



EDUCATIONAL MANAGEMENT IN THE DIGITAL ERA: THE ROLE OF TECHNOLOGY-BASED PEDAGOGY IN IMPROVING THE QUALITY OF LEARNING

**Nurcitra Re hulina Br Ginting ¹, I Made Astra ², Dwi Atmanto ³,
Universitas Negeri Jakarta**

**Email: nurcitra.rehulina@mhs.unj.ac.id¹, imadastra@unj.ac.id²,
dwiatmanto@unj.ac.id³**

ABSTRACT

Rapid development of digital technology has brought fundamental changes in the global education system which triggered a paradigm shift from traditional teaching methods to more innovative and learner-centered approaches. This study aims to explore how technology-based pedagogy can improve the quality of learning in the digital era and its implications for education management. Through a qualitative literature study, this study analyzes various scientific sources in the last decade to identify best practices in the integration of educational technology. The results of the study indicate that the application of digital pedagogy can create an interactive, inclusive, and adaptive learning environment. However, its implementation still faces challenges such as the digital access gap, limited infrastructure, and low digital literacy of teachers. Therefore, strategic efforts are needed to improve educator competence, design digital curriculum, and strengthen education management that supports comprehensive digital transformation. The application of digital pedagogy has been proven to improve the quality of learning by providing an interactive learning environment that supports the development of 21st century skills and expands access to learning resources. This study concludes that technology-based pedagogy plays an important role in improving the quality of learning and supporting adaptive education management in the digital era.

Keywords: Management education, pedagogy, education, digital era, learning

INTRODUCTION

The rapid development of digital technology has brought about major transformations in various aspects of life, including education. The digital era is pushing educational institutions to adapt quickly to changing learning paradigms, which are no longer solely teacher-centered but also emphasize the active information role of students through the use of technology and communication. Technological developments have impacted the digitalization of education, where the presence of technology enables faster advancement of knowledge and encourages educators to integrate technology into the teaching and learning process (Hakim and Yulia, 2024).

One of the approaches focused on education in the digital era is technology-based pedagogy, a strategy that combines pedagogical principles with the use of technology. Pedagogy plays a crucial role in shaping an effective and meaningful learning process, focusing not only on delivering material but also on strategies, approaches, and methods that support holistic student development (Muhadi and Robandi, 2025). Educational transformation in the digital era requires not only changes to learning systems and tools but also to the pedagogical approaches used. Pedagogy in the digital era requires educators not only to be able to use technology but also to be facilitators in innovative

and adaptive learning processes. However, the implementation of digital pedagogy also faces challenges, such as unequal access to technology, limited infrastructure, human resource readiness, and educators' ability to utilize technology effectively. An adaptive pedagogical approach is needed to ensure learning remains personalized, inclusive, and meaningful, and can improve the quality of student learning (Harahap et al., 2021).

Educational management plays a role in designing, directing, and optimally managing technology in the learning process. Appropriate educational management strategies can improve access, quality, and relevance of education by combining technology with innovative pedagogical practices to address the evolving educational landscape (Desi & Ratna, 2024). The convergence of educational management and digital pedagogy is crucial for realizing flexible learning in line with the demands of the digital era (Huseyin et al., 2024). In addition, educational management strategies must concentrate on the implementation of adaptive learning models, human resource management, and curriculum development that is in line with Industry 4.0 (Arum, 2023). Educational management plays a crucial role in facilitating digital transformation and ensuring that the use of technology truly supports the pedagogical goal of improving the quality of learning. Effective educational management is necessary for institutions to maximize the potential of digitalization to produce students with 21st-century competencies, such as digital literacy, critical thinking skills, collaboration, and creativity (Sihotang, 2025). This article aims to examine the role of educational management in integrating technology-based pedagogy to support inclusive and relevant learning in the digital era. This study is expected to provide theoretical and practical contributions in the development of an education system that is relevant to current developments and is able to improve the quality of learning in the 21st century.

METHOD

This study used a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize previous research findings. The SLR method allows for structured and comprehensive data collection from literature relevant to the research topic and provides a strong foundation for further analysis (Romlah et al., 2024). The research process using a systematic literature review requires the same preparation as other research, with the difference being that the data sources are drawn from relevant Google Scholar, ResearchGate, and SINTA websites. The focus of this literature review was directed at sources discussing the role of technology-based pedagogy as part of educational management strategies in the digital age. The search was conducted to identify concepts, approaches, challenges, and best practices related to the use of technology in the learning process with the aim of obtaining a theoretical foundation and empirical findings that support the analysis in this study regarding improving the quality of learning. After obtaining relevant articles, the authors compared and analyzed the results. The researchers used content analysis techniques to extract important information from each source. Data analysis was carried out systematically through the following stages.

1. Literature Identification

The literature search process was conducted in several scientific databases, namely Google Scholar, ResearchGate, and SINTA (Science and Technology Index). Keywords used in the literature search included: educational management, digital era education, and digital pedagogy. Keyword combinations were performed using Boolean operators such as AND and OR to narrow or expand search results. For



example, a search using the combination "technology-based pedagogy" AND "educational management" helps find more specific articles, while "learning innovation" OR "educational technology" broadens the scope of studies. Each search result was then reviewed based on the title, abstract, and keywords to ensure its relevance to the research focus. The search was conducted on English and Indonesian-language literature from 2018–2025.

2. Article Screening

Screening was conducted based on the following inclusion and exclusion criteria:

- a. Inclusion criteria: Articles published in reputable scientific publications that have undergone peer review, published in national journals accredited by Sinta 1-5, or reputable international journals within the last 7 years, focusing on educational management in the digital age and written in English or Indonesian.
- b. Exclusion criteria: Articles that solely discuss non-formal education without relevance to pedagogy-based learning in the digital age.
- c. Each search result was reviewed to ensure its relevance to the study's focus. This strategy was designed to maximize the inclusion of relevant articles while minimizing the potential inclusion of articles that were not aligned with the research focus.

3. Article Quality Assessment

Articles that passed the screening stage were assessed for quality based on the relevance of the findings, research methodology, and contribution to the topic of educational management in the digital age, particularly as it relates to the application of technology-based pedagogy. Articles that met these quality standards were selected for further analysis. After the evaluation process, 20 articles deemed to meet the criteria were then analyzed in-depth.

4. Data Synthesis

The selected articles were analyzed to identify key themes, explore issues related to the implementation of technology pedagogy, including challenges and opportunities in the context of educational management, and provide strategic recommendations for improving the quality of digital-based learning. This synthesis process also aimed to provide a comprehensive understanding of how educational management can facilitate and guide learning transformation through a technology-based pedagogical approach.

5. Drawing Conclusions

Based on the data synthesis results, researchers formulated conclusions that reflect the patterns of findings from the 20 articles analyzed. The conclusions not only answer the research problem but also provide practical implications and recommendations for strengthening educational management in the digital era through the application of technology-based pedagogy to improve learning quality.

RESULTS AND DISCUSSION

This study summarizes the findings of twenty relevant scientific articles and addresses four main areas of focus related to educational management in the digital age, with an emphasis on the role of technology-based pedagogy. These four areas are the concept of education in the digital age, the management of the role of education in digital learning transformation, the effectiveness of technology-based pedagogy in improving learning quality, and the challenges and strategies for its implementation.

1. The Concept of Education in the Digital Era

Global rivalry has increased due to the digital age, necessitating ongoing improvements in human resource quality. One important component of human resource development that needs to change significantly to meet the demands of the modern world is education. This is a difficulty as well as an opportunity for Indonesia in its attempts to raise the standard of education in the country. Digital literacy is a key idea in education in the digital age. Digital literacy includes critical comprehension of material offered through various digital media in addition to proficiency with technology equipment.

Digital literacy is a fundamental component of contemporary learning processes in the context of technology-based pedagogy. In order to facilitate interactive and contextual learning processes, multimedia devices like computers, laptops, smartphones, and other audio-visual media are used. Kristiawan et al. (2019) emphasize that the world of education does not rely on one particular type of technology, but rather on a diversity of technologies that can be adapted to learning needs. This concept is realized through the development of learning designs that integrate software and hardware, including audio-visual aids and other electronic media, to create efficient and effective learning.

Teachers now facilitate and create meaningful learning experiences rather than just imparting knowledge within the framework of digital pedagogy. To promote individualized, collaborative, and project-based learning, educators must be able to creatively use technology. This is in line with Hussin's (2018) viewpoint, which emphasizes the significance of developing 21st-century skills in the face of education's digital change. Hussin further underlined that in order to help students develop critical thinking, problem-solving, creativity, and effective communication and teamwork skills, educators must be able to consistently adjust to technology advancements. Additionally, in the digital age, students must be able to responsibly and intelligently access, handle, and communicate information.

Law Number 20 of 2003 concerning the National Education System (Sisdiknas) affirms that national education serves to enhance capabilities and build dignified character in order to educate the nation. The goal of Sisdiknas is to direct the development of students' potential so that they become human beings who believe in and fear God Almighty, possess noble character, are healthy, knowledgeable, capable, creative, independent, and as quality students (Abakar, 2025). In this regard, digital pedagogy provides a bridge to achieving these goals through a contextual, adaptive, and future-relevant learning approach. Given that digital technology has a significant influence on changes in the economy, behavior, organizational structures, and educational strategies, educational development in the digital era requires support from adequate infrastructure. Access to reliable and affordable information technology is key to the successful implementation of digital pedagogy. Therefore, an efficient strategy for managing digital access is needed to support the availability of quality technology services in the school environment.

Thus, the concept of education in the digital age emphasizes the importance of digital literacy, the active role of teachers as facilitators, and adequate technological infrastructure support. All of these elements are key to creating a learning system that is adaptive, relevant, and capable of meeting the challenges of 21st-century education.



2. The Role of Educational Management in Digital Learning Transformation

The transformation of digital learning involves not only changes in classroom teaching methods but also new interpretations of the concept of education itself. This requires comprehensive adjustments to educational elements, including strengthening the curriculum, improving teacher competency, and integrating technology into the teaching and learning process. Educational management plays a crucial role in managing this change process. Generally, educational management encompasses planning, implementation, evaluation, financing, and supervision, all aligned with the use of digital technology. The goal of digital-based educational management is to foster a culture of discipline, increase student competitiveness, and transform them into agents of change capable of making positive contributions to society. This transformation encompasses three main aspects: digital transformation, human resource transformation, and cultural transformation (Mahmudah & Putra, 2021). The emergence of artificial intelligence, robotics, and big data is also accelerating this shift in the learning process. Educational management must be able to align these three dimensions so that they are integrated and support learning objectives.

The success of digital transformation depends heavily on the quality of educators. According to Hamdani et al. (2021), educational management plays a crucial role in developing educators to possess adequate digital competencies through structured training and targeted career planning. Educator professionalism is a key element in bridging the technology gap in the school environment. Dacholfany et al. (2022) emphasize that educational management systems must support pedagogical innovation and the optimal use of digital media to ensure enjoyable, relevant, and contextual learning experiences for students. Thus, educational management functions not only technically but also transformatively in shaping 21st-century learning. The management of digital curricula is one of this transformation's main priorities. One specific illustration of how educational management must modify curriculum design to reflect current needs and technological advancements is the introduction of the Independent Curriculum (Kurikulum Merdeka). Said et al. (2024) stress that in order to guarantee that learning is content-relevant and in line with upcoming difficulties, curriculum digitization necessitates cooperation between educational actors, including principals, teachers, students, and parents. Moving away from traditional mindsets and learning approaches toward more dynamic and technology-integrated models is the biggest problem facing educators in the digital age. This is where educational management needs to provide training, technical guidance, and a supportive environment for these changes. Furthermore, educational management must also prepare systems that are responsive to barriers to digital implementation, such as limited technological competency among educators, disparities in access, and resistance to change (Ghani and Muhammad, 2019; Sihotang, 2025). Strategic, participatory, and data-driven managerial policies are needed to ensure effective and equitable digital transformation. Roesminingsih and Winarko (2019) demonstrated that digital information management systems can improve the effectiveness of academic services in higher education through technology-based archiving and monitoring systems. This emphasizes that digital education management must be data-driven and systematic to support accurate and rapid decision-making.

Overall, adaptive, innovative, and transformative education management is key to success in facing the challenges of digitalization. Through its strategic role, education management not only guides change but also ensures that digital learning

transformation is effective, inclusive, and oriented towards improving the quality of education.

3. The Effectiveness of Technology-Based Pedagogy in Improving the Quality of Learning

At all educational levels, digital technology-based teaching strategies have proven to be highly successful in raising the standard of instruction. Teachers' and students' roles in the teaching and learning process have changed as a result of the methodical application of digital pedagogy, becoming more flexible, collaborative, and learner-centered. Here are some ways that technology-based pedagogy can enhance the quality of learning, as determined by a review of pertinent scientific papers.

1) Students Active and Collaborative Engagement Is Improved by Digital Pedagogy

Students may access materials online and participate in conversations through platforms like MOOCs and LMSs, digital pedagogy makes learning more inclusive and dynamic. This removes the barriers of space and time, enabling real-time, cross-regional collaboration through digital media. This collaboration and interactivity increase student engagement and deepen understanding of the material (Nanjundaswamy et al., 2021).

2) Support Constructivism-Based and Student-Centered Learning

Based on research conducted by Vaataja & Ruokamo (2021), digital pedagogy supports constructivist-based learning through active student engagement in the learning process. Students can autonomously evaluate, investigate, and create knowledge by using technology. Through social and reflective activities including online forums, digital project development, and self-directed problem-solving, this method strengthens constructivist learning.

3) Improving Students' and Teachers' Digital Proficiency

Enhancing teachers' and students' digital competency is one of the primary advantages of digital pedagogy. Teachers are not only required to master technology but also to be able to design effective technology-based learning. Students are also encouraged to develop digital literacy, information navigation skills, and critical understanding of digital content. These competencies are necessary to face the challenges of the 21st century and develop a generation of adaptive and competitive learners (Toktarova & Semenova, 2020).

4) Realizing Sustainable and Inclusive Learning

Digital pedagogy extends learning outside the classroom. Students can study continually and autonomously thanks to open resources including digital learning forums, online videos, and Open Educational Resources (OER). Building a culture of lifelong learning requires this (Nanjundaswamy et al., 2021).

5) Supporting Flexible and Adaptive Learning

Learning procedures that are customized to each student's unique needs, learning preferences, and speed are made possible by digital technology. Teachers can measure student progress and give more individualized and focused feedback by using digital-based formative assessments, adaptive learning algorithms, and student activity tracking through "digital footprints" (Toktarova & Semenova, 2020).

6) Encourage Student Motivation and Learning Independence



Digital pedagogy requires teachers not only to use technology but also to understand how to use it appropriately, including when, how, and which applications are appropriate for learning objectives, thereby encouraging student exploration and independent learning. Students may be challenged and inspired to learn by this method. Teachers' roles are not simply replaced by technology integration; rather, it calls for a more strategic and reflective approach to developing innovative teaching methods that are tailored to the requirements of the students. Teachers must therefore be pedagogically and technically equipped to oversee learning (Harahap et al., 2022).

4. Challenges and Strategies for Pedagogy-Based Educational Management in the Digital Era

There are several obstacles to overcome when integrating technology into school management, such as a lack of infrastructure, low levels of digital literacy, and opposition to change. According to Sari et al. (2024), solving these challenges calls for an all-encompassing approach to educational administration that includes everything from infrastructure improvement to organizational culture changes in educational institutions to training in digital literacy. This is in line with Mariatul's (2025) view, which highlights the importance of responsive educational management policies in addressing issues such as unequal access to technology and human resource readiness. The implementation of digital pedagogy in the technological era faces various obstacles that need to be addressed with appropriate strategies.

Some of the primary obstacles to adopting technology-based digital pedagogy include the following, along with potential solutions:

1) Teachers Digital Competency Gap

Many educators lack the necessary digital abilities, especially when it comes to using technology for collaborative and constructivist learning. This hinders the optimal integration of digital pedagogy (Vaataja & Ruokamo, 2021). To address this, educational institutions must provide intensive training in digital literacy and technology-based learning design, both independently and collaboratively. The goal is to strengthen teachers' role as facilitators of digital learning (Hamdani et al., 2021; Sari et al., 2024).

2) Limitations of Technology Infrastructure

Lack of access to hardware and a stable internet connection in some areas, particularly remote or underdeveloped ones, is a major obstacle to implementing technology-based learning. Many educational institutions, particularly in 3T (outermost, isolated, and disadvantaged) areas, still face limitations in internet access, digital devices, and technical support. The fair adoption of digital learning is significantly hampered by this (Toktarova & Semenova, 2020; Mariatul, 2025; Sari et al., 2024). Implementing a technology-based Independent Curriculum (Kurikulum Merdeka) is one strategy that can be used. This gives educational institutions the freedom to adapt their teaching methods to the local environment (Said et al., 2024). Furthermore, a blended learning approach, the use of simple digital platforms, and the development of internal school policies for resource allocation are also practical solutions implemented by several educational institutions.

3) Low Digital Literacy among Students

Most teachers lack adequate digital competency to implement technology-based pedagogy. Additionally, students sometimes lack the information literacy necessary to properly filter and use digital learning resources (Hamdani et al., 2021; Dacholfany et al., 2022). A methodical approach is required to improve pupils' poor levels of digital literacy, which include incorporating digital literacy programs into educational activities. The ability to access, assess, and use digital information critically and ethically can be covered in regular basic digital literacy training that schools can offer (Hamdani et al., 2021). Additionally, creating lesson plans that include digital literacy into a variety of courses can support students' contextual and long-term development of digital abilities. Teacher support is also crucial through active mentoring, selecting credible learning resources, and fostering the habit of using digital platforms wisely and productively (Dacholfany et al., 2022).

4) Rigidity of the Conventional Curriculum

This curriculum is adaptable to the times and promotes contextual technology integration (Said et al., 2024). Additionally, curriculum strengthening is required through the adoption of several cutting-edge, technology-based learning models, like the flipped classroom, which enables students to watch instructional videos on their own at home and participate in group discussions and practice in class. By adding game components to the learning process, gamification techniques can be utilized to boost motivation for learning. Additionally, via purposeful project-based assignments, project-based learning fosters creativity, teamwork, and problem-solving abilities. (Nanjundaswamy et al., 2021; Dacholfany et al., 2022).

5) Lack of Managerial and Institutional Support

There isn't a defined strategy or vision for handling digital change in schools and other educational institutions. Resistance to pedagogical innovation results from the majority of educational institutions' lack of strategic vision and dedication to fostering digital transformation (Toktarova & Semenova, 2020). Improving transformational leadership at the school level and fostering important cooperation among educational actors, principals, teachers, students, and parents are two ways to get over this challenge. Additionally, management creates institutional rules that encourage creativity and incorporate learning analytics, or data-driven evaluation, into decision-making (Ng, 2023).

Overall, the research results show that the integration of technology-based pedagogy supported by innovative educational management plays a crucial role in improving the quality of learning in the digital era. This approach is capable of developing 21st-century competencies such as digital literacy, critical thinking, and collaboration. According to Said et al. (2024), the adoption of digital transformation in education necessitates the assistance of strategic and adaptive educational management rather than only depending on the availability of technology. However, obstacles including inequalities in infrastructure, strict curricula, and insufficient digital literacy continue to prevent optimal adoption. In this context, the role of educational management is crucial in driving the success of digital transformation. In line with the views of Roesminingsih and Winarko (2019), the development of digital pedagogy requires systemic support from the planning, implementation, and evaluation stages. Strategies such as digital literacy training for educators, strengthening data-driven learning systems, and developing



adaptive and contextual curriculum are important steps to create a sustainable learning environment that is relevant to students' needs.

The ramifications of these findings highlight how crucial it is to create national education strategy that harmoniously integrates digital pedagogy and education management. The primary agenda must include support for the creation of inclusive infrastructure, the development of human resource capacity, and the creation of curricula that adapt to new technologies. Furthermore, inclusive and contextual learning models will be enhanced by growing research on the application of digital pedagogy in many local contexts, particularly underprivileged places (Said et al., 2024).

Therefore, it is possible to position technology-based pedagogy under creative education management governance as a crucial tactic for developing high-quality, pertinent, and long-lasting learning in the digital age. In addition to meeting contemporary needs, this strategy opens the door for a more competitive and egalitarian educational system on a worldwide scale.

CONCLUSION

The development of digital technology has driven fundamental changes in the global education system, demanding the implementation of technology-based pedagogy to improve the quality of learning. Based on a literature review, this study concludes that digital pedagogy can create an interactive, inclusive, and adaptive learning environment, while supporting the development of 21st-century skills. However, its implementation still faces challenges such as disparities in access, limited infrastructure, and low digital literacy. Therefore, an education management strategy is needed that includes improving educator competency, designing a digital curriculum, and policies that encourage comprehensive educational transformation. Technology-based pedagogy has proven to play a crucial role in supporting adaptive education management and improving the quality of learning in the digital era.

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