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Classroom Management Strategies in the Transformation of Education in the Digital Era: Integration of Technology and Teaching Methodologies

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ABSTRACT

Technology integration into education has revolutionized the learning paradigm, driving significant transformations in teaching methodologies and learning experiences. This paper explores the multifaceted impact of digital education, emphasizing its role in addressing the demands of the digital era and enhancing inclusivity in learning environments. A comprehensive review of recent literature highlights the shift towards dynamic and interactive learning facilitated by technology, transforming teachers into facilitators of engaging educational experiences. Personalization approaches utilizing artificial intelligence and data analysis have furthered accessibility and tailored learning experiences to individual student needs, fostering a more inclusive educational landscape. Additionally, online platforms have facilitated cross-cultural collaboration and interdisciplinary learning, enriching global perspectives and expanding access to education. While digital education presents numerous benefits, challenges such as the digital divide and technology misuse require careful consideration. Issues like network instability and technological ablation hinder learning effectiveness, necessitating proactive measures for mitigation. Collaboration among schools, governments, and society is crucial in addressing infrastructure limitations and ensuring equitable access to technology-enhanced education. Furthermore, the strategic integration of online learning tools and applications offers opportunities for enhanced student engagement and personalized learning experiences. Innovative pedagogical strategies, including collaborative learning, educational games, simulations, and multimedia integration, are essential in creating effective and engaging learning environments. In conclusion, navigating the complexities of digital education requires a balanced approach that leverages technology's potential while addressing associated challenges. By fostering collaboration and innovation, education stakeholders can maximize the benefits of technology in preparing students for success in a rapidly evolving digital landscape.

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INTRODUCTION

Digital education has become a significant driver of change in the learning paradigm by integrating technology and teaching methodologies, resulting in significant transformation in the world of education (Alenezi et al., 2023; Hill & Hannafin, 2001). This change is further reinforced by the urgent need for technology-based skills to address the challenges of the digital era (Abulibdeh et al., 2024; Ahuja et al., 2023; Revola, 2024; Sofi-Karim et al., 2023). Deep integration of technology has created more dynamic and interactive learning experiences,

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transforming the role of teachers into facilitators who utilize technology to create engaging learning environments (Jenita et al., 2023; Kamalov et al., 2023; Naeem et al., 2023). Personalization approaches through artificial intelligence and data analysis have opened doors to enhancing accessibility and inclusivity in education (Nurachmy Sahnir et al., 2023), enabling effectively tailored learning experiences to meet the individual needs of students (Chen et al., 2020; Gusli et al., 2023; Liu & Yu, 2023; Magnisalis et al., 2011; Oktavianus et al., 2023). Additionally, cross-cultural and interdisciplinary collaboration has become more accessible through online platforms, allowing students and educators to explore interdisciplinary topics and enrich understanding of global diversity firsthand (Brewer et al., 2015; Cogburn & Levinson, 2003; Seeberg & Minick, 2012), while also providing access to quality courses, expanding access to previously inaccessible education, and facilitating self-directed learning anytime, anywhere (Rožman et al., 2023; Saleem et al., 2023). In this context, the role of teachers becomes crucial in leveraging technology to adapt teaching strategies, enhance student interaction, and provide time and place flexibility in the education process according to the individual needs of students (Gustina, 2023; Muammar et al., 2023; Rachmi et al., 2024).

Although there are many benefits to integrating technology into classroom management, challenges also arise that require careful handling (Deni, 2023). The digital divide among students is one significant issue, while technology misuse also needs attention (Kardika et al., 2023). Technology misuse, such as social media addiction or distractions caused by excessive gadget use, is also a concern (Wibowo, 2023). However, with the right approach, technology can enhance learning effectiveness, prepare students for a technology-driven future, and ensure greater inclusivity in education (Rambung et al., 2023). The appropriate use of technology can improve the efficiency and effectiveness of the learning process, providing support to teachers in facilitating student-centered learning (Ismaniati, 2010). Furthermore, it is essential to prepare students for an increasingly technology-driven world by giving them opportunities to develop digital skills and media literacy that align with the individual needs of students (Abbott et al., 2014).

Technology disruptions severely challenge education in the digital era (Hajarudin, 2023). Network instability, hardware damage, and software misuse can hinder learning (Astari, 2022; Rosmayati & Maulana, 2021). Technological ablation, where students cannot effectively utilize technology, also becomes a significant issue (Hajarudin, 2023). Factors such as lack of understanding of technology and resistance to its use can contribute to this ablation (Akbar & Noviani, 2019; Eveline Siregar dan Hartini Nara, 2011; Lestari & Kurnia, 2023). Adapting to student behavior and preferences changes is crucial in sustainable education (Apriadi & Sihotang, 2023). Creating a learning environment that supports student development and considers their preferences for technology use must be considered (Dewantara et al., 2020; Dewi, 2021; Putra & Pratama, 2023). Limitations in infrastructure and technology accessibility also hinder digital learning (Novelita et al., 2023; Putro et al., 2023). Addressing these issues requires collaboration among schools, government, and society (Maulido et al., 2024). Schools can play a role in providing access to hardware and the internet, while the government must ensure the availability of adequate infrastructure (Katharina, 2021; Nurbayanni et al., 2023). The role of society is also needed to address these limitations (Putri, A et al., 2023). Overall, understanding and addressing technology disruptions, technological ablation, infrastructure, and accessibility limitations need to be the primary focus in optimizing education in the digital era.

Utilizing online learning tools and applications has become a key strategy in harnessing the potential of technology in classroom management (Rožman et al., 2023). These tools and applications provide access to various learning resources that students can access anytime, anywhere (Apriadi & Sihotang, 2023). With online learning tools and applications, teachers can provide students with easy access to various learning materials such as texts, videos, simulations, and interactive exercises (Hajarudin, 2023). Using online learning tools and applications also offers significant advantages in enhancing student engagement in the learning process (Rosmayati & Maulana, 2021). Integrating multimedia content, interactive simulations, and

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educational games into the learning experience has proven to be an effective strategy for achieving this goal (Deni, 2023). Interactive simulations allow students to explore abstract or complex concepts (Chen et al., 2020). In the modern technology-driven era of education, differentiation and personalized learning are vital to creating compelling learning experiences for every student (Muammar et al., 2023). Technology enables adaptive and responsive learning approaches to meet the individual needs of students (Kamalov et al., 2023). Through features such as data analysis and adaptive learning, technology can assist teachers in adjusting learning materials and strategies according to each student's unique characteristics (Naeem et al., 2023). Data analysis enables teachers to understand students' learning progress. It needs better (Novelita et al., 2023), including their understanding of learning materials, learning preferences, learning pace, and challenges faced (Putro et al., 2023).

In the technology-driven education era, innovative pedagogical strategies are vital to creating effective and engaging student learning experiences (Purba & Saragih, 2023). Various innovative approaches have been developed, including collaborative learning and technology-based projects, educational games and simulations, and the integration of multimedia in presentations and learning materials (Wibowo, 2023). Collaborative learning and technology-based projects allow students to collaborate in groups to complete tasks or projects using various available technological tools and platforms (Zazin & Zaim, 2018). The effective use of educational games and simulations enhances student engagement and motivation (Ardiansyah & Nana, 2020). Computer simulations effectively provide learning experiences close to real-world situations (Silberman et al., 2021), helping students develop critical skills (Ummah et al., 2022). Integrating multimedia in presentations and learning materials enhances student engagement by utilizing images, audio, video, and animations to present information visually and audibly (Hakim & Windayana, 2016; Lestari & Kurnia, 2023). The use of audio media such as sound recordings or podcasts helps clarify material (Lubis & Mavianti, 2022), while the use of video or animation clarifies concepts or processes visually and is easily understood by students (Saman, 2023).

1. Introduction To Digital Education

a. Definition and Characteristics of Digital Education

Digital education, as an evolving learning paradigm, has shown significant changes in educational approaches through the integration of digital technology (Hill & Hannafin, 2001; Alenezi et al., 2023). Regardless of conventional concepts, digital education marks a fundamental shift in the learning process, where digital technology becomes an integral part of the learning experience (Rachmi et al., 2024). In this concept, digital education incorporates technological tools in classrooms, reflecting a profound transformation in the education paradigm. Teachers become technology users as the primary tool to deliver content, adapt teaching approaches to individual student needs, and facilitate student interaction and collaboration. Digital education also emphasizes improving accessibility and inclusivity in the education world (Gustina, 2023). With digital technology, education becomes more flexible and accessible from anywhere, overcoming geographical and economic barriers that may arise, providing opportunities for individuals from various backgrounds to access quality education, and creating equal access. Personalized learning is a crucial aspect of digital education (Putri et al., 2024). Through technologies such as artificial intelligence and data analysis, digital education can customize learning experiences to meet the needs and preferences of individual students. Thus, each student can develop their potential optimally according to their characteristics and needs.

Besides being a learning tool, digital education also aims to prepare students to meet the demands of the digital era by developing relevant skills (Abulibdeh et al., 2024). including digital literacy and the ability to understand, use, and evaluate information from various digital platforms. Additionally, students are taught to use various digital tools and platforms, deepen their understanding of technology problem-solving, and hone their creativity in leveraging

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technology for educational and professional purposes. Thus, digital education prepares students to be savvy consumers in the digital era and technology producers and innovators capable of creating positive change in society. In this context, digital education is not just about mastering technology but also about effectively utilizing it to create solutions for challenges and problems in real life. Through digital education, students are encouraged to be agents of change who can contribute to building a better future for an increasingly digitally connected global society.

The main characteristics of digital education reflect a profound transformation in the education paradigm, shaped by integrating digital technology into every aspect of learning (Kamalov et al., 2023). In digital education, technology no longer merely serves as an additional tool. However, it becomes the core of teaching strategies, enabling more dynamic, interactive, and relevant learning experiences according to student needs (Jenita et al., 2023). Teachers act as learning facilitators who leverage technology to create engaging learning environments for students (Naeem et al., 2023). Furthermore, digital education enhances the accessibility and inclusivity of education by expanding access to quality education through digital technology, ensuring individuals from various backgrounds have equal access to quality education (Nurachmy Sahnir et al., 2023). Personalized learning approaches are crucial in digital education, where teachers can customize learning experiences to meet the needs and preferences of individual students. Teachers use digital tools to monitor student progress and present materials tailored to their understanding levels (Muammar et al., 2023). Additionally, digital education aims to develop technology-based skills to prepare students to meet the demands of the digital era, including digital literacy, technology problem-solving, and creativity in leveraging technology (Revola, 2024). Thus, digital education reflects an evolution in teaching approaches and lays the foundation for education that is more inclusive, adaptive, and relevant to contemporary needs and challenges.

b. The Role of Technology in Educational Transformation

The role of technology in transforming education is crucial in addressing challenges and harnessing opportunities offered by the digital era. Technology has brought about profound changes in how we learn and teach, permeating every aspect of the educational process, from accessing information to teaching methods and evaluation. Technology plays a significant role in expanding the reach of education and providing learning opportunities to individuals worldwide (Ahuja et al., 2023). Online platforms and educational apps provide accessibility to educational resources without geographical or time constraints (Sofi-Karim et al., 2023). Leading educational institutions like Khan Academy, Coursera, and edX provide access to quality courses, enabling individuals from diverse backgrounds to access previously inaccessible education (Saleem et al., 2023). Apps like Duolingo and Photomath facilitate self-paced learning anytime, anywhere for students siswa (Rožman et al., 2023). Thus, technology facilitates access and empowers individuals to take control of their learning process.

Technology has become a means to facilitate personalized learning, using intelligent algorithms to tailor learning experiences for each individual based on their abilities, interests, and learning styles. In this context, intelligent algorithms are used to analyze data about each student, enabling more focused and individually tailored learning (Oktavianus et al., 2023). For example, online learning platforms can utilize intelligent algorithms to monitor student performance and offer additional materials or exercises tailored to each student's ability level. Students who quickly grasp the material can be given more challenging tasks to maintain their interest and motivation. Meanwhile, students needing additional assistance can be provided with deeper resources according to their needs (Liu & Yu, 2023). Thus, using intelligent algorithms and innovative educational technology makes personalized learning more accessible

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and easier to implement in modern classrooms (Gusli et al., 2023). It is about improving students' academic performance and helping them develop skills and interests aligned with individual potential (Magnisalis et al., 2011; Chen et al., 2020). In this regard, technology has become a learning tool and the primary facilitator in enriching the educational experience for everyone.

Technology has enabled more comprehensive collaboration and interaction among students and educators through online forums, chat rooms, and other online collaboration tools, opening up opportunities for cross-cultural and interdisciplinary learning (Cogburn & Levinson, 2003). Online forums allow them to share their views, experiences, and knowledge without being limited by space and time (Sofi-Karim et al., 2023). Technology also facilitates interdisciplinary learning by providing access to various learning resources and content covering a wide range of fields of study. Using online collaboration tools, students and educators can explore topics that transcend disciplinary boundaries (Brewer et al., 2015). Cross-cultural learning is also enhanced through technology, as students can easily interact with people from different cultural backgrounds and learn about global diversity firsthand. Chat rooms and online collaboration platforms allow students to share their experiences and understand others' perspectives, a crucial aspect of cross-cultural education (Seeberg & Minick, 2012). Thus, technology has opened the door to more inclusive and holistic learning, where students and educators can interact and learn from each other without being constrained by geographical or cultural boundaries. It creates a rich and dynamic learning environment where ideas and knowledge can flow freely, fostering more incredible intellectual and emotional growth among all participants.

Technology has been a significant driver in improving educational accessibility for individuals with special needs or learning challenges. Through accessibility options such as text-to-speech and language translation, technology enables greater inclusion in the educational environment (Abbott et al., 2014). For example, text-to-speech development allows students with visual impairments to access learning materials more independently. Screen reader software supports this, which converts written text into speech (Hill & Hannafin, 2001). Additionally, technology also facilitates language translation, eliminating language barriers to access. Various accessibility aids, such as significant text adjustments and special keyboards, help individuals overcome their learning challenges (Hasselbring & Glaser, 2000). By providing an inclusive learning environment, technology ensures that everyone feels accepted and supported in the learning process, creating an equal learning experience for all individuals and promoting their academic growth and success. Thus, the role of technology in providing accessibility and inclusion in education cannot be overlooked, providing a solid foundation for the development of abilities and potential for every individual.

c. Implications of Technological Changes on Classroom Management

Technological advancements have been a major driver in the transformation of education, with significant impacts on classroom management. The integration of technology in the context of learning has changed traditional paradigms, leading to changes in teaching approaches and practices. Developing new competencies and enriching students' learning experiences have become crucial in integrating technology into education (Muammar et al., 2023). Teachers must understand and apply technology in the context of learning, recognizing the role of technology as a tool to enhance learning, not just an addition to the teaching process (Kamalov et al., 2023). The need for an integrated approach in utilizing technology to achieve practical learning goals is becoming increasingly important. Personalized learning can enhance

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student achievement, highlighting the urgency of student-centered learning approaches. Teachers must be able to adapt learning to meet individual student needs and interests (Naeem et al., 2023). However, challenges in implementing technology integration in learning must be overcome. Proper training for educators is essential to integrate technology into teaching and learning. It is important to develop ongoing professionalism to support educators in adopting and integrating technology into their teaching practices. Equal access to technology is a critical concern, especially in addressing infrastructure limitations and technology accessibility (Abbott et al., 2014). Integrating technology into education offers great potential to enhance students' learning experiences and teaching effectiveness. However, related challenges require a holistic and collaborative approach to address them.

Communication among teachers, students, and parents has undergone significant transformation thanks to technological advancements. Technological advancements, such as online learning platforms, have enriched communication among key stakeholders in the educational context (Abbott et al., 2014). Tools like email, text messaging, and specialized apps allow teachers to easily interact with students and parents, conveying important information about academic progress, assignments, and classroom activities (Brewer et al., 2015). Integrating technology into home-school communication opens up opportunities for closer collaboration between both parties, with positive impacts on students' academic and social development, as well as enabling parents to be more actively involved in their children's education, supporting holistic learning processes (Muammar et al., 2023). Although there are many benefits to integrating technology into classroom management, challenges also arise that require careful handling ((Deni, 2023). The digital divide among students is one significant issue, while technology misuse also needs attention. Clear policies regarding technology use in the classroom are crucial to ensure that technology can be optimally utilized.

With technological advancements, many benefits have been brought to classroom management, challenges still need to be addressed. One of them is the digital divide among students, which can limit their access to technology and information (Kardika et al., 2023). It is essential to address this gap so that all students have equal opportunities to leverage technology in learning. Technology misuse, such as social media addiction or disruptions due to excessive gadget use, is also a concern. Clear policies and discipline in using technology in the classroom are crucial to ensure that students can utilize technology productively and safely (Wibowo, 2023). However, with the right approach, technology can be a powerful tool in enhancing learning effectiveness, preparing students for a technology-driven future, and ensuring greater inclusion in education (Rambung et al., 2023). The proper use of technology can improve the efficiency and effectiveness of the learning process, providing support to teachers in facilitating student-centered learning (Ismaniati, 2010). Additionally, the importance of preparing students for an increasingly technology-driven world by giving them opportunities to develop digital skills and media literacy cannot be overlooked. Ensuring greater inclusion in education involves providing better accessibility for students with special needs and enabling differentiated learning according to individual student needs (Abbott et al., 2014). Thus, technology can be a catalyst for enhancing the quality and accessibility of education for all students.

2. Classroom Management Challenges In The Digital Era

a. Technology Disruption and Ablation in Learning

Classroom management challenges in the digital era have become the primary focus in understanding the dynamics of learning influenced by technological advancements. Two main aspects highlighted are technology disruption and ablation in learning, adaptation to changes in student behavior and preferences, infrastructure limitations, and technology accessibility. Technological disruptions pose a severe challenge in the educational context in the digital era. This phenomenon encompasses various technical issues in the learning process's hardware, software, or Internet network infrastructure (Hajarudin, 2023). Network instability, hardware malfunctions such as computers or tablets, and errors in using learning software are real

p-ISSN: 1979-7842
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examples of technological disruptions that can impede the smooth flow of the learning process (Astari, 2022). Technical issues like unstable network disruptions often haunt educators in the digital era. When the internet network is unstable, students and educators may face difficulties accessing online learning resources, downloading or uploading assignments, or running learning applications that require a strong internet connection (Rosmayati & Maulana, 2021). Furthermore, hardware malfunctions, such as computer or tablet damage, can also cause severe disruptions in the learning process. Suppose the hardware used by students or educators is damaged. In that case, it can hinder their access to learning materials and make it difficult for them to participate in technology-dependent learning activities (Zazin & Zaim, 2018)

Errors in using learning software can be a source of disruption in the digital learning process (Liu & Yu, 2023). For example, difficulty operating or accessing specific applications can disrupt the learning flow and cause frustration for all parties involved. The inability to use the software effectively can also hinder students' ability to benefit from the provided digital learning experiences (Magnisalis et al., 2011). Addressing technological disruptions requires a deep understanding of various technological aspects used in learning. Educators need to understand how hardware, software, and internet networks used in their classrooms operate (Kamalov et al., 2023). They also need to be equipped with adequate technical skills to quickly and effectively address any technical issues, including diagnosing problems, performing repairs or troubleshooting, and providing technical assistance to students or fellow educators experiencing difficulties in using technology (Naeem et al., 2023). Besides technical skills, educators must also have mental and emotional readiness to deal with potential technological disruptions (Deni, 2023). They need to be able to remain calm and composed in potentially tense situations and think creatively and innovatively in finding solutions to emerging problems (Seeberg & Minick, 2012). Effective communication also becomes vital in addressing technological disruptions between educators and students and among fellow educators in the teaching team.

In addition to technological disruptions, technological ablation poses a severe challenge to learning in the digital era. Technological ablation, as a significant challenge in the context of education in the digital era, refers to students' inability to effectively utilize technology in the learning process (Hajarudin, 2023). This phenomenon includes several factors hindering students' ability to use or leverage technology in the learning environment. One of the leading causes of technological ablation is the need for adequate access to technology. Students who need adequate access to hardware, such as computers or tablets, or stable internet networks, may need help to use technology to access digital learning resources (Akbar & Noviani, 2019). A lack of understanding of how to use technology can also cause technological ablation. Although students may have access to technology, they may need more knowledge or skills to use technology effectively in an educational context. Lack of training or guidance on how to use software or digital learning applications and a lack of understanding of ethics and responsibilities in technology use can hinder students' ability to utilize technology optimally in learning (Lestari & Kurnia, 2023). Furthermore, resistance to the use of technology in the educational context can also be a cause of technological ablation. Some students may feel uncomfortable or uninterested in using technology in learning, perhaps because they prefer traditional learning methods or do not believe in the effectiveness of technology in enhancing learning (Hastini et al., 2020). Such resistance can hinder students' ability to engage fully in technology-involved learning activities and may reduce the learning benefits they can derive from technology use.

In the learning context, technological ablation indicates a gap in students' abilities to effectively leverage technology, which can hinder their access to digital resources and hurt participation and academic achievement (Abbott et al., 2014; Liu & Yu, 2023). Constraints in using technology can also cause inequalities in access to information and involvement in technology-based learning activities. Addressing technological ablation requires a holistic and inclusive approach that considers individual students' needs. Educators must be able to identify students experiencing technological ablation and provide appropriate support, such as

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additional training and ensuring equal access to hardware and the Internet (Ahuja et al., 2023; Hill & Hannafin, 2001). Additionally, collaboration among educators, students, parents, and other stakeholders is necessary to address resistance to using technology in learning. These efforts include providing information about the benefits of technology in learning, listening to students' concerns, and creating a learning environment that supports technology use (Rachmi et al., 2024; Saleem et al., 2023).

b. Adjustment to Changes in Student Behavior and Preferences

Adjusting to changes in student behavior and preferences is crucial in the continually evolving educational context. Technological advancements, social transformations, and cultural dynamics have significantly influenced how students interact with information, process knowledge, and respond to the learning process (Apriadi & Sihotang, 2023). These behavioral changes encompass various aspects, ranging from learning style preferences to more dynamic and responsive learning experiences. In facing these changes, educators are confronted with the challenging task of understanding, adapting to, and effectively responding to students' individual needs (Putra & Pratama, 2023). The importance of adjusting to changes in student behavior and preferences lies in creating a learning environment that motivates and supports optimal student development. By understanding changing student behaviors, educators can design learning strategies more suited to their needs and preferences (Dewi, 2021). For example, educators can utilize more interactive, collaborative, and project-based learning approaches to meet the needs of students more inclined towards practical and relevant learning processes. Additionally, educators also need to consider students' preferences regarding the use of technology in learning (Dewantara et al., 2020). Most students today are more accustomed to using technology daily, making them more responsive to learning that utilizes digital tools and online platforms.

Adjusting to changes in student behavior and preferences is an essential aspect of the learning process that demands a differential teaching approach. Recognizing each student's diverse needs, interests, and learning styles underscores educators' importance in aligning individualized learning approaches (Brewer et al., 2015). Such efforts include providing additional assistance to students struggling to understand the material, assignments tailored to student interests, and constructive feedback to enhance student's personal and academic development. In its implementation, educators need to adopt various proven effective teaching strategies and techniques in responding to changes in student behavior and preferences (Dewi, 2021; Liu & Yu, 2023). For example, using project-based approaches, group discussions, and digital media can facilitate more interactive and contextually relevant learning. Moreover, strengthening interpersonal relationships with students, listening to their needs, and providing emotional support are critical to creating a conducive learning environment and motivating students in the learning process (Hill & Hannafin, 2001; Rožman et al., 2023).

The main challenge in adjusting to changes in student behavior and preferences is the need to keep up with technological developments and emerging learning trends continuously. Educators must maintain the currency of their knowledge and skills and remain open to innovations in their teaching approaches (Chen et al., 2020). Additionally, collaboration among educators with peers in their field, active participation in training and seminars, and involvement in professional networks are essential for exchanging information and best practices in response to these changes (Putri et al., 2024). Thus, adjustment to changes in student behavior and preferences becomes crucial in creating an inclusive, relevant, and responsive learning environment in this digital era (Akbar & Noviani, 2019). By understanding and effectively responding to students' individual needs, educators can help them achieve their full potential in facing future challenges (Gustina, 2023). Therefore, this adjustment should be a primary focus in efforts towards sustainable and progressive education.

c. Limitations in Infrastructure and Technology Accessibility

p-ISSN: 1979-7842
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Limitations in infrastructure and technology accessibility are significant constraints in managing classrooms in the digital era (Novelita et al., 2023). Despite technology being a crucial component in the learning process, many students still need help accessing the devices and internet connections required for effective digital learning. Financial limitations hinder students' ability to purchase devices, limited access to stable internet in their environments, or a lack of understanding of how to use technology can obstruct active student participation in digital-based learning (Putro et al., 2023). Students who need adequate access to hardware and the internet are vulnerable to falling behind in utilizing digital resources and platforms used in the educational process. For example, students may need help attending online lectures, completing online assignments, or accessing digitally provided learning materials. These constraints not only affect students' ability to acquire the necessary knowledge and skills but can also hurt students' motivation and engagement in learning.

Addressing limitations in infrastructure and technology accessibility requires collaborative efforts from various stakeholders, including schools, governments, and communities (Maulido et al., 2024). Schools can play a role in providing access to hardware and internet connectivity in the learning environment and training students and educators on technology use (Nurbayanni et al., 2023). On the other hand, governments are responsible for ensuring adequate technology infrastructure, such as stable and affordable internet networks across all regions. Governments can also provide financial support or incentives for less privileged families to access educational technology (Katharina, 2021). The role of communities is also crucial in addressing limitations in infrastructure and technology accessibility. Communities can provide support by donating unused devices, organizing fundraising programs to assist students in need, or providing access to technology facilities in local communities (Putri, A et al., 2023). With strong collaboration among all stakeholders, these constraints are hoped to be effectively addressed, ensuring that all students have equal opportunities to access quality digital education. Thus, addressing limitations in infrastructure and technology accessibility is essential in ensuring inclusion and equality in education in this digital era.

3. Opportunities And Potential of Technology In Classroom Management

a. Utilizing Online Learning Tools and Applications

Technology has become integral to managing modern classrooms, offering various opportunities and potentials that educators can optimize to enhance learning effectiveness. Utilizing online learning tools and applications has become a key strategy in harnessing technology's potential in classroom management (Rožman et al., 2023). By leveraging online platforms and available learning applications, teachers can create more dynamic, interactive, and affordable learning experiences for their students. The utilization of online learning tools and applications has been a significant innovation in the context of modern education. These tools and applications offer various learning resources accessible to students anytime and anywhere, opening new opportunities in learning management for educators (Apriadi & Sihotang, 2023). With online learning tools and applications, teachers can provide students with easy access to various learning materials (Hajarudin, 2023). These materials can include texts, videos, simulations, and interactive exercises to support the students' learning process. For example, platforms like Google Classroom, Schoology, or Moodle enable teachers to manage all lesson materials in a structured manner in one place, making it easy for students to access them (Apriadi & Sihotang, 2023).

Online learning has become crucial as it facilitates self-paced learning where students can learn at their own pace (Rosmayati & Maulana, 2021). Additionally, students can review materials more flexibly since they can access learning resources anytime and anywhere through internet-connected devices (Putra & Pratama, 2023). The main advantages of online learning tools and applications lie in the efficiency of managing learning materials and interactions between students and teachers (Apriadi & Sihotang, 2023). Through these platforms, teachers can easily schedule lessons, provide assignments, and give feedback to students (Gustina, 2023).

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Moreover, interactions between students and teachers can also be efficiently managed through online discussion forums, live chats, or virtual meetings. Online learning tools and applications make education more inclusive and responsive to students' needs (Alenezi et al., 2023). They enhance the accessibility of education for students from various backgrounds and geographical conditions. Students living in remote areas or with mobility limitations can quickly access education through online learning platforms.

In implementing online learning tools and applications, it is essential to consider the challenges that may arise. One of the main challenges is technology accessibility, especially for students who may not have access to devices or stable internet connections. Attention should also be given to the security and privacy of student data and adequate training for teachers in using these tools and applications (Apriadi & Sihotang, 2023). Thus, online learning tools and applications offer great potential to enrich students' learning experiences and improve classroom management efficiency by teachers. However, to maximize their benefits, it is essential to address the challenges that may arise and ensure that the use of technology in learning is done effectively and responsibly.

b. Enhancing Student Engagement through Technology

The utilization of online learning tools and applications offers significant advantages in enhancing student engagement in the learning process. With online platforms, teachers have the opportunity to create more engaging, interactive, and relevant learning experiences for students (Rosmayati & Maulana, 2021). Integrating various multimedia content, interactive simulations, and educational games into the learning experience are some strategies that can be used to achieve this. Firstly, the use of multimedia content in online learning allows teachers to present information in a more visual and engaging manner. Learning materials presented in the form of videos, images, animations, and graphics tend to capture students' attention more effectively than plain text. For instance, teachers can use animated videos to visually explain complex concepts, making them easier for students to comprehend (Deni, 2023). Additionally, the use of images and graphics can help visualize information, reinforcing students' understanding of the learning material. In addition to multimedia content, the integration of interactive simulations can also enhance student engagement in learning. Simulations allow students to actively participate in exploring abstract or complex concepts (Chen et al., 2020). For example, in science lessons, students can use computer simulations to conduct virtual experiments, observe the results, and identify emerging patterns or relationships. This way, students not only become passive observers but also active participants in the learning process, which can enhance their understanding of the taught concepts.

Educational games or edugames are also effective tools in increasing student engagement in learning (Putro et al., 2023). Educational games offer fun and interactive learning experiences that can motivate students to become more involved in learning (Gustina, 2023). Through games, students can sharpen critical skills such as problem-solving, creativity, and collaboration while engaging with the learning material (Katharina, 2021). For example, in math games, students can solve puzzles or complete math challenges to earn points or higher levels (Putra & Pratama, 2023). Besides enhancing student engagement, the use of online learning tools and applications can also help students develop critical skills needed in the digital era (Rachmi et al., 2024). By interacting with various multimedia content, simulations, and educational games, students not only acquire knowledge but also develop critical, analytical, and creative thinking skills (Rožman et al., 2023). They learn to solve problems, make decisions, and think systematically, skills that are crucial in facing complex challenges in the current digital era.

Thus, the utilization of online learning tools and applications has great potential in enhancing student engagement in learning (Rosmayati & Maulana, 2021). Through the integration of multimedia content, interactive simulations, and educational games, teachers can create more engaging and relevant learning experiences for students (Brewer et al., 2015).

p-ISSN: 1979-7842
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Furthermore, the use of online learning tools and applications also helps students develop critical skills needed to tackle challenges in the digital era (Rožman et al., 2023). Therefore, the development and utilization of online learning tools and applications are important steps in improving the quality of education in the future.

c. Facilitating Differential and Personalized Learning

In the modern education era driven by technology, differentiation and personalized learning are vital to creating effective and meaningful learning experiences for every student (Muammar et al., 2023). Technology has opened doors to more adaptive and responsive learning approaches tailored to individual student needs, enabling teachers to customize materials and teaching strategies according to each student's unique characteristics (Kamalov et al., 2023). One of the main benefits of technology in this context is its ability to provide online learning tools equipped with data analysis features and adaptive learning (Naeem et al., 2023). Through data analysis, teachers can better understand each student's progress and learning needs (Novelita et al., 2023). This data may include information about students' understanding of learning materials, learning preferences, learning speed, and challenges faced (Putro et al., 2023). This information allows teachers to identify individual learning patterns and adjust teaching approaches more effectively.

Adaptive learning is one of the most prominent applications of technology in differentiation and personalized learning. Through adaptive learning algorithms, online learning platforms can adjust the content, difficulty levels, and learning sequences based on student's abilities and understanding levels (Kamalov et al., 2023). For example, students who have demonstrated a strong understanding of a concept can be provided with advanced materials or additional challenging tasks, while students experiencing difficulties can be given additional assistance or materials tailored to their understanding levels. Besides adaptive learning, technology allows differentiation through variations in learning content and teaching methods (Rožman et al., 2023). Teachers can use various online learning resources, such as instructional videos, articles, interactive simulations, and educational games, to present learning materials differently (Revola, 2024). Additionally, teachers can provide diverse assignments and learning activities, allowing students to choose the learning approaches that best suit their learning styles (Rachmi et al., 2024).

In addition to benefiting students, differentiated and personalized learning also benefits teachers. By using technology, teachers can manage classes more efficiently and effectively, enabling them to focus on individual student needs and provide appropriate support according to their understanding levels. Moreover, technology allows teachers to track students' progress in real time, enabling them to identify and proactively respond to learning difficulties. Technology has opened doors to more effective and affordable differentiation and personalized learning (Muammar et al., 2023). By providing adaptive and responsive online learning tools and features, technology enables teachers to accommodate individual student needs and interests better, enhancing student engagement and overall learning outcomes. In this technology-driven education era, differentiation and personalized learning are the foundation for creating inclusive, adaptive, and meaningful learning experiences for every student.

4. Innovative Pedagogical Strategies

a. Collaborative Learning and Technology-Based Projects

In facing the technology-driven era of education, innovative pedagogical strategies become vital in creating effective and engaging learning experiences for students (Purba & Saragih, 2023). Various innovative approaches have been developed to leverage technology in the learning process, including collaborative learning and technology-based projects, educational games and simulations, and multimedia integration in presentations and learning materials (Wibowo, 2023). Collaborative learning and technology-based projects are innovative pedagogical strategies that are increasingly popular among educators. This approach

p-ISSN: 1979-7842
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provides opportunities for students to collaborate in groups or teams to complete tasks or projects using various available technological tools and platforms (Zazin & Zaim, 2018). An example of its implementation is using applications such as Google Docs or Microsoft Teams, which allow students to collaborate on group assignments or presentations in real-time. Technology-based project platforms like Trello or Asana organize projects, assign tasks, and track progress efficiently.

This learning approach not only enhances student engagement in the learning process but also has the potential to develop various skills crucial for their future. One of these is collaboration skills, where students learn to work together with others to achieve common goals. In a collaborative environment, students learn to listen to others' opinions, share ideas, and appreciate the contributions of other team members. It helps them build good working relationships and value diversity of opinions, precious skills in the modern workplace, which often involves teamwork. Communication skills are also strengthened through collaborative learning and technology-based projects. In this context, students learn to clearly and effectively convey their ideas to their team members. They also learn to listen attentively, ask relevant questions, and provide constructive feedback to other team members. Good communication skills are crucial in various aspects of life, including academic, professional, and social settings.

Moreover, collaborative learning and technology-based projects also help students develop problem-solving skills. Working with other team members, they face challenges and problems they must solve together. This process triggers students to think critically, analyze problems, and find practical solutions. They learn to adapt to changing situations and find creative ways to overcome obstacles. Overall, collaborative learning and technology-based projects have great potential to enhance student engagement and develop essential skills for their future. By facilitating teamwork and improving collaboration, communication, and problem-solving skills, this strategy provides students with more meaningful and relevant learning experiences to meet the evolving needs of the workforce. Therefore, this approach is worth considering as an integral part of the learning approach in modern schools.

b. The Use of Educational Games and Simulations

Using educational games and simulations is an innovative pedagogical strategy that effectively enhances student engagement and motivation in learning (Ardiansyah & Nana, 2020). Educational games, such as interactive quizzes or puzzle-based games, reinforce learning concepts in a fun and interactive manner. Through these games, students can enhance their understanding of the subject matter and have enjoyable learning experiences, encouraging them to participate more actively in the teaching-learning process. Additionally, computer simulations are highly effective tools in providing learning experiences that closely resemble real-world situations ((Silberman et al., 2021). These simulations enable students to engage in experiments or simulate specific situations without the risks or costs associated with conducting experiments in the real world. For example, in physics or chemistry simulations, students can observe and interact with various physical phenomena or chemical reactions in a safe and controlled virtual environment, allowing them to delve deeper into exploration and better understand the concepts being learned.

The use of educational games and simulations can also help students develop various critical skills that are essential (Ummah et al., 2022). Students often face challenges or problems that require creative problem-solving and quick thinking when playing educational games. It helps sharpen their problem-solving skills and critical thinking in a fun and engaging context. Similarly, in simulations, students are encouraged to analyze situations, make decisions, and face the consequences of their actions, which helps them develop skills and strengthens their critical and analytical abilities. Besides the direct benefits of improving concept understanding and developing critical skills, educational games and simulations can also help create an inclusive and friendly learning environment for students with various learning styles. Some students may respond more to interactive and game-based learning than conventional learning approaches.

p-ISSN: 1979-7842
e-ISSN: 3021-8314

By providing various learning options that leverage games and simulations, teachers can accommodate students' various needs and learning preferences, enhancing their participation and engagement in the learning process.

Overall, using educational games and simulations is a highly effective pedagogical strategy in enhancing student engagement and motivation in learning while helping them develop a better understanding of learning concepts and sharpening critical skills essential for their future. By effectively harnessing this technology, teachers can create engaging and valuable learning experiences for their students, preparing them for success in an increasingly complex and globally connected world.

c. Integration of Multimedia in Presentations and Learning Materials

The integration of multimedia in presentations and learning materials represents an innovative and increasingly vital pedagogical strategy that significantly enhances student engagement and facilitates deeper learning. In a world where digital technology is ubiquitous, the adoption of multimedia in education reflects a necessary evolution in teaching methods, responding to the diverse learning needs and preferences of students. By incorporating various forms of media, such as images, audio, video, and animations, teachers can create a more dynamic and interactive learning environment that not only captures students' attention but also promotes a richer understanding of the subject matter. This multifaceted approach to teaching aligns with contemporary educational theories that emphasize the importance of catering to different learning styles and making learning experiences more relevant and engaging for students.

The use of multimedia in education offers several distinct advantages that contribute to more effective learning outcomes. First and foremost, visual media such as images, infographics, and diagrams play a critical role in clarifying complex concepts. Visual representations are often more accessible to students than textual descriptions alone, especially when dealing with abstract or intricate ideas. For example, in subjects like biology, the use of diagrams to illustrate the structure of a cell or the process of photosynthesis can make these concepts more tangible and easier to grasp. Similarly, in mathematics, visual aids like graphs and charts can help students better understand relationships between variables or trends over time. The ability to visualize concepts not only aids comprehension but also enhances memory retention, as visual information tends to be remembered more easily than text-based information alone (Hakim & Windayana, 2016).

In addition to visual media, the integration of audio elements in learning materials can also significantly enhance the learning experience, particularly for students who are more responsive to auditory learning methods. Audio recordings, podcasts, and sound clips can be used to explain complex topics, provide supplementary information, or reinforce key concepts. For example, a history teacher might use audio clips of famous speeches or interviews with historical figures to bring lessons to life, providing students with a more immersive and engaging experience. This auditory reinforcement can help students process information in a way that complements visual and textual learning, thereby catering to a broader range of learning preferences and improving overall understanding (Lubis & Mavianti, 2022).

The use of video in educational settings has also proven to be a highly effective tool for enhancing student engagement and learning. Videos can be used to present content in a more vivid and relatable manner, often bringing abstract concepts to life through real-world examples or animated simulations. For instance, a science teacher might use video demonstrations of chemical reactions to help students visualize and better understand the processes being described. Similarly, short animations can illustrate complex processes in subjects like physics or economics, making them more accessible to students who might struggle with traditional textual explanations. By showing real-life situations or case examples in video format, teachers can bridge the gap between theoretical concepts and practical applications, thereby deepening

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students' understanding and making learning more relevant to their everyday lives (Saman, 2023).

Moreover, the integration of multimedia in learning materials can significantly boost students' interest and motivation. Unlike traditional, static presentations, which may fail to engage students fully, multimedia-rich materials offer a more interactive and stimulating learning experience. The use of diverse media formats can break the monotony of conventional lessons, making learning more enjoyable and challenging for students. This increased engagement is crucial, as motivated students are more likely to invest effort in their studies, participate actively in class, and perform better academically. Furthermore, the use of multimedia can create opportunities for students to interact with the content in new ways, such as through interactive videos or multimedia presentations that allow them to explore topics at their own pace and according to their own interests.

The benefits of multimedia integration in education extend beyond engagement and motivation; they also have a significant impact on information retention and concept understanding. Research has consistently shown that students are more likely to retain information presented visually compared to information presented solely in text form. This is partly due to the dual-coding theory, which suggests that people process and store visual and verbal information separately but in interconnected systems, allowing for more robust memory formation when both types of information are used together. By including multimedia elements in their teaching, educators can help students encode information more effectively, leading to better recall and understanding of the concepts being taught. This improved retention is particularly important in subjects that require the mastery of complex information or the memorization of detailed processes.

Furthermore, multimedia integration supports differentiated instruction, which is essential for addressing the diverse needs of students in today's classrooms. Not all students learn in the same way; some are visual learners, others are auditory learners, and still, others may learn best through hands-on, kinesthetic experiences. By incorporating a variety of media into their teaching, educators can provide multiple pathways to understanding, ensuring that all students have the opportunity to engage with the material in a way that suits their learning style. This inclusive approach not only improves individual student outcomes but also contributes to a more equitable educational environment where every student has the chance to succeed.

The strategic use of multimedia also prepares students for the demands of the modern, digital world. In an era where digital literacy is increasingly important, exposing students to a variety of multimedia formats in their education helps them develop the skills they will need to navigate and analyze the vast array of information available online. This experience can also foster critical thinking and media literacy skills, as students learn to assess the credibility of different sources, understand the potential biases of media, and synthesize information from multiple formats.

In conclusion, the integration of multimedia in presentations and learning materials is an innovative and powerful pedagogical strategy that enhances student engagement, deepens understanding, and improves motivation. By effectively utilizing various forms of media, teachers can create a more dynamic, interactive, and inclusive learning environment that not only captures students' attention but also facilitates more effective learning. This approach not only helps students better understand and retain the material but also prepares them for the demands of the modern world, where digital literacy and the ability to process information from multiple sources are increasingly critical. As education continues to evolve, the integration of multimedia will undoubtedly play a central role in shaping the future of teaching and learning, helping students achieve their full academic potential.

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CONCLUTION

Digital education has transformed the learning paradigm by integrating technology and teaching methodologies, bringing about significant transformation in the world of education. Combining technology into the learning process has created more dynamic and interactive learning experiences, expanding the role of teachers as facilitators who use technology to create engaging learning environments. Personalization approaches through artificial intelligence and data analysis have increased accessibility and inclusivity in education, enabling tailored learning experiences to meet students' individual needs. Cross-cultural and interdisciplinary collaboration has become more accessible online, allowing the exploration of interdisciplinary topics and enriching the understanding of global diversity firsthand. Despite the significant benefits of integrating technology into classroom management, challenges that require careful handling also arise. The digital divide and technology misuse are serious issues that need attention.

However, with the right approach, technology can enhance learning effectiveness, prepare students for a technology-driven future, and ensure inclusivity in education. Technological disruptions such as network instability and device damage can hinder learning, while students' inability to use technology effectively is also a severe problem. Adopting innovative pedagogical strategies, such as collaborative learning and technology-based projects, and integrating multimedia in education is critical to creating effective and engaging student learning experiences. Digital education can significantly improve education quality significantly, but collaboration among schools, government, and society is needed to address infrastructure and technology accessibility challenges. The use of online learning tools and applications is also a crucial strategy in harnessing the potential of technology in classroom management. By understanding and addressing these challenges, digital education can be a significant driver in optimizing the education process in this digital era.

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