Challenges and Solutions In the Development of Educational Technology in Indonesia

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Abstract. The development of educational technology in Indonesia shows rapid progress, but the gap in access to technology between urban and rural areas remains a crucial issue. The main problems in this study are limited infrastructure, low internet access, and lack of digital literacy among educators and students. This research aims to analyze the development of educational technology, identify obstacles in its implementation, and offer solutions to overcome these obstacles. This study collects data from academic sources, policy reports, and related publications using the literature review method. The study results show that the main obstacles to the development of educational technology in Indonesia include lack of internet access, limitations of electronic devices, and lack of digital competence among teaching staff. The proposed solutions include improving internet infrastructure, digital training for educators, and collaboration between the government and the private sector. In conclusion, equitable access to educational technology is needed to improve the quality of national education inclusively.

Keywords: Education; Technology; Obstacle; Solution; TIK

1 Introduction

In recent years, educational technology in Indonesia has developed rapidly in response to the need for better accessibility and quality of education. The increasing adoption of e-learning, online learning, and digital platforms in schools and universities shows the growing awareness of the importance of technology in education. However, although these developments open up great opportunities for broader and flexible learning, many regions, especially remote ones, still need to overcome various obstacles. The lack of digital infrastructure and internet access, limited resources, and low digital competence among educators and students slow down the development of educational technology evenly throughout Indonesia. These issues show that while opportunities for educational transformation have emerged, the technology gap is still a significant challenge that requires comprehensive solutions.

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Various studies have examined variables related to the development of educational technology, barriers, and potential solutions. The first study of [1] found that e-learning has improved learning access for learners in urban areas but unevenly in rural areas. [2] highlighting the challenges of lack of infrastructure and its impact on school technology adoption. According to [3], educators' digital competence still needs to improve, hindering technology-based learning. Meanwhile, research by [4] shows that many students need help adjusting to the online learning model. [5] found that the digital divide between developed and disadvantaged regions in Indonesia impacts the unequal quality of education. The study from [6] also highlights the importance of technology training for educators to improve the effectiveness of digital learning. Research by [7] shows that limited internet connections in remote areas are the main obstacle to learning access. Finally, the study's results [8] concluded that collaboration between the government and the private sector is needed to provide equitable infrastructure solutions.

This research aims to identify the development of educational technology in Indonesia in general, explore the obstacles that hinder the equitable application of the technology, and formulate potential solutions that can support the spread of educational technology throughout Indonesia. This research also aims to provide a comprehensive understanding of the factors that affect the development of educational technology in Indonesia so that it can contribute to education policy planning.

The study results show that although significant developments in the use of educational technology, access and utilization have yet to be evenly distributed throughout Indonesia. The main obstacles are more digital infrastructure, low technological competence, and limited connectivity in remote areas. Suggested solutions include improving technological infrastructure in disadvantaged areas, training educators in digital literacy, and developing collaborative programs between the government and the private sector to expand internet access in the regions that are still isolated. With these steps, the development of educational technology can be even more inclusive to help improve the quality of education throughout Indonesia.

2 Method and Materials

The study highlights how infrastructure, digital skills, and policy support affect the spread of educational technology, especially in areas with limited access. The study looked at the implementation of technologies such as e-learning and mobile learning in schools and universities, as well as the factors that slow down or support the development of these technologies. This study uses a research design based on a literature review to examine the topic being researched in depth. Data were obtained from secondary sources that included journals, scientific articles, policy reports, and related documents relevant to educational technology in Indonesia. The literature reviewed provides research in education and technology, reports from government agencies, and publications from international organizations that discuss the challenges and developments of educational technology. This study gathers various perspectives through a literature review approach to comprehensively understand educational technology in Indonesia.

At the data collection stage, this research collects literature and documents from various academic sources and educational institutions, including databases of international journals such as the International Journal: accredited National Journal, books, and Google Scholar. Data was also obtained from the Indonesian Ministry of Education report, which provides data related to educational technology development and challenges at the national level. Each literature relevant to the research variable is classified and analyzed to obtain data per the research

objectives. This process involves selecting appropriate literature based on the relevance and quality of the source.

The data analysis stage is carried out with a thematic analysis approach, where the data obtained from the literature review is grouped based on the central theme: the development of educational technology, the obstacles faced, and solutions to overcome these obstacles. The analysis process involves critically examining findings from various literature to find patterns, relationships, and differences that underlie the three research variables. The key findings from this analysis were then summarized and used to formulate relevant conclusions and recommendations for educational technology development in Indonesia. This analysis helps to provide a comprehensive picture of the actual conditions and strategic recommendations for the future of educational technology in Indonesia.

3 Results and Discussion

Result

3. 1. The Meaning of Educational Technology

According to [9], Educational technology constitutes a multifaceted and cohesive process encompassing individuals, methodologies, concepts, instruments, and institutions to assess issues, strategize, execute, appraise, and oversee problem-solving related to all dimensions of human learning.

According to [10], The multifaceted idea of educational technology comprises the following: 1) a systematic procedure that applies information to develop answers that can be applied to issues in teaching and learning, 2) Products like TV shows and texts are particular components of education. Furthermore, according to [11], educational technology combines learning, learning, development, management, and other technologies applied to solve academic problems.

The research and ethics of using educational technology to support and enhance learning outcomes is known as educational technology. Through the development, application, process environment, and technology resources, such activities can be studied and their ethics examined. Humans, machines, concepts, processes, and management are all educational technology components. Technology in education is a vague concept. In this instance, educational technology can be viewed as a multifaceted, integrated process that incorporates individuals, methods, concepts, tools, and organizations to analyze issues, come up with solutions, implement, evaluate, and oversee problem-solving techniques that encompass all facets of human learning [12], [13].

Additionally, educational technology is a systematic approach to planning, carrying out, and completing the entire learning process while adhering to specific learning goals [14] based on human communication and learning theory studies and employing non-human and human learning resources to improve learning [15].

From some of the opinions above, educational technology is defined as a systematic and critical approach to education that uses technological methods or tools to solve academic problems.

3. 2. Development of Educational Technology in Indonesia

Rapidly evolving technological advancements have indirectly impacted every facet of human existence, including politics, economy, culture, and education. In the present era, we cannot prevent technological advancement since the more sophisticated science, the more sophisticated technology will become.

[16] describing how technological advancements have made it possible to create a worldwide, networked learning environment that centers the learning process on students and surrounds them with a range of e-learning services and learning resources. Every technology undoubtedly has both advantages and disadvantages. Although technological advancements can be advantageous in education, particularly as a source of information and a reference for learning, they can also have detrimental effects that can lead to adverse outcomes, so we must use technology cautiously [17], [18].

Knowledge and Interaction: All technology about gathering, processing, storing, sharing, and presenting information is considered a component of science and technology in general. At this point, information technology is developing, particularly in Indonesia. The availability of information and communication technologies can facilitate our ability to study and obtain the information we require from any location at any time.

As a result of the substantial changes that are beginning to occur in the field of education, the advancement of information technology has a positive effect on this field. With the development of several applications to support teaching and learning activities, time and distance are no longer significant obstacles to knowledge acquisition.

The emergence of mass media, particularly electronic media like internet networks, online media, computer labs in schools, and others, as a source of information and an educational hub is one of the positive effects of technology use in Indonesian education. These resources benefit teachers and students in carrying out the learning process. [19], Because teachers are not the only source of knowledge, students can acquire the material from the Internet and do not need to be overly focused on what their teachers teach. As a result, teachers here serve as both instructors and mentors for students throughout learning activities.

The introduction of innovative teaching strategies that facilitate learning for both educators and learners. New techniques will be developed in tandem with technology breakthroughs, which will help pupils comprehend the still-abstract topic. Thanks to technology improvements, the learning process no longer requires students and professors to meet in person; instead, they can use online resources and other tools.

It will be simpler for instructors to handle learning outcome data if a system is in place for managing assessment results utilizing technology, such as computers. The demand for educational facilities can be promptly satisfied. Naturally, there are a lot of items and resources needed in the field of education to carry out the teaching and learning process. For instance, the availability of a photocopy will speed up and make it easier to duplicate exam questions.

As technology advances, all of this can be completed quickly. Technology advancements have many advantages, including making learning more engaging and compelling, assisting teachers in presenting information through visual and audiovisual media, improving time management, and fostering a different learning environment [20], [21].

In addition to the positive influence, technology hurts the world of education in Indonesia [22]. Aside from students' lack of motivation to learn, technological advancements should also make learning easier. For example, using devices and laptops with Internet access makes students less motivated to study, and many of them spend their time on the Internet for pleasure rather than to learn more. This includes playing online games and using Facebook, YouTube, Instagram, Twitter, TikTok, and other platforms, affecting students' interest in learning.

Immoral transgressions are common, and we frequently witness on television and in print media that students are either the perpetrators of these crimes or the victims are students. Facebook, YouTube, and other technical advancements catalyzed it all. The prevalence of aberrant conduct, such as students wasting time on Facebook, online gaming, and chatting instead of studying [23]. The following actions can be taken to mitigate the detrimental effects of technological advancements on Indonesian education: first, taking into account the use of communication and technology tools in the classroom, particularly for young students who still require supervision when using them; second, avoiding the use of ICTs as the sole medium for instruction; Third, educators—parents, instructors, and lecturers—offer ethical technology training so that students can use technology responsibly without sacrificing morals [24].

Since the government is in charge of information systems and stakeholders, it should enforce laws restricting minors' access to information more strictly against business owners of Facebook, Instagram, YouTube, Twitter, and other platforms.

3. 3.Obstacles in the Development of Educational Technology in Indonesia

There are numerous advantages to technological advancements in the millennial period, particularly in education. As a result, many people wish to become proficient in and benefit from technology advancements. Nonetheless, it is indisputable that there are several barriers to ICT use in the education sector, including:

a. Lack of ICT infrastructure procurement [25]. This results in an unequal distribution because some parts of Indonesia are hard to reach. It is still challenging to get to many places using transit. The only way to get to the designated location is on foot. At the same time, there are other options than carrying different multimedia devices on foot.
b. Educational institutions in rural regions continue to use outdated multimedia equipment [14]. Naturally, this outmoded multimedia device's specs mean its utilization needs to catch up with the rapid advancements in ICT.
c. There is a need for a regulatory framework and telecommunications infrastructure [12]. Cyberlaw has yet to be applied in Indonesia's legal world.
d. The high cost of procurement and use of ICT facilities [26]. The government gets this back. The government continues to provide limited funding for acquiring ICT infrastructure to enhance Indonesian education. For instance, more infrastructure is needed in rural areas. In contrast, it is evenly dispersed around the city, particularly in prestigious educational institutions.

3. 4.Solutions to the Problem of Educational Technology Development in Indonesia

These challenges must be addressed and overcome, and doing so is a requirement for the effective use of ICT in education. According to [27], Providing infrastructural facilities that support information and communication technology-based learning is one of the conditions listed in his book ICT for Superior Schools for implementing this type of learning. He went on to discuss the prerequisites that need to be fulfilled to implement ICT-based learning, which include the following:

1. Digital technology and the Internet must be available to instructors and students in classrooms, schools, and other educational settings.[28]. Schools need sufficient information and communication technology infrastructure, including PCs and laptops, internet networks, computer labs, and multimedia devices like CDs, DVDs, and focus.

2. Teachers and students must access high-quality, culturally relevant, and valuable resources.[29]. These resources may take the shape of computer-assisted interactive learning resources like CDs and DVDs and focus on interactive learning.
3. To meet the Minimum Completeness Criteria (KKM) Standard, educators must proficiently use digital tools and resources in their lesson plans[30].
4. The budget or funds needed to acquire, create, and maintain information and communication technology infrastructure must be adequate [31].
5. The willingness and support of all parties, in this case the principal, is equally crucial [32]; teachers and students can use information technology and communication to implement learning.[30], [33].

Discussion

This research highlights the significant development of educational technology in Indonesia, including the use of e-learning, mobile learning, and digital platforms at various levels of education. This growth is driven by the need to improve access and quality of education, especially in remote areas. The study also noted a surge in interest in learning technologies accelerated by the pandemic, which prompted schools and universities to leverage digital platforms to facilitate remote learning. However, the development of educational technology is still faced with various challenges.

The implications of this study show that although educational technology has opened up new opportunities for educational inclusion, several aspects, such as the availability of infrastructure, training of educators, and accessibility of technology, still require special attention. This research emphasizes that to maximize the benefits of educational technology, governments, and institutions need to work together to expand digital infrastructure and prepare curricula that support technology-based learning.

The study results show that the main obstacles to the development of educational technology in Indonesia include lack of internet access, limitations of electronic devices, and lack of digital competence among teaching staff. These factors are slowing the adoption of educational technologies in underdeveloped regions [34]. From the user side, a significant technological access gap deepens educational inequality between developed and disadvantaged areas [35], [36].

Other research has also shown that developing countries face similar challenges in implementing educational technologies [4]. For example, studies in India and the Philippines found identical constraints, such as lack of internet access and teacher training[37], that hindered the optimization of educational technologies. However, these countries also found that with investment in infrastructure and training [38], educational technological developments could be improved [39]. These results align with research findings in Indonesia, where the main challenge is access and readiness of technology [36], [40].

This study recommends that further studies explore implementing practical solutions to overcome these obstacles, such as developing internet networks in remote areas and improving digital training for educators. In addition, further research can be conducted in more depth to examine the impact of educational technology on learning effectiveness in various socio-economic contexts. The government, private sector, and academic institutions need collaboration to strengthen an inclusive and effective digital ecosystem.

4 Conclusion

This study reveals that the development of educational technology in Indonesia has made significant progress, primarily through the application of e-learning, mobile-based learning, and digital platforms. However, adopting educational technology still needs to overcome many obstacles, especially those related to digital access and competence. These barriers show that although technology opens up more comprehensive access to education, many regions in Indonesia, incredibly remote areas, are still marginalized in technology. In addition, solutions that have been identified include improving technology infrastructure and training educators, which is believed to accelerate the adoption of educational technology across Indonesia.

This research makes a valuable contribution to the academic world by enriching the understanding of the dynamics of educational technology development in developing countries. This research provides empirical insights into Indonesia's specific challenges, such as the lack of infrastructure and limited internet access, which can be used as a basis for further studies in education policy and educational technology development. By mapping out barriers and solutions, the study also provides direction for academic institutions and governments in designing more inclusive strategies to expand the adoption of educational technology.

This study has several limitations, including the fact that it does not include a comprehensive analysis of all regions in Indonesia so that the results could be more representative of the national context. In addition, this study focuses more on macro aspects, such as policies and infrastructure. It has yet to explore individual variables, such as the level of digital literacy and students' psychological readiness to adopt educational technology. For this reason, more comprehensive follow-up research, including micro-studies at the school or specific regional level, is needed to get a more detailed picture of the readiness of educational technology throughout Indonesia.

This conclusion shows that despite positive educational technology developments in Indonesia, adoption success depends entirely on addressing the main obstacles and developing solution strategies appropriate to the region's needs and the community's socio-economic conditions.

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