoming these gaps is important to ensure that all students have equal opportunities in learning (Akbar, A., & Noviani, N. 2019; Khotimah et al., 2019).

Second, adapting to rapid technological change is also a challenge in education. Educators and educational institutions need to keep up with technological developments to ensure that the teaching methods used are relevant and effective. Teachers have an important role to play in integrating technology into learning. The challenge is to ensure that all teachers have sufficient expertise and training to use technology effectively in their teaching. It covers an understanding of digital tools, educational applications, and online teaching methodologies (Syamsuar, S., & Reflianto, R. 2019).

Third, student involvement. While technology can make learning more interactive and exciting, there is a challenge to ensure that students remain engaged. Too much distraction from the internet and digital devices can reduce learning effectiveness. It is important to create interesting learning materials and use technology to improve, not reduce, student involvement (Hidayat et al., 2023).

Fourth, data security and privacy. The existence of student personal data and other critical information stored in technology systems can be targeted by cybercrime attacks and privacy violations. With more and more student information being stored and processed online, data security becomes a major concern. Schools and educational institutions must ensure that student data is protected from unauthorized access and data breaches (Cayeni, W., & Utari, A. S. 2019).

The technological challenges in education and learning require comprehensive and inclusive solutions. These include investments in technology infrastructure, teacher

training, developing exciting learning materials, strategies to overcome digital gaps, and strict data security measures. With the right approach, technology can be a very valuable tool in improving the quality of education for all students.

Besides challenges, technology offers a variety of transformative opportunities in education and learning that can address some of the traditional challenges and open a new path for more effective, inclusive, and exciting learning experiences. Here are some of the key aspects where technology can have a positive impact; the first chance is wider access to information and educational resources. With the advancement of technology, students and educators can access a variety of learning resources, reference materials and learning platforms online. Technology enables a more personalized approach to education, where learning materials can be tailored to the needs, speed, and interests of each student. Adaptive learning platform and learning management system (LMS) can analyze student performance in real-time and customize learning materials to suit their level of ability. (Hall, B. H., & Maffioli, A. 2008).

The second chance is the possibility of improving the learning experience through technology. With technology, learning can become more interactive and exciting through the use of multimedia, simulation, and virtual reality. Technology expands access to high-quality learning resources without geographical or physical constraints. Online learning and mass open courses (MOOCs) allow students from all over the world to access content from leading universities and other educational institutions. It also provides flexibility for students to study at the time and place that best suits them (Choi, S. Y., Lee, H., & Yoo, Y. 2010).

The third possibility is the possibility of personalizing learning using technology. With technology, educators can use data and algorithms to understand the individual needs of students and provide learning experiences that are tailored to the needs of each student. Digital tools facilitate collaboration and communication between students and teachers, as well as between students, even if they are in different locations. Platforms like Google Classroom, Slack, and Zoom enable classroom discussions, group projects, and social interactions that are vital to the learning process (Raja, R., & Nagasubramani, P. C. 2018).

Fourth opportunity is Curriculum Enrichment. Technology provides teachers with tools and resources to enrich the curriculum and make learning more interesting. These include multimedia, virtual simulations, educational games, and virtual reality (VR) or augmented reality (AR), which can make abstract concepts easier to understand and remember by students. (Dalenogare et al., 2018).

Learning through technology helps students develop key skills of the 21st century, such as problem-solving, critical thinking, digital literacy, and teamwork. It is relevant to preparing students for the future job market, where digital skills and adaptability are becoming increasingly important (Ghobakhloo, M. 2020).

Sixth opportunity, Assessment and Feedback. Technology enables more efficient assessment and real-time feedback on student work. Digital assessment tools can quickly analyze test answers and provide constructive feedback, helping students understand which areas they need to improve (Zheng et al., 2021).

The success of digital transformation in education depends on several key factors, including investment in technological infrastructure, teacher training and professional development, as well as the development of a curriculum that is adaptive and responsive to the needs of students and the demands of the labour market. (Raj et al., 2020). In addition, it is important to address challenges such as digital gaps, ensure strong data security, and support effective student engagement to ensure that technology acts as a learning enhancer, not a distraction.

Digital transformation also opens up opportunities for the development of essential 21st century skills, such as critical thinking, problem-solving, collaboration, and digital literacy, all of which are vital in preparing students for success in their future workplace and in their personal lives. By leveraging technology, education can become more relevant, attractive, and tailored to the needs of individuals and societies.

Thus, the opportunities offered by technology in education and learning bring great potential for educational transformation. By integrating technology strategically and effectively, educational institutions can improve the quality of learning, make education more inclusive and accessible to all, as well as equip students with the skills they need to succeed in the future.

Conclusion

Digital transformation in education is an important step that must be taken to face the technological age successfully. It's not just about adopting new tools, but about reflecting and re-adjusting the way we teach, learn, and interact. With the right approach, technology can be a powerful catalyst for creating a more effective, inclusive, and dynamic education system that is ready to face challenges and take advantage of future opportunities.

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