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The Impact of Technology on Education: Transforming Learning in the Digital Age

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ABSTRACT

This study aims to analyze the influence of technology on education and the transformation of learning in the digital era. Rapid technological developments have brought significant changes to learning methods and approaches, enabling the creation of more interactive, flexible, and effective learning experiences. The research method used is the Systematic Literature Review (SLR), which was chosen because it is able to present a comprehensive and structured picture of the results of previous studies. The initial stage of the SLR method is to formulate specific research questions, such as how technology influences learning methods in the digital era, the challenges of implementing technology in education, and strategies for optimizing technology in learning. Furthermore, a literature search was conducted on leading academic databases, such as Google Scholar, Scopus, Web of Science, IEEE Xplore, and ScienceDirect, using keywords such as "technology in education," "digital learning transformation," "the influence of technology on learning," and "e-learning and online learning." The results of the study show that the implementation of technology in education has a positive impact, such as increasing interaction, flexibility, and effectiveness of learning. Technologies such as online learning platforms (LMS), multimedia, artificial intelligence, and digital collaboration tools enable independent learning and better interaction between students and teachers. However, there are challenges in implementing technology, such as the digital access gap, low digital literacy, and the risk of reduced social interaction. To overcome these challenges, it is necessary to improve digital infrastructure, digital competency training, and policies for equal access to technology. Government support and collaboration with the technology industry are essential to maximize the benefits of technology in education.

Keywords: *Educational Technology, Learning Transformation, Digital Era*

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INTRODUCTION

The development of digital technology in the 21st century has brought significant changes in various aspects of life, including the world of education. In today's digital era, technology is not only a tool in the learning process, but also changes the paradigm of education as a whole (Putra, LD, & Pratama, SZA 2023). Technology has opened up various new possibilities that were previously unimaginable, bringing broad and profound impacts on the way we access, convey, and receive knowledge. Initially, technology was only used as a teaching aid, such as the use of projectors, calculators, or computers to process data. However, with the rapid development of information and communication technology (ICT), the role of technology in education has now expanded and

covers almost all aspects of the education system (Sayekti, R., & Mardianto, M. 2019).

One significant change is the presence of online learning or e-learning, which allows students to learn anytime and anywhere without being tied to a physical classroom. This provides enormous flexibility for students and opens up opportunities for those who live in remote areas or have limited time. Online education platforms, such as Google Classroom, Zoom, and Moodle, have replaced traditional learning that originally required face-to-face interaction, making learning more accessible and personalized (Verawati, UJ, et al. 2023).

In addition, technology also brings changes in the way material is delivered. Learning is no longer limited to textbook texts or teacher lectures, but can involve various media, such as videos, animations, podcasts, and infographics, which allow students to understand difficult concepts in a more interesting and interactive way (Merlina, Y., et al. 2023). The use of technology also allows for more creative project-based learning, where students can use digital tools to create presentations, applications, and even other digital products. This provides an opportunity for students to be more involved in the learning process and develop 21st century skills, such as creativity, collaboration, and problem solving. Technology also provides the ability to carry out adaptive learning, where learning materials and tasks can be adjusted to the abilities and learning speed of each student. Artificial Intelligence (AI)-based applications allow for rapid feedback and personalization of learning according to individual needs (Ayunda, V., et al. 2024). That way, students no longer feel left behind if they have difficulty with certain material, because technology can provide a more flexible and development-oriented approach (Miagusttin, AP, et al. 2024).

However, this paradigm shift in education does not only bring positive impacts. On the other hand, there are challenges that must be faced, such as the gap in access to technology between students in cities and in remote areas, as well as the need to improve digital skills for teachers and students so that technology can be utilized optimally (Westari, N., & Sumarsono, RB 2025). In addition, this change also requires changes in teaching and evaluation methods, where teachers are no longer just conveyors of information, but also as facilitators, guides, and mentors who help students develop critical, creative, and independent thinking skills. Overall, technology has transformed education from a structured and conventional process to a more dynamic, flexible, and personal learning experience. The educational paradigm that was originally focused on one-way teaching has now shifted to collaborative learning that allows students to be actively involved in their educational process. This transformation opens up many opportunities, but also requires readiness to overcome existing challenges so that technology can truly improve the quality of education in the future (Qurtubi, A., et al.2023). The transformation of learning that occurs due to the use of digital technology opens up opportunities as well as challenges for educators, students, and education policy makers. Changes driven by technology not only change the way we access and disseminate

knowledge, but also change the roles and expectations of each party involved in the education system. The use of digital technology in learning has a profound impact, both positive and negative, which requires adaptation and wise policies so that these changes can provide maximum benefits (Purba, A., & Saragih, A. 2023).

One of the biggest opportunities presented by digital technology is its ability to open up wider access to education, especially for those in remote or underserved areas. Through online learning platforms such as Coursera, edX, and Khan Academy, learners from all over the world can access quality educational materials without being limited by distance or time. Technology also enables flexible learning, allowing students to learn at their own pace, so that education is no longer tied to a fixed schedule or physical classroom. In addition, technology allows for more personalized learning, where learning materials and methods can be tailored to individual needs and abilities. Artificial Intelligence (AI)-based learning applications, such as the Duolingo platform or Khan Academy, can provide immediate feedback and adjust the difficulty level of the material based on the student's progress. This gives students the opportunity to learn in the way that is most effective for them, increasing their engagement and understanding of the material being studied (Hadziq, M., et al. 2024).

However, the implementation of digital technology also brings challenges. One of them is the digital divide, where not all students have equal access to technological devices or adequate internet connections. This gap is especially visible in rural areas or among families with low economic backgrounds. Without adequate access, the use of technology in education can exacerbate existing social and economic inequalities, creating a gap between students who do and do not have access to technology. In addition, educators must have sufficient digital skills to use technology effectively in learning. However, many teachers still find it difficult to integrate technology into their teaching methods. Therefore, ongoing training and provision on the use of educational technology is very important so that teachers can optimize the potential of technology in supporting the learning process (Suweta, IM 2023).

Technology also demands changes in the way teaching and existing curriculum. Curriculum must be updated to include digital skills, critical thinking, and broader 21st century competencies. This means that teachers must not only master technology but also be able to design learning that combines technology with educational goals effectively. In addition, although technology offers various advantages, excessive use of digital devices can cause distractions that interfere with students' learning focus. Dependence on digital devices can also have a negative impact on students' physical and mental health, such as sleep disorders, anxiety, and decreased social skills. Data security and privacy are also major concerns, given that many online education platforms store students' and teachers' personal data, making them vulnerable to cyber attacks (Mulyono, R. 2022).

Education policy makers, both government and educational institutions, play an important role in ensuring that the application of technology in education has a positive impact. Policies that support the provision of equitable technology infrastructure, increasing digital literacy among teachers and students, and developing a curriculum that is adaptive to technological developments must be a priority. Continuous training programs for educators and students are also needed to address digital skills challenges and ensure that technology is used effectively and safely. With joint efforts between educators, students, and policy makers, technology can be used to create a better, more inclusive, and more prepared education system to face future challenges (Purba, EF 2024).

Educational technologies, such as online learning, e-learning platforms, educational applications, and the use of artificial intelligence (AI) in adaptive learning, have changed the way teachers teach and students learn. The learning process that was previously conventional and limited to the classroom can now be carried out flexibly and without space and time limits. This allows students to learn independently with wider and faster access to information. However, behind these conveniences, there are challenges that need to be overcome. Not all students have the same access to technology, especially in remote areas or with low economic backgrounds. In addition, the quality of digital education also depends heavily on the digital competence of educators and the readiness of the infrastructure. Lack of digital literacy in teachers and students can hinder the effectiveness of technology-based learning (Muthmainnah, N., et al. 2024).

In addition, the increasing use of technology in education also has psychological and social impacts on students, such as lack of direct interaction with peers and teachers. Therefore, strategic efforts are needed to maximize the positive impact of technology in education while minimizing the negative impacts that may arise. Based on the description above, this study aims to examine the influence of technology on education and analyze how the transformation of learning in the digital era can be optimized to improve the quality of education in Indonesia.

METHODOLOGY

The research method used in this study is the Systematic Literature Review (SLR). The SLR method was chosen because it is able to provide a comprehensive picture of the results of previous studies in a systematic and structured manner, especially regarding the influence of technology on education and learning transformation in the digital era. The first stage in the SLR method is to formulate clear and specific research questions, such as how technology influences learning methods in the digital era, the challenges that arise due to the application of technology in education, and strategies for optimizing technology in learning. After the research questions are determined, the next stage is a literature search through various leading academic databases, such as Google Scholar, Scopus, Web of Science, IEEE Xplore, and ScienceDirect. The search was carried out using relevant keywords, such as technology in

education, digital learning transformation, the influence of technology on learning, and e-learning and online learning (Fatmawati, R., & Yahfizham, Y. 2024).

The literature found was then selected based on inclusion and exclusion criteria. Inclusion criteria include indexed journal articles, publications in the last 10 years, relevant to the research topic, and written in Indonesian or English. Meanwhile, exclusion criteria include articles that are not fully accessible, unverified publications, and opinion pieces without empirical data support. Furthermore, data from literature that has passed the selection is extracted by considering the title of the article, author's name, year of publication, research methods used, and main results and conclusions. After the data is collected, thematic data analysis is carried out to find patterns, trends, and research gaps. The analysis techniques used include meta-synthesis to combine research findings and content analysis to evaluate the contents of the article in depth.

The results of this analysis process are then presented in the form of tables, graphs, and narratives to provide a complete picture of the influence of technology on education. The synthesis report also includes a discussion of the challenges and opportunities faced in the transformation of learning in the digital era. With this SLR approach, the research is expected to provide a significant contribution to understanding the role of technology in improving the quality of education in Indonesia.

RESULTS AND DISCUSSION

Implementation of Technology in the Learning Process

The implementation of technology in the learning process is an effort to utilize various digital devices and technology-based applications to support, improve, and change the way learning takes place. In this digital era, technology has become an inseparable part of education, by providing various conveniences and opportunities for educators and students to explore more innovative, efficient, and effective learning methods. Technology not only functions as a tool in delivering material, but also as a driver of change in the structure and dynamics of learning, which allows for the creation of a more interactive and comprehensive learning experience (Sawitri, E., Astiti, MS, & Fitriani, Y. 2019, July). One form of technology implementation in learning is the use of online learning platforms or Learning Management Systems (LMS), such as Google Classroom, Moodle, and Schoology. This platform allows educators to manage teaching materials, give assignments, and conduct evaluations digitally. Students can access learning materials anytime and anywhere, without being tied to a physical classroom. Communication features such as discussion forums, private messages, and video conferencing allow interaction between teachers and students, as well as between students themselves, without geographical barriers. Learning becomes more flexible and can be adapted to the needs of each individual (Andari, E. 2022).

In addition, the use of multimedia media such as videos, animations, simulations, and interactive graphics also enrich the learning experience. For example, in

science learning, the use of computer-based simulations can provide clearer visualizations of concepts that are difficult to understand if only explained verbally. Learning videos also make the material presented more interesting and easy to understand, and can be repeated by students according to their needs. This technology not only makes learning more interesting, but also improves students' understanding of the material in a more fun and interactive way (Arriza, L. 2020).

Artificial intelligence (AI)-based applications have also been introduced to personalize learning. Applications such as Duolingo or Khan Academy utilize AI technology to provide quick feedback and adjust the difficulty level of the material based on each student's progress. Thus, technology enables more personalized learning, where students can learn at their own pace, reducing the pressure and stress that often occurs in traditional education systems. The use of digital collaboration tools such as Google Docs, Padlet, or Trello is also part of the implementation of technology that enhances collaboration between students. These tools allow students to work together on assignments or projects, even if they are in different locations. This digital collaboration not only develops students' social and communication skills but also facilitates them in working on projects together, which is an important skill in today's workplace. In addition, gamification technology is also starting to be applied in education to increase student engagement and motivation. By using game elements such as points, levels, and challenges, gamification can make learning more interesting and fun. For example, the Kahoot! or Quizizz allows students to take interactive quizzes that assess their understanding of the material in a fun way, while also fostering a healthy spirit of competition among them (Novelti, N., et al. 2024).

However, although technology offers various conveniences and benefits, its implementation also faces challenges that need to be considered. One of them is the digital divide, where not all students have the same access to adequate devices or internet connections. This can cause inequality in learning and hinder the potential of students who should be able to benefit from the use of technology. Therefore, efforts need to be made to ensure that infrastructure and access to technology are evenly available across all levels of society. In addition, educators must also continue to develop their digital skills in order to make maximum use of technology. Continuous training in the use of digital devices and applications needs to be provided to teachers so that they not only master technology but are also able to integrate it with effective teaching methods. Teachers must also be able to be creative facilitators in utilizing technology to create an interesting and productive learning environment (Raisha, N., et al. 2025).

Overall, the implementation of technology in the learning process has significant positive impacts, such as increasing accessibility, personalizing learning, and developing 21st century skills for students. However, in order for technology to be utilized optimally, attention needs to be paid to access gaps, training for educators, and curriculum updates that accommodate changes in digital learning. Thus, technology can be a very effective tool in improving the quality

of education and preparing students to face future challenges. In this digital era, the use of technology in education is not only limited to tools, but also as an integral part in creating interactive, flexible, and effective learning experiences (Baharuddin, B., & Hatta, H. 2024).

One of the most common forms of technology implementation is online learning through platforms such as Google Classroom, Microsoft Teams, and Zoom. These platforms allow the teaching and learning process to take place virtually without the limitations of space and time. In addition, the use of Learning Management Systems (LMS) such as Moodle and Edmodo helps teachers manage learning materials, assignments, and assessments more systematically. Technology is also applied through the use of interactive multimedia in the learning process, such as learning videos, simulations, and animations. This helps improve understanding of complex concepts and makes learning more interesting. In addition, Augmented Reality (AR) and Virtual Reality (VR) technologies are also starting to be widely used to create a more immersive and realistic learning environment, so that students can experience direct simulations of the concepts being studied.

In addition, artificial intelligence (AI) technology is also applied in adaptive learning, where the system automatically adjusts materials based on students' abilities and progress. For example, applications such as Khan Academy and Duolingo use intelligent algorithms to recommend materials that are appropriate to the user's level of understanding. Technology also enables digital collaboration through the use of applications such as Padlet and Jamboard, where students can work together on projects virtually. Even the use of educational social media, such as discussion groups on WhatsApp or Telegram, is also increasingly widespread as a place to exchange information and ideas between students and teachers (Pratama, HAP, & Mansur, H. 2023).

However, the implementation of technology in learning also faces various challenges, such as the digital divide, limited internet access, and lack of digital literacy among some teachers and students. This is a significant obstacle to maximizing the potential of technology in education, because without adequate access or the right skills, technology cannot be used optimally to improve the quality of learning. One of the biggest challenges is the digital divide, which refers to the uneven distribution of technological devices and internet connectivity between urban and rural areas, as well as between different socio-economic groups. In many remote areas, many students do not have enough devices or stable internet access to participate in online learning or utilize digital learning platforms. This creates inequalities in learning opportunities, which can exacerbate social and educational inequalities.

Limited stable internet access is also a major challenge in the implementation of educational technology. In areas that do not have adequate internet infrastructure, online learning or the use of digital tools for educational purposes becomes difficult to reach. Even in some urban areas, although internet access is more available, poor connection quality or high internet costs are still barriers for students and educators to use technology effectively. These

limitations increase the gap between those who can access technology and those who do not, creating inequalities in the learning experience. Overall, the application of technology in the learning process not only changes learning methods but also encourages the creation of more dynamic, participatory, and contextual learning, in accordance with the demands of the digital era (Oktania, S., et al. 2024)

Positive and Negative Impacts of Technology on Education

Positive Impact of Technology on Education

1. Wider Access to Learning

Technology allows students to access a variety of learning resources from around the world through online platforms such as Coursera, edX, and Khan Academy. These platforms provide flexibility for students to learn anytime and anywhere without geographical restrictions. With courses provided by leading universities, students can study various topics independently, repeat materials as needed, and even earn certificates or academic degrees. In addition, these platforms offer a more interactive learning experience, with elements such as simulations and forum discussions.

However, the challenges faced are the digital skills needed to access and use these platforms, as well as the problem of limited internet access in some areas. Therefore, it is important to improve digital literacy and provide supporting infrastructure so that all students can take advantage of the potential of this technology. Overall, technology opens up great opportunities in global education, but it also requires efforts to ensure equitable and effective access for all.

2. More Interactive and Interesting Learning

The use of multimedia such as videos, animations, and simulations makes learning more interesting and easier to understand. Technologies such as Virtual Reality (VR) and Augmented Reality (AR) offer immersive and contextual learning experiences, allowing students to "experience" the subject matter firsthand. VR enables immersive learning simulations, such as exploring anatomy or history, while AR combines virtual elements with the real world, enriching learning with interactive additional information. These technologies increase student engagement, making learning more fun and effective. However, limited access and high device costs remain major challenges in their widespread adoption. With the right solutions, these technologies can transform the way learning is taught and improve the quality of education.

3. Personalization of Learning

Artificial Intelligence (AI)-based applications, such as Duolingo and Smart Learning, can tailor learning materials to each student's abilities and needs. AI analyzes students' progress in real-time and provides recommendations for materials or exercises based on their level of understanding. This enables personalized and adaptive learning, increasing student effectiveness and engagement. These applications also provide immediate feedback, helping

students address difficulties appropriately. However, challenges such as access to technology and reliance on accurate data need to be addressed. Overall, AI can create a more focused and effective learning experience, opening up opportunities for more inclusive education.

4. Efficiency of Administration and Data Management

Learning Management Systems (LMS) such as Google Classroom and Moodle allow teachers to manage academic data more efficiently. LMS facilitates the management of assignments, assessments, and communication between teachers and students. Teachers can create and collect assignments digitally, provide instant feedback, and track student progress in real-time. More efficient communication through online announcements and discussions also supports more interactive learning. However, challenges such as access to technology and digital competency still need to be considered so that the use of LMS can be optimal. Overall, LMS improves the efficiency and quality of teaching by leveraging data and technology.

5. Improving Collaboration and Communication

Collaborative platforms such as Microsoft Teams, Zoom, and Padlet allow students and teachers to work together on group projects virtually, expanding interactions despite being in different locations. Teams supports discussions, file sharing, and collaborative work on documents, while Zoom facilitates video sessions and small group sharing through breakout rooms. Padlet enables creative collaboration with digital boards to share ideas and content. These platforms offer flexibility in time and place, enabling effective remote collaboration. Despite challenges related to technology access and digital competency, these technologies create more inclusive, flexible, and interactive learning (Miagusttin, AP, et al. 2024).

Negative Impact of Technology on Education

1. Digital Access Gap

Not all students have access to adequate devices and internet, especially in remote areas or from low-income backgrounds. This causes gaps in learning opportunities.

2. Decreased Social Interaction

Excessive online learning can reduce direct interaction between students and teachers and between students. This can have an impact on students' social skills and empathy.

3. Potential for Distraction and Dependence

Students can easily be distracted by social media or other applications during online learning. In addition, dependence on technology can also reduce critical thinking and independent problem-solving skills.

4. Ethical Issues and Data Security

The use of technology in education carries risks to the security of students' personal data. In addition, plagiarism and cheating in online exams are also serious problems.

5. Lack of Digital Literacy among Teachers and Students

Not all teachers and students have adequate digital skills to make optimal use of technology. This results in ineffective use of technology or even misapplication.

(Haniko, P., et al. 2023).

Improving Digital Skills in Students

In this digital era, digital skills are an important competency that must be possessed by students in order to be able to adapt to technological developments and the challenges of the world of work in the future. Improving digital skills is not only about the ability to operate technological devices, but also includes an understanding of digital literacy, ethics of use, and the use of technology productively and creatively.

1. Important Aspects in Digital Skills

Improving digital skills in students includes several important aspects, including:

a. Digital Literacy

Digital literacy is the ability to understand, evaluate, and use digital information effectively. This includes searching for accurate information, analyzing data, and the ability to understand various digital media formats.

b. Use of Digital Tools and Applications

Students need to be skilled in using various software and applications that support the learning process, such as Microsoft Office, Google Workspace, LMS (Learning Management System), and other collaborative applications.

c. Digital Security and Ethics

Students should be equipped with an understanding of cybersecurity and digital ethics. This includes protecting personal data, preventing the spread of hoaxes, and communicating ethically in cyberspace.

d. Problem Solving and Critical Thinking

Digital skills also include the ability to solve problems using technology, such as performing basic programming, data analysis, or using digital tools to complete complex tasks.

e. Digital Creativity and Innovation

Students are encouraged to develop creativity by utilizing technology, such as creating multimedia content, graphic design, or developing simple applications.

2. Digital Skills Improvement Strategy

Here are some strategies that can be applied to improve digital skills in students:

a. Technology Integration in the Curriculum

Incorporating the use of technology into everyday learning processes will help students become more familiar with digital technology. For example, utilizing e-learning platforms and collaborative tools regularly.

b. Technology Training and Workshop

Organize specialized training that focuses on digital skills, such as coding, graphic design, or data analysis. This training can be done in person or online.

c. Project-Based Learning

Engaging students in real-world projects that require the use of technology, such as creating educational vlogs, podcasts, or simple apps, can enhance their skills in a practical way.

d. Collaboration with Technology Industry

Working with a technology company or training institution can provide first-hand insight into the digital skills needed in the workplace.

e. Digital Literacy Guidance

Conducting digital literacy activities regularly so that students understand how to find the right information, manage data, and use technology safely and responsibly.

(Pare, A., & Sihotang, H. 2023).

The Role of Teachers and Educators in Digital Transformation

Digital transformation in the world of education has brought significant changes to the role of teachers and educators. They no longer only act as the main source of knowledge, but also as facilitators, mentors, and drivers in integrating technology into the learning process. Adaptability and digital literacy are important competencies that educators must have in order to carry out their duties optimally in this digital era. One of the important roles of teachers in digital transformation is as a digital learning facilitator. Teachers must be able to utilize technology to create interactive and engaging learning. Through digital platforms such as Google Classroom, Microsoft Teams, and Zoom, teachers can hold virtual classes with interactive methods such as online discussions, digital presentations, and online project collaboration. In addition, teachers also need to use technology-based learning media, such as learning videos, digital simulations, and other interactive multimedia to improve student understanding (Naibaho, D., & Banurea, L. 2024).

In addition, teachers also play a role as developers of digital learning materials. They are required to compile technology-based materials to make them more relevant and interesting for students. This includes creating digital modules, learning videos, and interactive content that can be accessed online. Mastery of Learning Management Systems (LMS) such as Moodle and Schoology is essential so that teachers can manage materials, assignments, and assessments effectively. In addition, teachers must also be digital literacy and cybersecurity mentors for students. They need to teach how to use technology wisely, use information critically, and maintain digital ethics and security. Education about protecting personal data, avoiding hoaxes, and behaving positively in cyberspace is also the responsibility of teachers so that students can use technology safely and responsibly (Anggreini, D., & Priyojadmiko, E. 2022, May).

Another equally important role is as a motivator and driver of innovation. Teachers need to foster a spirit of innovation among students by encouraging them to use technology in creative projects and research. For example, teachers

can facilitate the creation of educational vlogs, learning podcasts, or other digital projects involving information technology. Thus, students become not only consumers of technology but also producers of useful content. To stay relevant amidst rapid technological changes, teachers must also act as lifelong learners. They need to continue to improve their competencies through online training, webinars, and professional courses. Training programs such as Digital Teaching Certification and Strengthening ICT Competence are essential for teachers to adapt to changes in educational technology.

However, in carrying out this role, teachers also face challenges such as low digital literacy, limited access to technology, and changes in teaching paradigms that require adaptation time. Therefore, support is needed from the government and educational institutions in improving teachers' digital competence in a sustainable manner. Overall, teachers and educators play a strategic role in the success of digital transformation in education. They are not only tasked with delivering material, but also as facilitators, digital literacy mentors, and innovation motivators for students. Therefore, investment in improving teachers' digital competence is very important so that they can carry out this role optimally. With the guidance of competent teachers, students will be better prepared to face the challenges of the increasingly digital modern world (Selvia, TA, et al. 2024).

Challenges and Obstacles in Implementing Technology

The application of technology in education brings many opportunities, such as more interactive, personalized learning, and wider accessibility. However, major challenges include uneven access to technology, limited digital competency among teachers, and a digital culture that has not been fully accepted in the school environment. The success of digital transformation requires infrastructure readiness, teacher training, and policies that support technology adoption. By meeting these needs, technology can improve the quality of education and prepare students for an increasingly digital world.

1. Access and Infrastructure Gaps

One of the biggest challenges in implementing technology is the gap in access, especially in remote and isolated areas. Not all students and teachers have access to adequate digital devices and internet. Limited internet networks, expensive data costs, and the absence of devices such as laptops or smartphones are very real obstacles. This causes an imbalance in the quality of learning between urban and rural areas.

2. Low Digital Literacy among Teachers and Students

Not all teachers and students have adequate digital literacy. Many teachers are still technologically illiterate and find it difficult to use digital devices effectively. Likewise, students do not fully understand how to use technology productively and safely. The lack of training and guidance on the use of technology causes the digital learning process to not run optimally.

3. Dependence on Technology and Distractions

The increasing use of technology in learning also poses challenges in the form of dependence on digital devices. Students tend to be more engrossed in social media or other entertainment applications, so that their focus on learning decreases. In addition, the excess of information from the internet without proper filtering can confuse students and make it difficult for them to separate accurate information from false information.

4. Data Security and Privacy

Digital technology in education also brings cybersecurity and personal data protection risks. Many online learning platforms store personal data of students and teachers, making them vulnerable to data leaks and cyberattacks. In addition, a lack of understanding of digital security can leave students vulnerable to personal data exploitation and misuse of information.

5. Lack of Policy and Budget Support

Support from the government and educational institutions in terms of policies and budgets is also still an obstacle. Procurement of technological devices and internet infrastructure requires large investments, while education budgets are often inadequate. In addition, the absence of clear regulations regarding data security and digital ethics in education is also a concern.

6. Resistance to Change

Some educators are still reluctant to switch to technology-based learning because they feel that traditional methods are more effective. There is also concern that the use of technology will reduce the role of teachers in the learning process. This change in mindset requires a persuasive approach and ongoing training so that educators are more open to innovation.
(Khosyiin, MI, & Khoiiri, MY 2024).

Conclusion

The implementation of technology in education has a significant impact on improving the quality of learning by creating a more interactive, flexible, and effective experience. Technologies such as online learning platforms (LMS), multimedia, artificial intelligence, and digital collaboration tools enable students to learn independently according to their abilities, and strengthen interactions between students and teachers. However, the application of technology in education also faces various challenges. The digital access gap is a major problem, especially for students in remote areas or with low economic backgrounds. In addition, low digital literacy among some teachers and students can hinder the optimal use of technology. Dependence on digital devices also has the potential to reduce direct social interaction and increase the risk of distraction. To overcome these challenges, efforts are needed to improve digital infrastructure, ongoing digital competency training, and policies that support equal access to technology. Teachers and educators must act as facilitators, digital

literacy mentors, and innovation motivators. With government support and collaboration with the technology industry, the application of technology can run optimally and prepare students to face the digital world in the future.

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