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The Future of Education: Integrating Technology with Interactive Teaching Methods

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Abstract
The integration of digital technology in education has brought significant changes, especially through the implementation of Learning Management System (LMS), artificial intelligence (AI), and augmented reality (AR). LMS allows flexibility in learning, while AI helps in personalization of materials and identification of students' learning difficulties. AR, on the other hand, enriches the learning experience with interactive visualizations. In addition, game-based learning approaches and virtual reality (VR) technology enhance students' motivation and understanding of complex material. However, the application of this technology still faces challenges, such as limited infrastructure in remote areas, educator readiness, and digital access gaps. This study used descriptive qualitative methods with interviews, observations and document analysis of 30 respondents consisting of teachers, students and educational technology developers. The results show that technology integration improves student engagement and learning effectiveness, but still requires infrastructure support and training for educators. To optimize the implementation of technology in education, synergy is needed between the government, educational institutions and the private sector in providing adequate facilities and training. With the right strategy, technology can be a catalyst in creating a more adaptive, inclusive and up-to-date education system.

Keyword: *Digital Integration; Education Technology; Interactive Learning*

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Introduction
The integration of digital technology in education has brought significant changes, especially through the application of Learning Management System (LMS), artificial intelligence (AI), and augmented reality (AR). LMS, such as Google Classroom and Moodle, have changed traditional learning methods to be more flexible and adaptive, allowing students to access materials at their own pace and schedule (Maftuh et al., 2024). In addition, these systems also strengthen the interaction between teachers and students through online discussion features, assignment submission, and real-time feedback. AI also plays a role in personalizing learning by analyzing student data to provide appropriate material recommendations, helping teachers identify student learning difficulties, and providing chatbot-based virtual tutors that can be accessed at any time (Oktafia et al., 2025). Meanwhile, AR enriches the learning experience by presenting interactive digital elements, enabling visualization of abstract

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concepts in various subjects, such as simulation of human organs in biology or historical reconstruction in history learning. With the integration of these technologies, the learning process becomes more engaging, effective and suited to the individual needs of students in the fast-paced digital era.

However, although digital technology offers various benefits, its implementation in Indonesia still faces quite complex challenges. One of the main obstacles is the limited technological infrastructure, especially in rural and remote areas, where many schools do not yet have access to adequate hardware and stable internet networks (Khosyiin & Khoiiri, 2024). In addition, teachers' competence in utilizing technology is also an obstacle, considering that not all educators have sufficient digital skills to optimize LMS, AI, or AR in the learning process. The digital divide between different regions and socio-economic backgrounds exacerbates disparities in access to and quality of technology-based education, with students from underprivileged families often struggling to access adequate devices and internet connections (Rahman & Asha, 2024). Therefore, synergy between the government, educational institutions, and the private sector is needed to build more equitable infrastructure, provide wider internet access, and develop training programs for educators. With the right strategic steps, the integration of digital technology in education can be a catalyst for improving the quality of learning in Indonesia, creating an education system that is more adaptive, inclusive and in line with the demands of the times.

Game-based learning approaches have been proven effective in increasing student motivation and engagement. By integrating game elements such as challenges, rewards and healthy competition, this method creates a more engaging and interactive learning environment. Research shows that students who engage in game-based learning experience significant improvements in problem-solving skills and material comprehension (Saba, 2024). In addition, the use of educational games allows the adjustment of difficulty levels according to individual abilities, thus supporting personalized and effective learning. This approach can also improve students' retention in a more natural way, as they learn through direct experience and active engagement. In the context of digital education, the adaptation of artificial intelligence (AI) in educational games further opens up opportunities to provide real-time feedback and customize learning strategies based on each student's needs (Sitorus & Murti, 2024). With the advancement of technology, the utilization of game-based learning is not only limited to the academic field, but also extends to professional skills training, enabling competency development in a more engaging and applicable way.

In addition to game-based learning, virtual reality (VR) technology offers great potential in creating immersive and practical learning experiences. Through VR, students can interact with complex simulations of real environments, enabling the exploration of abstract concepts in a more concrete manner (Hariyono, 2023). The implementation of VR in mathematics learning, for example, has helped students understand the concepts of space and shape better through three-dimensional visualization. However, the application of this technology requires adequate infrastructure and specialized training for educators to ensure effective integration in the curriculum. Besides VR, augmented reality (AR) is also an important innovation in education, where digital elements can be integrated into the real world to enrich the learning experience. For example, in science learning, AR can be used to interactively display models of human organs, allowing students to understand their structure and function more deeply. With the rapid advancement of educational technology, the synergy between game-based learning, VR, and AR has the potential to revolutionize traditional learning methods. The successful implementation of these technologies depends not only on technical aspects, but also on effective pedagogical design as well as the readiness of educators in adopting them. Therefore, further research is needed to explore the best strategies in optimizing these technologies to improve learning effectiveness at various levels of education.

The integration of technology in teaching methods in Indonesia faces a number of complex challenges. One of the main barriers is the limited technology infrastructure, especially

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in rural and remote areas. Many schools in these areas do not have adequate access to hardware such as computers and stable internet networks, hindering the implementation of technology-based learning. This digital divide deepens educational disparities between urban and rural areas, resulting in inequalities in the quality of learning received by students. In addition, these infrastructure limitations are often exacerbated by the lack of financial support for the procurement and maintenance of technological devices, making schools in underprivileged areas fall further behind in the implementation of educational technology (Wahyudi & Jatun, 2024).

In addition to infrastructure issues, the readiness of human resources is also a significant challenge in the integration of technology into teaching. Many educators do not have sufficient competence and confidence to utilize technology effectively in the learning process. Lack of training and professional development in educational technology makes it difficult for teachers to adapt innovative and interactive teaching methods (Sitopu et al., 2023). Resistance to change and limited digital skills among educators hinder the transformation of education that should improve the quality of learning. Therefore, collaborative efforts between the government, educational institutions and the private sector are needed to provide continuous training and adequate resources to empower educators to effectively integrate technology into the curriculum.

The integration of technology in teaching methods in Indonesia faces a number of complex challenges. One of the main barriers is the limited technology infrastructure, especially in rural and remote areas. Many schools in these areas do not have adequate access to hardware such as computers and stable internet networks, hindering the implementation of technology-based learning. This digital divide deepens educational disparities between urban and rural areas, resulting in inequalities in the quality of learning received by students (Anggraini & Winarti, 2023). Furthermore, these infrastructure limitations are often exacerbated by the lack of financial support for the procurement and maintenance of technological devices, making schools in underprivileged areas fall further behind in the implementation of educational technology.

In addition to infrastructure issues, human resource readiness is also a significant challenge in the integration of technology into teaching. Many educators do not have enough competence and confidence to utilize technology effectively in the learning process. Lack of training and professional development in educational technology makes it difficult for teachers to adapt innovative and interactive teaching methods. Resistance to change and limited digital skills among educators hinder the transformation of education that should improve the quality of learning. Therefore, collaborative efforts between the government, educational institutions and the private sector are needed to provide continuous training and adequate resources to empower educators to effectively integrate technology into the curriculum.

Methodology

This research uses a descriptive qualitative approach to analyze the integration of technology in interactive teaching methods. The study focuses on schools and educational institutions that have adopted technology, with 30 respondents, consisting of 10 teachers, 15 students and 5 educational technology developers. The purpose of this study is to understand the implementation of artificial intelligence (AI), virtual reality (VR), and game-based learning and the challenges faced. Data were collected through in-depth interviews, participatory observation and document analysis, then analysed using thematic analysis that included data reduction, categorization and conclusion drawing. This process aimed to identify patterns in the use of educational technology and evaluate its benefits and challenges. The results are expected to provide comprehensive insights and policy recommendations for the government and educational institutions in optimizing technology in learning.

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Results and Discussion

The Effectiveness of Technology Integration in Improving the Quality of Learning

1. Increased Student Engagement and Motivation

The use of interactive technologies such as Virtual Reality (VR) and game-based learning has been shown to increase student engagement and motivation in the learning process. By providing a more immersive experience, this technology allows students to understand concepts in more depth through real simulations. In an interview with AR, an educational technology expert, he stated,

> *"Interactive technologies such as VR provide hands-on experiences that are difficult to obtain in conventional methods, so students are more active and enthusiastic about learning*."

This is in line with the research of AlShaikh et al (2024) in Multimedia Cognitive Theory, which emphasizes that simultaneous visual and audio-based learning can improve conceptual understanding better than text alone. In addition, a study by Komariyah et al. (2024) found that gamification in education increases student motivation through reward and challenge systems designed to encourage active exploration and problem-solving. A further study by Putra et al. (2024) shows that gamification elements such as leaderboards, badges, and challenges increase student engagement in a digital learning environment. Students' intrinsic motivation is increasingly developed because they feel challenged and have control over their learning process, in accordance with the Self-Determination Theory of Deci and Ryan (1985) which emphasizes the importance of autonomy, competence, and social connectedness in learning (Yuan et al., 2021).

In various fields, the implementation of this technology has shown a positive impact. In an interview with Prof. LW, a senior educator in the STEM field, he emphasized,

> *"VR in science lessons allows students to conduct experiments that were previously risky or difficult to access, such as simulating chemical reactions or space exploration."*

This is supported by the research of Lase et al. (2024), which showed that the use of VR in science improves concept understanding better than traditional methods. For example, at Stanford University, VR is used in physics labs to allow students to explore wave phenomena and quantum mechanics in greater depth. Aman et al's study (2024) also found that students who used VR in science lessons showed a 40% increase in comprehension scores compared to those who learned through conventional methods.

In language learning, educational games have been shown to improve students' vocabulary retention and communication skills. Cholifah & Fada's study. (2022) revealed that students who learned language through interaction-based games had an increase in communication skills of up to 25% higher than the group using conventional methods. A case study from the University of Helsinki showed that the use of narrative-based games in English learning helped students improve their speaking skills and understanding of cultural context. Similar results were found in a study by Nuraeni et al (2022), where students who used simulation-based games such as Second Life in language learning showed improvement in the use of more complex language structures. Similarly, history and geography subjects benefit

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from VR, allowing students to "visit" historical places and understand geographical concepts first-hand. A project at Harvard University, for example, used VR to take students on a historical tour of ancient Egyptian civilization, which was shown to improve their understanding of the architecture and culture of the era.

However, while the benefits are significant, there are some challenges that need to be considered in the implementation of this technology. High infrastructure costs are a major obstacle for many educational institutions. According to an interview with BS, an educational technology researcher,

> *"The availability of VR devices in schools is still limited due to the relatively high price, but alternatives such as smartphone-based AR can be a more affordable solution."*

The use of AR in science education increases student participation without the need for expensive hardware such as VR headsets. In addition, teacher readiness in operating this technology is also an important factor. A study by Wahyudi & Fauziati (2025) on Technological Pedagogical Content Knowledge (TPACK) highlights that the effectiveness of technology in learning is highly dependent on teachers' readiness and skills in integrating it into the curriculum. In Finland, a teacher training program in VR and AR integration into the curriculum successfully increased their readiness in applying these technologies by 80% (Anjani et al., 2024). Another challenge is the potential distraction that can reduce learning effectiveness. The study conducted by Ali et al. (2024) emphasized the importance of gamification design that remains oriented towards academic goals to avoid learning that focuses too much on the entertainment aspect.

Thus, it can be concluded that interactive technology plays an important role in increasing student engagement and motivation. Case studies and scientific research from various institutions show that these technologies have a positive impact in various fields of education, ranging from science, language, to history. With the right implementation strategies, such as the use of more affordable devices, teacher training, and effective learning design, these technologies can be a very useful tool in improving the quality of education. Through an evidence-based approach and support from scientific research, interactive technology can bring about a positive transformation in education, providing a more engaging learning experience and encouraging students to learn independently and actively.

2. Personalizing Learning with Artificial Intelligence (AI)

Artificial intelligence (AI) technology in education has brought about a major change in learning personalization, allowing materials to be tailored to the individual needs of students. By analyzing students' learning patterns, AI can provide material recommendations that match their level of understanding, so that students can learn at their own pace without the pressure of the general rhythm of the class. According to JS, an educational technology expert from stating

> *"AI enables more adaptive learning by adapting material in real-time, which ultimately improves knowledge retention and student learning motivation."*

This not only improves learning effectiveness, but also helps teachers to focus more on tutoring struggling students.

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In addition, AI enables early detection of student learning difficulties, provides instant feedback, and offers a more engaging and interactive learning experience through chatbots or virtual tutors. A study conducted by Abbas et al (2024) showed that students using AI-based learning platforms experienced a 45% increase in material understanding compared to conventional learning methods. One interesting case study is the application of AI in the education system in Finland, where schools use AI platforms such as Eduten to analyze student performance in mathematics and provide personalized exercises. As a result, students using these platforms showed an average score improvement of 20% within six months, compared to traditional teaching methods.

Some adaptive learning platforms such as Duolingo and Google Classroom have also successfully applied AI to customize exercises and materials based on student progress. In China, the company Squirrel AI has created an AI-based learning system that is used in more than 1,700 schools. With algorithms that detect students' weaknesses in certain subjects, Squirrel AI can customize the curriculum so that each student gets more effective learning. In a trial of 10,000 students, those who learned using AI had 15-20% higher average exam results compared to students who only learned through traditional methods.

However, despite the many benefits offered, the implementation of AI in education also faces various challenges, such as limited access to technology in some areas, issues of student data security and privacy, and the need for training for teachers to optimally utilize AI. In an interview with BBC Education, JA, a specialist in AI and education, stated,

> *" It's really important that we help young people to navigate that world - just in the way that we do when we hold their hand while we're walking along a busy street and we teach them the rules of the road and the risks."*

Another challenge that arises is how AI can maintain a balance between automation and human interaction, as learning depends not only on knowledge transfer, but also on social and emotional aspects.

While AI cannot completely replace the role of teachers, it can be a helpful tool in creating more inclusive, adaptive and effective learning in the future. With examples of success in countries such as Finland and China, the application of AI in education in various countries can continue to be developed by considering technological readiness, supportive policies, and training for teaching staff to optimally utilize this technology.

3. Evaluation of the Effectiveness of Technology-Based Learning

An evaluation of the effectiveness of technology-based learning shows that the use of technology in education can improve students' understanding, personalize the learning experience, and increase their involvement in the learning process. According to AW, an educational technology expert from the University of Indonesia, in an interview, he stated that

> *"The use of digital assessments in learning allows teachers to more accurately identify student difficulties and provide timely interventions, so that learning outcomes can be significantly improved."*

This statement is in line with research conducted by Syahputra & Hanum (2023), who found that an adaptive learning system based on artificial intelligence (AI) can improve learning

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outcomes by adjusting the material according to the individual needs of students, resulting in an increase in the average exam score.

In addition, research conducted by Manihuruk & Sutabri (2024) in the Journal of Creative Student Research shows that technology-based learning not only improves concept understanding but also student engagement, especially through interactive methods such as video, simulation, and gamification. With digital assessment, the measurement of learning outcomes becomes more accurate, allowing for more precise identification of student weaknesses and real-time feedback. According to a UNESCO report (2022), data analysis from AI-based learning platforms has provided deep insights into the effectiveness of teaching methods as well as their potential for improvement in the future.

As an example of real implementation, the “Smart Classroom” program implemented in several schools in South Korea has successfully improved learning effectiveness by integrating smart technology in the teaching and learning process. A study conducted by Alonemarera (2024) showed that students who used AI-based systems in this smart classroom experienced a 25% increase in material understanding compared to students who learned using conventional methods. In this program, each student has access to a tablet and AI-based software that analyzes their learning progress and provides additional material according to their level of understanding.

Based on research by Khoir (2024), the implementation of AI-based tutors in the classroom can improve learning efficiency by providing personalized recommendations for each student. The program allows students to access learning flexibly, while teachers can use data obtained from the platform to adjust their teaching strategies.

However, while technology brings many benefits, there are some challenges to overcome, such as gaps in access to devices and the internet, teachers' readiness to adopt technology, and the validity and security of data collected from digital learning systems. SR, a researcher in the field of digital education, emphasized that

> *"The main challenge in the implementation of educational technology in Indonesia is infrastructure inequality, where schools in remote areas still face difficulties in accessing stable internet."*

This problem also occurs in several other developing countries, such as in India, where the digital learning project "Diksha" is experiencing obstacles in technology accessibility for students in rural areas, as reported by The World Bank (2022).

Therefore, comprehensive and continuous evaluation is urgently needed to ensure that technology truly contributes positively to learning effectiveness. With the right strategic steps, such as training teachers in the use of technology, providing more equitable infrastructure, and developing a better data security system, technology can continue to be developed to support innovation in the world of education to be more inclusive and quality.

Challenges and Strategies for Technology Implementation in Education

1. Infrastructure Gap and Technology Accessibility

The gap in infrastructure and accessibility of technology in education is a big challenge, especially for schools in rural areas that still face limitations in digital devices, internet

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connection, and technical support. This inequality leads to a digital divide, where students in urban areas have better access to technology than those in remote areas. As a result, the quality of learning becomes uneven as schools with good infrastructure can adopt technology-based learning methods more effectively, while schools that lack access to technology still rely on conventional methods. In addition, the implementation of technology-based education policies also faces obstacles because uneven infrastructure makes it difficult to implement these policies optimally in all regions. For example, in the implementation of Merdeka Belajar, which relies on digital platforms such as Rumah Belajar and various other online education applications, schools in cities can easily access and utilize them, while schools in rural areas that do not have internet or digital devices find it difficult to follow the policy (Haniko et al., 2023).

The main factors causing this disparity include the limited internet network, the lack of school budgets to procure technology devices, and the low digital literacy among teachers and students in disadvantaged areas. Many remote areas do not have stable internet access due to geographical conditions that are difficult to reach by telecommunication service providers, while the cost of installing networks in these areas is often higher than in urban areas. In addition, rural schools often have limited budgets to purchase devices such as laptops, computers or projectors, making it difficult to implement learning technology to its full potential. On the other hand, educators in these areas also still experience difficulties in adopting technology in the teaching and learning process due to the lack of adequate training and mentoring. For example, in some remote areas in Papua, teachers have to use blackboards and oral methods entirely because there is no access to electricity or internet networks. Some initiatives have been undertaken, such as a tablet delivery program with pre-downloaded learning content, but limited electrical power remains a major obstacle to technology implementation in these schools (Rosyida et al., 2024).

To address this gap, strategic solutions are needed, such as providing subsidies and infrastructure assistance to schools that are still lagging behind. The government can cooperate with the private sector in distributing technology devices to areas in need, including by building computer labs and providing free internet access in remote schools. In addition, the expansion of internet networks to rural areas should be a priority, either through cooperation with telecommunications service providers or by utilizing alternative technologies such as satellite or community networks. One example of the success of this solution can be seen in the Giga Initiative program initiated by UNICEF and ITU, where they work with local governments to provide internet access in remote schools through satellite technology. A similar program has also been carried out in Indonesia through Kominfo's BAKTI project, which provides internet access to thousands of schools in 3T (Disadvantaged, Frontier and Outermost) areas.

Last but not least, teachers' capacity building in technology utilization should also be done through continuous training and certification programs, so that they can be more confident in using technology for learning (Rofii et al., 2023). An example of an inspiring initiative is the “Innovative Teacher” program, where teachers are given intensive training on the use of technology to improve teaching effectiveness in remote areas (Komara & Suhendraya, 2024). The program provides not only training but also technological devices that can assist teachers in teaching digitally even with limited internet access. A similar approach can be applied in Indonesia, for example by providing offline-based training modules that can be accessed through flash drives or simple digital devices to support teachers in areas that do not have stable internet access.

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For this solution to work effectively, policies that support equal access to technology in education must be implemented in an inclusive and sustainable manner. The government needs to ensure that technology-based education policies do not only benefit schools in urban areas but are also accessible to all regions, including disadvantaged areas. Incentives for private companies to invest in technology-based education infrastructure should also be considered, so that collaboration between the government and the private sector can accelerate equitable access. One example of a successful policy model is the One Laptop Per Child (OLPC) program carried out in various developing countries, where each primary school child is given a simple laptop device that can be used for digital learning (Ames, 2019). Although this program has its own challenges in terms of maintenance and curriculum adaptation, a similar concept can be applied in Indonesia with modifications that suit local needs. With concerted efforts from various parties, the infrastructure gap in education can be reduced, so that all students, regardless of geographical location, have the same opportunity to get a quality technology-based education.

2. Readiness and Competence of Educators in the Use of Technology

The success of technology integration in education is highly dependent on the readiness and competence of educators in adopting digital technology. Currently, there are still many teachers who face challenges in utilizing technologies such as Artificial Intelligence (AI), Virtual Reality (VR), and digital learning platforms optimally. One of the main factors that causes this difficulty is the lack of structured and continuous training, so many teachers do not have adequate skills in integrating technology into the learning process (Ghalia & Karra, 2023). In addition, infrastructure limitations such as unstable internet access, lack of technological devices, and resistance to change are also obstacles in the effective use of technology in the school environment. For example, in some rural areas, many schools still use conventional learning methods due to limited access to the internet and lack of digital devices. Teachers in these areas often do not have the opportunity to take part in technology training that can improve their competence in digital learning. In an interview with a teacher from TT from Yogyakarta, he revealed,

> *"We want to use technology in teaching, but the limited infrastructure and lack of training make it difficult for us. Most of the time, we rely only on printed materials because internet access is unstable."*

This shows that the readiness of educators is still a big challenge in technology integration in education.

To overcome this challenge, continuous training and workshops are the main strategies in improving educators' competencies. Through practice-based training, teachers can understand how to use technology effectively and gain hands-on experience in applying it in learning. Scientific studies conducted by Suyamto et al (2020) in the Technological Pedagogical Content Knowledge (TPACK) theory explain that teacher competence in technology includes not only technical understanding but also how to integrate technology into effective pedagogical methods. Case studies from Finland show that by providing continuous intensive training for teachers in educational technology, student learning outcomes can improve significantly. The training programs in the country cover not only the use of technology in teaching but also how technology can be used to analyze student needs and provide more personalized learning. In

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addition, mentoring programs can also help teachers overcome technical difficulties and build confidence in using technology.

Schools also need to play an active role by providing adequate infrastructure and creating policies that encourage the use of technology in learning. A good example is the digital transformation program in Singapore, where schools are given full support in terms of technology devices and teacher training. The local government even launched a Digital Learning Plan scheme that gives every student access to personal devices integrated with AI-based learning platforms. In their study, Ali et al (2024) mentioned that the Singapore government's investment in teacher digital competency development contributed significantly to the effectiveness of technology-based learning. With this kind of policy, teachers not only get access to technology but are also encouraged to continue developing their skills in using it optimally.

On the other hand, incentivizing teachers who actively adopt technology can be an additional motivation to improve their digital skills. With appreciation in the form of certification, awards or other incentives, teachers will be more encouraged to continue learning and applying technology in the learning process. Examples from the United States show that some school districts have adopted a performance-based reward system for teachers who successfully integrate technology in their classrooms, leading to increased creativity and teaching effectiveness. In an interview with RC, he stated.

> *"When teachers are given the right support, training, and incentives, they will not only be more confident in using technology, but will also be able to create a more meaningful learning experience for students."*

If the readiness and competence of educators in the use of technology continues to be improved, then learning can become more interactive, innovative, and in accordance with the times, so as to be able to provide a more effective learning experience for students.

3. Data Security and Ethics in the Use of Educational Technology

In the digital era, data security and ethics in the use of educational technology have become increasingly crucial issues along with the increasing use of online learning platforms. The risk of leaking student and educator data is getting higher due to the rampant collection of personal information such as academic history and study habits. For example, the online learning platform Edmodo experienced a massive data leak that resulted in more than 77 million user accounts being exposed, including the personal information of students and teachers. A similar case also occurred in the ProctorU application, an online exam proctoring service, which experienced data leaks of more than 440,000 accounts, raising concerns about the protection of student privacy in the exam monitoring system. In an interview with the SC, the cybersecurity expert from, he stated,

> *"Many educational institutions still do not have adequate security systems in place to protect student data. Information leaks not only have an impact on individual privacy, but can also affect public trust in educational technology."*

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Unfortunately, there are still many users who do not understand the importance of maintaining digital privacy, so the use of weak passwords, account sharing, and lack of data protection policies are loopholes for information misuse.

In addition, ethical violations are also a concern, where student data is often used by third parties for commercial purposes without explicit consent. For example, in 2022, learning service provider Google Classroom came under scrutiny regarding the alleged use of student data for advertising purposes, although the company later stated that it had taken steps to remove ad tracking for education users. According to research by Ali et al (2024) in the journal Educational Data Ethics, the use of student data by educational technology companies is often not transparent and can give rise to conflicts of interest. The study found that 72% of users do not fully understand how their data is being used by digital learning platforms. On the other hand, adaptive learning algorithms applied to some platforms can lead to bias in the educational process, as happened with the AI-based evaluation system in the UK in 2020. At the time, the algorithm used to determine students' final grades replaced exams that were canceled due to the pandemic, but were found to tend to discriminate against students from schools with limited resources, thus creating inequities in the education system. In an interview with Prof. MR, he emphasized that

> *"Artificial intelligence in education must be closely monitored so as not to cause systemic bias that is detrimental to certain groups. Transparency in algorithm design is key to preventing these injustices."*

Regulations related to data security in the education sector have not been implemented consistently in various countries, leading to weak enforcement against information leaks.

To address this challenge, educational institutions need to implement clear data protection policies, including transparency in the collection and use of student information and compliance with international regulations such as GDPR in Europe and COPPA in the United States. Security technologies such as data encryption and two-factor authentication should also be implemented to ensure that only authorized parties can access critical information. In addition, digital security education should be provided to students and educators to make them more aware of cyber threats such as phishing and malware. Case studies show that this approach is effective, such as Harvard University, which implemented a strict cybersecurity policy with a high-level encryption system and mandatory training for all faculty and students to raise awareness of data protection. Regular data security audits should also be conducted to identify and mitigate potential leaks before they occur. The government also has an important role in strengthening regulations and enforcing the law for those who violate data protection rules.

With the right measures, data security in education technology can be improved, so that students and educators can learn and teach in a safer digital environment. Without strict regulations and high awareness of the importance of digital privacy, the risk of data misuse will continue to rise, threatening the rights of individuals in modern education. Therefore, cooperation between governments, educational institutions, and technology users is key to creating an ethical and safe digital learning ecosystem. Case studies from various countries show that good data protection efforts can reduce the risk of privacy breaches and create a fairer and more trusted learning system for all parties involved.

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Conclusion

The integration of technology in education is proven to increase student engagement and motivation through interactive methods such as Virtual Reality (VR) and gamification. In addition, artificial intelligence (AI) enables more effective personalization of learning by tailoring materials based on students' individual needs. Technology in learning also makes academic evaluation easier with digital assessments that provide instant feedback and early detection of student learning difficulties. However, infrastructure gaps and technology accessibility remain a major challenge, especially in remote areas where devices and internet networks are limited. The readiness of educators to use technology is also a determining factor for success, so training and mentoring for teachers is needed. On the other hand, data security and ethical use of education technology must be considered to prevent information leakage and exploitation of student data by third parties. Some countries have successfully implemented effective strategies, such as the Smart Classroom program in South Korea and AI Tutors in Finland, which improve learning effectiveness. Collaboration between the government and the private sector in providing infrastructure and teacher training can accelerate equitable access to education technology. Continuous evaluation is also needed to ensure that technology really has a positive impact and is not just a passing fad. With the right implementation strategy, technology can be a very useful tool in improving the quality of education in an inclusive and equitable manner. The future of technology-based education depends on continuous innovation, supportive policies and the readiness of all parties to adopt these changes.

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