Digital Transformation in Primary School Education: Challenges and Implications for Learning Quality

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Kata Kunci
Transformasi digital
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Abstrak
Artikel ini mengkaji tantangan yang dihadapi dalam proses transformasi digital, seperti keterbatasan infrastruktur, kurangnya kompetensi digital guru, serta kesenjangan akses antarwilayah. Di sisi lain, artikel ini juga mengeksplorasi implikasi positif dari transformasi digital, termasuk meningkatnya interaktivitas pembelajaran, personalisasi materi ajar, dan penguatan keterampilan literasi digital siswa. Metode yang digunakan dalam penelitian ini adalah studi pustaka, dengan menganalisis berbagai literatur dan penelitian terdahulu yang relevan. Hasil kajian menunjukkan bahwa meskipun transformasi digital menawarkan potensi besar dalam meningkatkan kualitas pembelajaran, keberhasilannya sangat bergantung pada kesiapan sekolah, kompetensi pendidik, serta dukungan kebijakan pendidikan yang berkelanjutan dan merata. Oleh karena itu, diperlukan strategi terpadu dan kolaboratif dari berbagai pemangku kepentingan guna mewujudkan transformasi digital yang efektif dan berkeadilan di sekolah dasar.

Keywords
Digital transformation
Basic education
Quality of education

Abstract
This article examines the challenges faced in the digital transformation process, such as limited infrastructure, teachers' lack of digital competence, and access gaps between regions. On the other hand, this article also explores the positive implications of digital transformation, including increased learning interactivity, personalization of teaching materials, and strengthening students' digital literacy skills. The method used in this research is a literature study, by analyzing various relevant literature and previous research. The results of the study show that although digital transformation offers great potential in improving the quality of learning, its success is highly dependent on school readiness, educators' competencies, and sustainable and equitable education policy support. Therefore, an integrated and collaborative strategy from various stakeholders is needed to realize effective and equitable digital transformation in primary schools.

1. Introduction

Education is one of the strategic sectors that has a crucial role in supporting the development of a country. In today's digital era, the integration of technology in education is increasingly showing its urgency and requires in-depth study. Technological developments have led to fundamental changes in teaching and learning methods. The transformation of education through the utilization of digital technology, including educational software and supporting hardware, is now a major topic that has received widespread attention from various circles. (Dorlince O Hutapea et al., 2024)

In the midst of rapid change, the world of education cannot avoid the impact of the digital revolution that has penetrated all aspects of life. In recent decades, technological developments have revolutionized the way we access information, interact with culture, and undergo the learning process. The shift from traditional education systems to the utilization of digital technology has a significant impact and great potential in reshaping the face of education globally.(Haq et al., 2023)

As a first step, one of the main characteristics of the transformation of education in the digital era is the increased ease of access to information. With the widespread internet connection, both students and educators can access a variety of learning resources quickly and without restrictions. They are no longer confined by geographical barriers or formal curriculum limitations, as the world has become an open learning space for anyone who wants to explore it.(Saerang et al., 2023)

However, this transformation is not only limited to the expansion of access to information. This change also presents a new paradigm in learning approaches. The presence of various educational apps, simulation media and educational games has created a more interactive and fun learning experience. Learning that was once one-way and static has now become more active and dynamic, encouraging students to be more involved in understanding complex material.(Picauly, 2024)

In addition, the digital era has also fundamentally changed the relationship between teachers and students. Through online learning platforms, interaction and collaboration become more open and intensive. Learners can engage in global discussions, exchange ideas and work together on projects across countries. This not only improves their social skills, but also promotes more holistic and globally-oriented learning.(Agustian, 2024)

Digital transformation is a process of comprehensive change in an organization or institution that covers various aspects, such as human resources, operational processes, strategies, and institutional structures, through the adoption of digital technology to improve effectiveness and performance. Although computer technology has been known for a long time, the concept of digital transformation has only developed significantly along with the emergence and widespread use of the internet as part of people's lives. This phenomenon has caused a shift from the use of traditional media to digital formats based on binary data.(Maritsa et al., 2021)

The transformation of education in the digital era does not only provide easy access to information, but also encourages significant changes in learning methods. Educational apps, interactive simulations and game-based learning have enriched learners' learning experience, replacing the conventional linear approach with a more dynamic and adaptive one. The main challenge faced today is how educators can effectively integrate technology into the learning process, while addressing access gaps and optimizing the opportunities offered by digitalization. To achieve this, a holistic approach and adequate support are needed to ensure that every teacher and learner can gain the maximum benefit from digital transformation in education.(Aliyah & Masyithoh, 2024)

The transformation of learning in the digital era has brought convenience and flexibility that was previously hard to imagine. Through the wide availability of internet access, various learning materials are now accessible anytime and anywhere. The learning process is no longer limited by time and location, as learners can obtain materials from various global sources, participate in online learning, and interact with educators and fellow students from all over the world. This allows for a more personalized and independent learning process, where each individual can customize learning according to their own pace and learning style.(Waruwu et al., 2024)

The development of the digital era has had a huge impact on various areas of life, including the education sector. It not only changes the way we communicate, but also affects learning and teaching methods. Technological advances allow access to information to be faster and easier, thus opening up new opportunities for both teachers and learners. This condition creates a more active and interactive learning atmosphere. However, this transformation requires all parties in education to be able to adapt. Therefore, it is very important to understand the right technology integration strategy in the learning process. With this understanding, the use of technology can be optimized to improve the quality of education.(Huda, 2025)

However, the implementation of technology in learning in primary schools still faces various challenges, both in terms of infrastructure, teacher readiness, and parent participation. Given the importance of basic education as the main foundation in shaping children's character and cognitive abilities, it is important to understand in depth how digital transformation impacts the quality of learning. This article aims to examine the challenges and implications of digital transformation on the quality of education in primary schools, as well as provide strategic suggestions in the implementation process.(Picauly, 2024)

2. Method

This research uses a library research approach, which is a method carried out by examining various reference sources and relevant previous research results. This method aims to obtain a strong theoretical foundation related to the problem under study through the review of books, scientific articles, and other written sources. The focus of this literature study is to explore a deeper understanding of the issues or topics discussed in the article. As a data collection technique, desk research involves reviewing literature, documentation and records.(Mansir, 2022)

Data were collected from scientific documents in the form of accredited national and international journals, academic books, and popular scientific articles relevant to the research theme. Data inclusion criteria were: Sources published in the last 10 years (2015-2025), focusing on digital transformation in primary school education and its challenges and implications for learning quality. Available in full text and open access, or obtained through official scientific databases such as Google Scholar, ResearchGate, DOAJ, and Garuda.(Riska Rahman Tanjung et al., 2024)

3. Results and Discussion

3.1. Results and Discussion 2

1) Realities and Challenges of Digital Transformation in Elementary Schools

Digital transformation in basic education in Indonesia still faces various complex challenges. These challenges are not only technical, but also touch on cultural, social, and pedagogical aspects.

a. Limited Infrastructure and Access to Technology

One of the most obvious challenges is the inequality of technological infrastructure between regions. Many primary schools, especially those in the 3T (frontier, outermost, underdeveloped) areas, do not have adequate(Yusuf & Kamariah, 2025)te internet access or even digital devices at all. This creates a significant digital divide between urban and rural schools. As a result, students in less developed areas do not benefit equally from digital transformation, potentially widening the gap in the quality of national education.

b. Teacher Readiness in the Face of Change

Teachers are the main actors in the success of digital transformation in primary schools. However, many teachers do not have adequate digital competencies. Some teachers still have difficulties in operating technological devices, designing technology-based learning, and evaluating digital learning. This is exacerbated by the lack of comprehensive and sustainable training that can improve teachers' digital literacy. In this context, digital transformation is not only about providing devices, but also building the mental readiness and competence of educators.

c. The Role of Parents and Learning Environment Support at Home

Digital transformation also demands the active role of parents, especially in online or hybrid-based learning. Unfortunately, not all parents have the ability, knowledge, or time to assist their children in learning with technology. On the other hand, the economic background of the family also determines the ability to provide devices and internet access at home. The unpreparedness of the home environment as part of the digital learning ecosystem can lead to gaps in student learning achievement.

d. Digital Safety and Children's Mental Health

The use of technology at an early age also raises concerns about digital safety and its psychological impact. Children who are not adequately supervised may be exposed to inappropriate content, develop screen addiction or experience social pressure from online interactions. Therefore, digital transformation in primary schools must be accompanied by efforts to build adequate digital awareness and literacy, not only for students but also teachers and parents.

2) Implications of Digital Transformation on Learning Quality

a. More Interactive and Engaging Learning

Digital technology allows learning to be more interactive through videos, animations, simulations, online quizzes and educational games. This can increase students' interest in learning and make the learning process more enjoyable. For elementary school children who are still in the concrete-operational phase, visual and hands-on approaches are very helpful in understanding concepts.(Handayani, 2025)

b. Wider Access to Learning Resources

With the internet, teachers and students have wide access to various learning resources. Conventional textbooks can be enriched with e-books, learning videos and other online resources. Teachers can customize learning materials according to students' needs and abilities, so that the learning process becomes more personalized and adaptive.

c. Improving the Effectiveness and Efficiency of Learning Evaluation

Digital transformation allows the implementation of a faster, more objective and accurate evaluation system. With e-learning platforms and assessment software, teachers can monitor students' learning progress in real-time. This provides room for teachers to provide early intervention for students experiencing learning difficulties.

d. Strengthening 21 Century Skills

By using technology in the learning process, students can develop important skills such as critical thinking, problem solving, collaboration and creativity. In addition, students will also become familiar with the use of technology as a learning tool, which will be very useful in their next level of education and future professional life.

3) Strategies and Efforts to Promote Quality Digital Transformation

For digital transformation to have a positive impact on the quality of learning in primary schools, a planned, collaborative and sustainable strategy is needed.(Hendayani et al., 2024)

a. Improving Teacher Competence through regular training, mentoring and digital learning communities so that teachers are not only proficient in using technology but also able to integrate it pedagogically.

b. Strengthening Infrastructure by providing stable internet access and adequate technology devices for schools and students.

c. Digital Curriculum Development that is adaptive, appropriate to the local context, and accommodates the characteristics of primary-age children.

d. Collaboration with Parents and Communities to build mutual awareness of the importance of an active role in supporting children's digital learning.

e. Progressive and Inclusive Government Policies that guarantee equal access and incentives for schools that develop technology-based innovations.

3.2. Conclusion

Based on the results of the literature analysis, it can be concluded that digital transformation in education, especially at the primary school level, is an unavoidable phenomenon in the current era of globalization and the development of information technology. Digitalization has brought significant changes in the education paradigm, starting from how teachers teach, how students learn, to how the interaction process between educators, learners, and learning resources takes place. With internet access, digital devices, and various online learning applications and platforms, education has become more open, flexible, and oriented to students' individual needs. The application of technology in learning in elementary schools provides many benefits, including increased motivation to learn, easy access to information and learning resources, and strengthening 21st century skills such as critical thinking, collaboration, and digital literacy. Technology also enables a more interactive and engaging learning process through the use of visual media, simulations and educational games. Thus, if implemented effectively, digital transformation has great potential to improve the overall quality of learning. However, behind these opportunities, there are a number of challenges that cannot be ignored. One of the main challenges is the digital divide that still exists in various regions, especially between urban and rural areas, leading to unequal access to technology and the internet. In addition, many teachers in primary schools do not have sufficient digital competencies to optimally utilize technology in the learning process. Lack of training, technical support and adaptation of relevant curricula are also major obstacles in this transformation process. In addition, digital transformation also requires a shift in mindset from conventional learning approaches to more innovative, creative and student-centered approaches. This is not an easy task, as it requires a change in school culture, commitment from all parties, and a continuity of educational policies that support the integration of technology as a whole. Therefore, to ensure that digital transformation really makes a positive contribution to improving the quality of learning in primary schools, a number of strategic steps need to be taken. These include improving technology infrastructure in all education units, providing continuous professional training for teachers and education personnel, and developing a curriculum that is relevant to technological developments and the needs of the times. In addition, periodic evaluations of the impact of technology implementation need to be conducted to assess effectiveness and identify areas that still need improvement. Through synergy between the government, schools, teachers, parents and communities,

digital transformation can be directed towards creating a more inclusive, adaptive and sustainable education system. That way, primary schools will not only be able to face the challenges of the digital era, but will also be able to produce a generation that is ready to compete globally, has a strong character, and is technologically literate as a provision for the future.

Author Contributions

Pilma Sindy Arizka: Conceptualization, Data curation, Methodology, Investigation, Formal analysis, Visualization, Writing - original draft, Writing - review & editing, Supervision, Project administration.

The authors declare that all contributions to the research and writing of the manuscript were made independently. The authors have read and approved the final manuscript.

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