



Digital Transformation in Education to Foster Personalized Learning

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Article Info	Abstract
Article History Received: 2024-09-07 Revised: 2024-10-27 Published: 2024-11-11 Keywords: <i>Digital Transformation;</i> <i>Personalized Learning;</i> <i>Student;</i> <i>Teacher;</i> <i>Digital Innovations.</i>	This article is to explain the principles of digital transformation practices that can effectively enhance personalized learning. The article is written using a literature review method to identify various concepts, approaches, and findings from previous studies that support or challenge the role of digital technology in promoting personalized learning. The findings of this article indicate that there are four key principles to understand in digital transformation: digital innovation must specifically address students' needs, collaboration between teachers and technology must be well-established, strong student engagement must be fostered—beyond mere compliance, and continuous evaluation must be conducted to identify challenges in technology implementation. By adhering to these principles, education can become more responsive and inclusive in meeting the unique needs of everyone, thereby enabling the effective realization of personalized learning.
Artikel Info	Abstrak
Sejarah Artikel Diterima: 2024-09-07 Direvisi: 2024-10-27 Dipublikasi: 2024-11-11 Kata kunci: <i>Transformasi Digital;</i> <i>Personalized Learning;</i> <i>Siswa;</i> <i>Guru;</i> <i>Inovasi Digital.</i>	Tujuan artikel ini adalah untuk menjelaskan prinsip-prinsip praktik transformasi digital yang dapat secara efektif meningkatkan pembelajaran yang dipersonalisasi. Artikel ditulis dengan metode kajian literatur untuk mengidentifikasi berbagai konsep, pendekatan, dan temuan dari penelitian sebelumnya yang mendukung atau menantang peran teknologi digital dalam mendorong pembelajaran yang dipersonalisasi. Melalui tulisan ini dihasilkan bahwa terdapat empat prinsip yang harus dipahami dalam transformasi digital, yaitu inovasi digital harus secara spesifik menjawab kebutuhan siswa, kolaborasi antara guru dan teknologi harus terjalin dengan baik, ada engagement yang kuat dari siswa, bukan sekadar kepatuhan, dan ada evaluasi berkelanjutan untuk mengidentifikasi tantangan dalam penerapan teknologi. Dengan mengikuti prinsip-prinsip ini, pendidikan dapat lebih responsif dan inklusif dalam memenuhi kebutuhan unik setiap individu, sehingga personalized learning yang efektif dapat berlangsung.

I. INTRODUCTION

Digital transformation in education has become a phenomenon that is altering the ways in which teaching and learning are conducted. With technological advancements, education is now more widely and flexibly accessible, allowing students to learn in ways that align with their individual needs and preferences. According to McCarthy, Maor, McConney, dan Cavanaugh (2023), digital transformation encompasses not only the use of technological tools but also the creation of learning environments that are adaptive and responsive to the needs of individual students. This serves as the foundation for the implementation of personalized learning, whereby each student can optimally develop their potential.

Numerous theories are relevant in this context. Albert Bandura's Social Learning Theory (1977) emphasizes the significance of social interaction in the learning process (Koutroubas

& Galanakis, 2022). In the digital age, online learning platforms enable students to collaborate and engage with peers and educators from diverse backgrounds. This creates opportunities for students to learn from the experiences of others, enriching their understanding. By leveraging technology, students can participate in discussions, collaborative projects, and constructive feedback, which support a personalized learning approach.

David Ausubel's Cognitive Theory (1968) also provides a crucial perspective on how students assimilate information. Ausubel emphasizes that meaningful learning occurs when students can connect new information to their existing knowledge (Basyir, Dinana, & Devi, 2022). In the context of digital transformation, technology can be employed to deliver relevant and contextual materials, enabling students to relate their learning to their personal experiences. Consequently, personalized learning can be

achieved by technology that facilitates the connection between new and prior knowledge.

Furthermore, Vygotsky's Social Constructivism Theory (1978) highlights the importance of social context in learning. Vygotsky argued that social and cultural interactions influence how individuals learn (Saleem, Kausar, & Deeba, 2021). In the digital age, students can access a plethora of resources and perspectives from around the world, enriching their learning experiences. By leveraging technology, educators can create inclusive and diverse learning environments where students can learn from various viewpoints and collaboratively construct their knowledge.

Additionally, digital technology enables the delivery of content in multiple formats, such as videos, audio, interactive texts, and simulations, catering to different learning styles. Howard Gardner's Theory of Multiple Intelligences (1983) posits that individuals possess diverse learning modalities, including visual, auditory, and kinesthetic (Santrock, 2018). Digital technology provides students with the flexibility to choose the media that best aligns with their learning preferences, ultimately enhancing their effectiveness and engagement in the learning process. One of the key aspects of personalized learning, supported by digital technology, is the ability to offer self-paced learning experiences tailored to each student's learning speed.

By utilizing online learning platforms, students also gain the freedom to access course materials at any time and learn at their own pace. This aligns with Jean Piaget's Constructivist Theory (1971), which asserts that students construct their own knowledge through active interaction with learning materials, in accordance with their developing understanding (Misman, Jaini, Kadir, Mahmood, Rashid, & Dzulkifli, 2021). For instance, e-learning platforms like *Khan Academy* and *Coursera* provide resources that are accessible at any moment, allowing students to learn according to their individual speed and preferences, which embodies the principles of personalized learning.

Finally, the significance of feedback in the learning process cannot be overlooked. The Feedback Theory proposed by Hattie and Timperley (2007) demonstrates that effective feedback can enhance student learning outcomes (Wisniewski, Zierer, & Hattie, 2020). In the context of digital transformation, technology enables the delivery of prompt and accurate feedback, tailored to the specific needs of individual students. By employing digital tools,

educators can provide more targeted and relevant feedback, helping students to understand their strengths and areas for improvement in their learning journey. Thus, digital transformation plays a crucial role in creating a more personalized and effective learning experience.

Considering all the theories outlined, it is evident that digital transformation in education should ideally promote the process of personalized learning in schools. However, the reality within educational environments faces numerous obstacles and challenges in realizing this goal. There are significant limitations in digital innovation in schools, accompanied by an inability to keep pace with rapid technological advancements. Many educators also lack adequate training in the use of educational technology, rendering them unable to collaborate effectively with these tools, which results in technology implementation appearing merely as a matter of compliance. This perception of compliance adversely affects student engagement, as the digital technologies employed do not genuinely address students' needs. Furthermore, there are many unsystematic evaluation processes that lead to a lack of understanding regarding the effectiveness of digital technologies in the applied teaching methods (Quaicoe, Ogunyemi, & Bauters, 2023). Based on the aforementioned issues, the purpose of this article is to elucidate the principles of digital transformation practices that can effectively promote personalized learning. It is hoped that this writing will provide new insights for teachers and schools to focus digital education on students' needs.

II. METHOD

The methodology employed in this article is a literature review. The literature review was conducted by exploring journal articles, books, research reports, conference proceedings, and other supporting publications (Sajeevanie, 2021). Through this method, the author can identify various concepts, approaches, and findings from previous research that either support or challenge the role of digital technology in promoting personalized learning. Snyder (2019) emphasizes that a systematically and thoughtfully conducted literature review helps provide a robust conceptual framework, allowing the author to identify relevant theoretical contributions and integrate diverse perspectives. This literature analysis also enables the author to synthesize various viewpoints and construct

arguments based on existing evidence and theory, thereby offering a comprehensive insight into the topic.

III. RESULT AND DISCUSSION

Digitalization is the result of technological advancements that have a profound impact on various aspects of human life. This process can be defined as the phenomenon of transforming analog data into digital formats, enhancing relationships and providing added value to society as a whole (Reis, Amorim, Melão, Cohen, Rodrigues, 2020). The shift to the digital realm fosters the occurrence of digital transformation. Digital transformation is a process aimed at driving and instigating significant changes through the collaboration of information, computation, communication, and connectivity, which promotes the utilization of digital technologies (Valenda, Sobri, Triwiyanto, Kusumaningrum, Maulina, Putri, & Maitreepun, 2023). Thus, digital transformation is not merely the implementation of new technologies, it represents a holistic process designed to create substantial changes in organizational operations. Digital transformation should facilitate better collaboration, enhance productivity, and accelerate innovation, ultimately driving improvements in the quality of services or products while increasing competitiveness in an increasingly complex digital era.

Based on the discussion regarding digital transformation, this process should be viewed as a necessity in education to facilitate the transition from traditional teaching and learning methods to new approaches that align with students' needs. Research conducted by (Veckalne & Tambovceva, 2022) indicates that digital transformation in education even fosters sustainable development by personalizing education to meet diverse individual needs. The personalized approach that has long been implemented in teaching and learning processes is known as personalized learning.

Carter, as cited in Walkington & Bernacki (2020), states that personalized learning is a systematic instructional design focused on tailoring instruction to each student's strengths, preferences, needs, and goals, leading to a comprehensive educational experience that includes improved access to various disciplines and 21st-century skills. With a personalized learning approach, teachers can adapt their teaching methods to accommodate the abilities and requirements of each student. In an increasingly advanced technological era,

personalized learning is closely associated with digital environments. Makhambetova, Zhiyenbayeva, & Ergesheva, (2021) assert that digital learning environments are classified as personalized learning environments tailored to individual knowledge, experiences, interests, and the enhancement of expected learning outcomes. Ultimately, this is anticipated to promote the achievement of educational goals for every student.

Educational objectives must be student-centered, as everyone possesses unique potential, needs, and learning styles. This student-oriented approach places learners at the core of the educational process, ensuring that content and teaching methods are tailored to their abilities, interests, and developmental stages. By focusing on individual needs, student-centered education creates an environment that fosters intellectual, emotional, and social growth, thereby preparing them more holistically to face future challenges.

Digital transformation in education has paved the way for the implementation of personalized learning, which positions students at the heart of the learning process, providing them with experiences that are more relevant and individualized compared to traditional, uniform methods. However, for this digital transformation to be effectively realized, various key principles must be considered. It is not only the technological innovations that are important but also how these technologies are integrated with the role of teachers, student engagement, and ongoing evaluation of processes and challenges that arise during implementation. As part of the transformation process, digital technology should not merely serve as an additional tool but rather as a catalyst for changing how education is delivered, necessitating a more strategic and comprehensive approach.

1. Digital Innovation as a Tool for Meeting Student Needs

Digital innovation in education has become an essential tool for addressing the diverse needs of students. With technologies such as online learning platforms, educational apps, and AI-based learning tools, students can access course materials tailored to their individual learning styles and paces. According to Rapanta, Botturi, Goodyear, Guardia, & Koole (2021), digital innovation allows for more flexible adaptation of instructional content, enabling students to learn in the most effective manner for

themselves. This is particularly crucial in the context of personalized learning, where each student possesses unique needs and potential.

Furthermore, digital innovation also facilitates better data collection regarding student learning progress. By utilizing Learning Management Systems (LMS), teachers can track student development in real time and provide feedback that is both quicker and more accurate. Zawacki-Richter, Marín, Bond, & Gouverneur (2019) emphasize that analytics can be employed to identify areas where students may be struggling, allowing teachers to adjust their instructional approaches to meet specific student needs. Thus, digital innovation not only enhances educational accessibility but also improves teaching effectiveness.

However, to maximize the potential of digital innovation, it is essential to understand that the innovation process must be grounded in a deep comprehension of the needs, preferences, and challenges faced by students. Digital innovation in education becomes effective when its implementation is purposeful and well-planned, rather than merely a response to trends or external pressures. When schools pursue innovation solely to keep up with others or to avoid the perception of being outdated, they tend to overlook the specific needs of their students. Conversely, innovations designed with a focus on realizing student potential are more relevant and have a positive impact. By understanding the unique characteristics of each student, schools can develop more targeted and effective solutions, ensuring that the technology employed genuinely supports educational goals.

An intentional innovation process also avoids the "just for the sake of it" approach, where technology is implemented without a deep understanding of how it can enhance the learning experience. When innovation is centered on learning outcomes, it is more likely to achieve the desired educational objectives. Furthermore, the involvement of all stakeholders, including teachers, students, and parents, is crucial in this process. By engaging them in decision-making, schools can ensure that the innovations implemented reflect the needs and expectations of the educational community, while also facilitating ongoing evaluation and adjustments to ensure that technology continues to support the unique potential of each student.

2. Teachers and Technology Collaboration

As educators, teachers must adapt to digital transformation to create a more creative, innovative, and dynamic learning process that enhances the quality of education. According to Ishmatullah, Samkhi, & Savira (2023), one of the characteristics of 21st-century teachers is maximizing the use of technology. This does not simply mean that teachers increase their frequency of technology use in the classroom; rather, it is insufficient to rely solely on the frequency of digital device or software usage to comprehend the pedagogical approaches that underpin technology integration (Antonietti, Schmitz, Consoli, Cattaneo, Gonon, Petko, 2023). Zhang (2022) emphasizes that teachers need to be trained to use digital tools effectively in their instruction. This entails that educators are encouraged to possess up-to-date technological knowledge in the field of education and to master these tools, enabling them to collaborate in creating a robust and high-quality learning ecosystem.

Quoting Panggabean and Hidayat (2022), when employing technology in teaching, teachers should view technology through three different lenses: the technology used before instruction, the technology utilized during instruction, and the technology applied after instruction. This means that teachers must pay careful attention to technology usage in preparing a comfortable learning environment for students before teaching, accommodating the diverse needs and characteristics of individual students, such as learning styles, skills, cognition, potential, and varying needs, during instruction, and ensuring and evaluating learning outcomes after teaching. Therefore, there must be strong collaboration between teachers and the technology employed.

Collaboration between teachers and technology is a crucial aspect of the digital transformation in education. Teachers function not merely as information deliverers but also as facilitators who leverage technology to create more engaging and interactive learning experiences. The use of digital technology in education should not be seen merely as compliance, rather, it should involve meaningful engagement that strengthens the relationship between teachers and the technologies employed, thereby having a genuine impact. Given the rapid advancement of technology, teachers must

continually update their knowledge and skills to remain relevant. Evaluation and reflection on their teaching practices are also essential to ensure that this collaboration positively influences student learning. Thus, the partnership between teachers and technology should be viewed as mutually beneficial. Skilled teachers using technology can create richer and more relevant learning experiences for students, while technology itself can enhance the role of teachers in supporting effective and personalized learning.

3. Enhancing Student Engagement

Digital transformation in education should facilitate student engagement. This engagement is characterized by students feeling comfortable with the technology being used, which in turn empowers them to reach their optimal potential. Student engagement with digital technology is typically reflected in positive interactions between students and the technology. This can be observed through active participation in discussions, the intensity and duration of technology use, an increase in knowledge, and a strong desire to continue utilizing digital tools. This indicates that digital transformation in education must be responsive to the dynamic and unique needs of students, allowing them to continually find effective learning experiences through digital technology.

According to Aprianto & Wahyudin (2023), the use of interactive media and engaging learning platforms can enhance student motivation to learn. When students are given choices in how they learn, such as selecting the format of materials (video, text, or simulations), they tend to feel more involved and have greater control over their learning process. Another effective strategy for increasing student engagement is through the use of gamification in education. Gamification involves the application of game elements in a learning context to boost motivation and student involvement. According to Legaki & Hamari (2020), gamification can create a more enjoyable and engaging learning experience, which, in turn, encourages students to participate more actively. In this way, technology not only serves as a tool but also acts as a driver of student motivation.

However, to achieve high levels of engagement, it is essential for educators to design learning experiences that are relevant and appealing. According to Makhambetova,

Zhiyenbayeva, & Ergesheva (2021), learning experiences tailored to students' interests and needs can significantly enhance their engagement. Therefore, educators must understand their audience and create content that aligns with students' preferences. In this way, students will feel more connected to the subject matter and more motivated to learn.

Ultimately, enhancing student engagement should be viewed as a long-term goal in education. High engagement levels not only impact academic outcomes but also contribute to students' personal and social development. By fostering a learning environment that supports engagement, educators can help students cultivate self-confidence and independence in their learning. This is a crucial step in promoting personalized learning and preparing students to face future challenges.

4. Continuous Evaluation of Challenges and Obstacles

Numerous challenges and obstacles inevitably arise during the digital transformation process within educational organizations, as this process is inherently dynamic. This necessitates ongoing evaluation to ensure that the transformation effectively addresses the needs that promote personalized learning. Understanding the integration of technology in education is essential for assessing teaching and learning activities that involve technology, as well as determining whether such technology merely replaces traditional teaching methods or is utilized to foster deeper and more complex learning activities (Antonietti, Schmitz, Consoli, Cattaneo, Gonon, Petko, 2023).

Continuous evaluation of the digital transformation process in education is crucial for identifying and addressing potential obstacles. Digital transformation is not an instantaneous process; rather, it requires ongoing adjustments and improvements. Cuban (2001) in Noeth & Volkov (2004) emphasizes the importance of a systematic approach to evaluating technology implementation, which includes identifying educational needs, specifying implementation goals, and designing instructional strategies to create an effective learning environment. By conducting regular evaluations, schools can ensure that the technology implemented genuinely meets student needs and supports personalized learning.

In addition, continuous evaluation also encompasses the collection of feedback. According to Muslu & Siegel (2024), feedback is a crucial step that enables communication between students and teachers. This communication helps identify student needs and enhances learning. It also fosters relationships between students and teachers, which in turn can increase engagement and motivation within the learning process.

Furthermore, continuous evaluation of challenges and obstacles in digital transformation should include data analysis derived from technology usage. By leveraging data analytics, educators can identify patterns and trends in student learning, as well as assess the effectiveness of various teaching methods employed. This will assist educational institutions in ensuring that they not only adopt new technologies but also optimize their usage to support effective and relevant personalized learning for all students.

IV. CONCLUSION AND SUGGESTION

A. Conclusion

Digital transformation that fosters personalized learning must consider several key principles to achieve optimal outcomes. First, digital innovation should be utilized as a tool to meet the diverse potential, needs, and learning styles of students by aligning with their preferences. Second, the success of personalized learning relies on the collaboration between teachers and technology, where technology aids educators in understanding individual student needs and assists them in designing more personal and relevant learning experiences. Third, this approach plays a crucial role in enhancing student engagement, as the use of digital technology tailored to their interests and needs will encourage greater motivation and active participation. Finally, it is essential to conduct continuous evaluation of the challenges and obstacles in the implementation of digital technology to ensure that the digital transformation proceeds effectively and inclusively.

B. Suggestion

Through this writing, the author offers the following recommendations:

1. Educational institutions should conduct regular research and evaluation of the implementation of digital technology in the

learning process to ensure that the innovations applied genuinely meet student needs and preferences, thereby enhancing the effectiveness of personalized learning.

2. It is crucial for teachers to continuously develop their technological skills and build strong relationships with students in order to select appropriate tools and methods for teaching, thus creating more personal and relevant learning experiences.

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