



Identifying the Best Model for Implementing Technology-Based Education in Indonesian Schools

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Abstract: This research aims to identify optimal models that can be implemented effectively in Indonesian schools using technology-based education. The approach used in this research is literature study analysis, using literature study research methods to collect and summarize related literature from various sources such as journals, books, research reports, and theses. An in-depth evaluation of the literature reviewed shows that each model, such as Blended Learning, Flipped Classroom, Learning Management Systems, Game Based Learning, Video-Based Learning, Open Educational Resources - OER, STEM Model, Social Media in Learning, and Mobile Learning (m-learning), has specific advantages and disadvantages. The results of this research identify optimal models to be implemented in the context of technology-based education in Indonesian schools but also provide a basis for improvement and concrete recommendations for further research and implementation. The implications of these research findings are significant, providing valuable guidance for educational stakeholders, teachers, and researchers. The resulting conclusions can also be a basis for policymakers to design more effective technology-based education strategies in Indonesia. Thus, this research has the potential to inspire positive changes in curriculum development and technology education in schools while supporting efforts to improve the overall quality of education in Indonesia.

Abstrak: Penelitian ini bertujuan untuk mengidentifikasi model optimal yang dapat diimplementasikan secara efektif di sekolah-sekolah di Indonesia dengan menggunakan pendidikan berbasis teknologi. Pendekatan yang digunakan dalam penelitian ini adalah analisis studi literatur, dengan menggunakan metode penelitian studi literatur untuk mengumpulkan dan merangkum literatur terkait dari berbagai sumber seperti jurnal, buku, laporan penelitian, dan tesis. Evaluasi mendalam terhadap literatur yang ditinjau menunjukkan bahwa setiap model, seperti Blended Learning, Flipped Classroom, Learning Management Systems, Game Based Learning, Video-Based Learning, Open Educational Resources - OER, STEM Model, Media Sosial dalam Pembelajaran, dan Mobile Learning (m-learning), memiliki kelebihan dan kekurangan masing-masing. Hasil penelitian ini mengidentifikasi model-model yang optimal untuk diimplementasikan dalam konteks pendidikan berbasis teknologi di sekolah-sekolah di Indonesia, tetapi juga memberikan dasar untuk perbaikan dan rekomendasi konkret untuk penelitian dan implementasi lebih lanjut. Implikasi dari temuan penelitian ini cukup signifikan, memberikan panduan yang berharga bagi para pemangku kepentingan pendidikan, guru, dan peneliti. Kesimpulan yang dihasilkan juga dapat menjadi dasar bagi para pembuat kebijakan untuk merancang strategi pendidikan berbasis teknologi yang lebih efektif di Indonesia. Dengan demikian, penelitian ini memiliki potensi untuk menginspirasi perubahan positif dalam pengembangan kurikulum dan pendidikan teknologi di sekolah sekaligus mendukung upaya peningkatan kualitas pendidikan di Indonesia secara keseluruhan.

A. Introduction

Education has played a central role in a country's development, and Indonesia is no exception. It has greatly emphasized the education sector as one of the main pillars of development (Sobirin, 2023). In the last few decades, Indonesia has shown maximum efforts to improve the quality and accessibility of education, responding to the demands of times that continue to change and develop. Subroto et al (2023) emphasized that the integration of technology in the educational environment is one of the aspects that play the most role in efforts to improve education. The development of information and communication technology (ICT) has brought fundamental changes in various aspects of life, and the education sector is no exception to its positive impact. In this context, technology-based learning (EdTech) approaches have become important in improving the quality of learning, student engagement and educational accessibility worldwide (Widiyono & Millati, 2021). Despite its significant benefits, implementing technology in an educational environment is complex. Instead, this often requires a planned approach suited to the existing educational context. It is important to recognize that challenges arise in various problems that must be faced in integrating technology into the education system. Currently, the Indonesian education sector is trying to prepare a generation that can compete in the era of technological development.

In the context of preparations for the fourth industrial revolution, the Minister of Research, Technology, and Higher Education (Syamsuar & Reflianto, 2019) stated several strategic steps, including creating an innovative learning system to produce competitive graduates, rebuilding the higher education institutional system to be flexible and prepare to face the industrial revolution with reliable, flexible and responsive human resources. In addition, infrastructure renewal and development are needed to improve the quality of education, research, and innovation. Although these steps reflect the government's commitment to developing educational technology, their implementation could have been better. Even so, these steps provide a real picture of Indonesia's government's efforts to overcome educational backwardness. Looking at the Information and Communication Technology (ICT) progress, its impact on education is extraordinary. Previous research has highlighted that information technology can have beneficial and detrimental impacts depending on its use. These advances enable easy access to high-quality learning resources such as books, journals, and literature and facilitate interaction and collaboration with international experts through scientific discussion forums and video conferencing.

Challenges that arise in the form of problems must be faced with solutions that can overcome these obstacles. Currently, the education sector is busy preparing a generation that can compete. In order to prepare for the fourth industrial revolution, the Minister of Research, Technology, and Higher Education stated (Syamsuar & Reflianto, 2019) that several things must be done. Among other things: a) creating a more innovative learning system to produce competitive and skilled graduates, especially in the fields of data literacy, technological literacy, and human literacy. b) Rebuilding a higher education institutional system that is flexible enough to respond to the demands of the Fourth Industrial Revolution

while creating a transdisciplinary science curriculum. c) Prepare to face the industrial revolution with reliable, flexible, responsive human resources. 4. d) Infrastructure renewal and development are also needed to improve the quality of education, research, and innovation. Besides that. One of the studies conducted by [Taopan et al \(2019\)](#) aimed to examine the influence of Internet and cellphone use on student morality, as well as the best efforts made by parents, teachers, and the wider community to protect students from the negative impacts of cellphone use and to identify the best ways to protect students from the negative impacts of cellphone use action. This study will focus on student morals, especially at SMA N 3 Kupang City. A qualitative description approach was used in this research. Using interviews, observation, and documentation approaches, research data was collected from 10 students who often use cell phones in class, guidance and counseling teachers, citizenship teachers, school extracurricular members, parents, ulama, and community leaders. The findings of this study suggest that telephone and internet use have beneficial and detrimental impacts on student morale. One of the benefits of cell phones is that they can be a useful communication tool, especially when interacting with individuals over long distances. In addition, we can communicate online, which gives us access to any information related to information and communication technology ([Taopan et al., 2019](#)).

Advances in ICT have had a tremendous impact on education. The following research states that information technology can benefit and harm society and the environment, depending on how it is used. Both the people who use it and the people around them use it. Due to human behavior and technological advances, it is impossible to separate this from the need for human contact. As a result, human interaction can extend to all levels of society and geographical locations. New technological advances cannot just be a window to get to know the culture of certain local communities. Society's culture and environment have been impacted by the rapid growth of information and communication technology, both positively and negatively. Progressive changes in society's cultural and environmental characteristics are one aspect of life that impacts this development ([Novi, 2020](#)). [Asmawi et al \(2019\)](#) say that we can learn and obtain the knowledge we need more easily thanks to information and communication technology anywhere and from anyone. Due to advances in technology, information is beginning to have a positive influence in the field of education. The use of information technology in education is starting to experience quite a big shift. Time and distance are not the main obstacles in acquiring knowledge because many applications have been developed to make it easier. Information technology is the use of technology to process data in various ways, such as collecting, processing, compiling, storing, and manipulating data. The result is quality information, or timely, relevant, and accurate information that can be used for government, business, and personal purposes, as well as strategic information for decision-making ([Asmawi et al., 2019](#)).

Apart from that, previous research also discussed technology in education. Researchers concluded that technology in education was developed to solve learning problems and improve teaching standards. Educational technology concepts can be used to structure messages and learning experiences inside and outside the Classroom. This is

intended so that by using learning technology, learning information can be presented in an organized manner without being limited by time and place so that learning becomes fun and easy to adapt. Technology in education has many advantages but also presents several challenges that can ultimately contribute to system progress. The future of education will most likely be addressed by a variety of computer-based learning models, including computer-based instruction (CBI), computer-assisted instruction (CAI), electronic instruction, and e-learning, as stated by Kristiawan (Husnul et al., 2019). With this learning model, educators, and students can use computers to search for their educational resources directly from the website. Without requiring direct teacher supervision, teachers and students who are computer literate can access educational resources via intranets and internet networks. They can also learn educational resources engagingly and interactively by using CDs. As a result, the education sector has benefited greatly from technological advances, and is among the sectors that have benefited the most. Everyone can do anything, from researching high-quality learning sources such as books, journals, and literature to creating scientific discussion forums and talking to international experts, which can be done easily and without difficulty. As a beginner, the Indonesian government responded quickly to the world of education's need for technology.

As an illustration, in the higher education environment, internet availability is increasingly widespread, and video conferencing technology is starting to be implemented, providing support for the learning process on campus. The same happens in primary, secondary, and vocational education, where the government is actively building the *edukasi.net* learning site. Even though the implementation of *Jardiknas* has not been evenly distributed, this step reflects the government's real commitment to developing e-education in Indonesia. Launching e-books and developing e-libraries in various government libraries and universities is also a form of the government's efforts to encourage technological progress in education, aiming that education in Indonesia can more quickly catch up with other countries. Research conducted by Mayudho (2022) states that technology has advanced rapidly and has had an impact, both positive and negative, on the world of education and the progress of science. These developments motivate redoubled efforts to integrate technology into the educational process. Teachers must be able to assist the learning process effectively and use technological devices efficiently according to current expectations. Apart from that, teachers must have sufficient understanding and expertise in learning media to develop their abilities to create teaching materials. Utilizing electronic media for learning models – such as websites or other forms of information technology – is one approach to improving students' flexible learning quality (Mayudho, 2022).

This study emphasizes how urgent the situation is and how important education is for the nation's progress. First of all, its application to the needs of developing countries where technology is changing rapidly highlights the need for human resources with data, technology, and human literacy skills. Understanding these dynamics depends on the effective integration of technology in the Classroom. In addition, this study significantly increases the readiness of the next generation to face the challenges of the fourth industrial

revolution. Its emphasis on developing cutting-edge learning platforms and human resources capable of competing worldwide is a calculated step to meet contemporary demands. The main finding of this research is the extraordinary influence of information and communication technology (ICT) on education. To advance the education system, it is important to understand how ICT can improve the quality and accessibility of learning.

The study also acknowledged that integrating technology into the Classroom is difficult. This research offers an in-depth understanding of these barriers and suggests workable solutions by identifying new challenges. Contributing to education policy is another important element. Policymakers can greatly benefit from the findings of this research, especially in the areas of infrastructure, curriculum, and human resource preparation. The Indonesian government's quick action in meeting technology needs in the education sector shows the government's firm determination to overcome educational setbacks and maintain Indonesia's competitiveness in the global education arena. Ultimately, this research highlights the importance of choosing the most effective model for implementing technology-based education. These goals focus on outcomes that can be implemented practically, providing useful direction for educational institutions and policymakers.

The main objective of this research is to identify optimal models for implementing technology-based education in schools in Indonesia. To achieve this goal, we will conduct a comprehensive literature study. The focus of this research is to explore various approaches that have been proposed and evaluated in the related scientific literature. By doing this, this research will provide valuable insight into the most effective models, the benefits that can be generated, and the challenges that need to be overcome to integrate technology in the educational context in Indonesia optimally.

B. Method

The literature study method was used in this research to collect, analyze, and summarize literature related to the implementation of technology-based education in Indonesia. This method involves searching sources such as books, journals, research reports, and theses and analyzing the findings, research methods, and conclusions contained in the literature (Moleong, 2017). The literature data obtained is used to build a theoretical basis and conceptual framework related to the research topic. This literature analysis and synthesis provide comprehensive insight into the main models and concepts of technology-based education. In addition, this research also evaluates the strengths and weaknesses of the models that have been identified, as well as provides recommendations for further research and practical implications in the educational context in Indonesia. The following is the Research Flow of the literature method used by researchers.

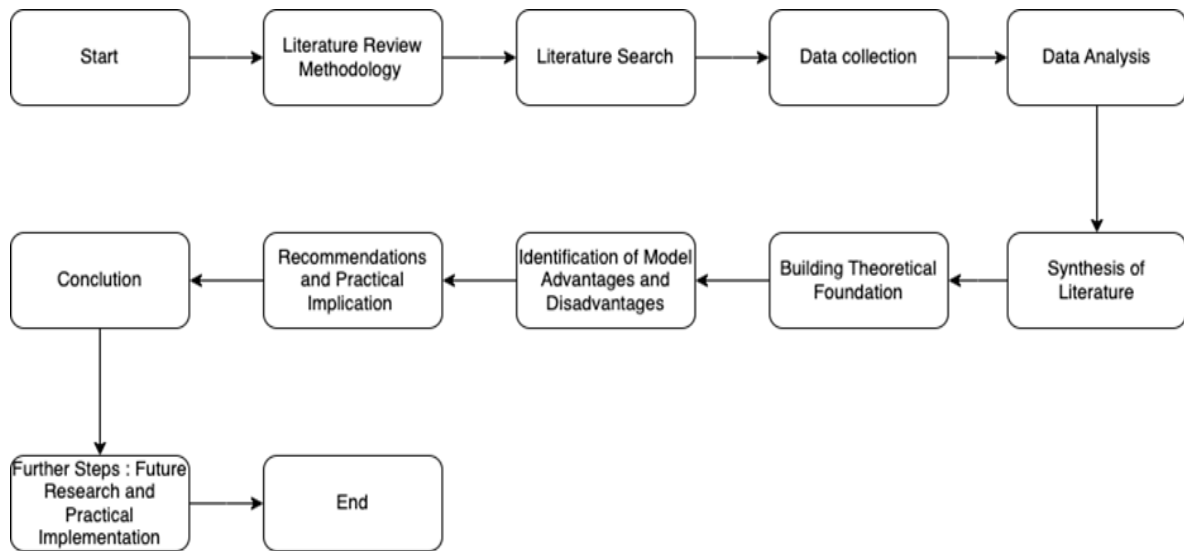


Figure 1. Research Flow

C. Result and Discussion

Result

Models in implementing technology-based education that researchers use as material or literature data include Blended Learning, Flipped Classroom, Learning Management Systems, Game-Based Learning, Video-Based Learning, Artificial Intelligence-Based Education, Open Educational Resources - OER, Model STEM (Science, Technology, Engineering, and Mathematics), Social Media in Learning, and Mobile Learning. Table 1 summarizes researchers' findings from several journals or previous research regarding models that are frequently used in implementing technology-based education.

Table 1. Summary Results of Previous Research

No	Citation	Objective	Results
	(Arifin & Abduh, 2021)	Increasing learning motivation for Class II-A SD Negeri 3 Pandean in 2020/2021	Pre-cycle results show that the average student motivation is at 26.85%. Meanwhile, in cycle I, the motivation percentage increased to 63.88%, and in cycle II, motivation increased to 80.55%. Therefore, using the blended learning model effectively increases student learning motivation at SDN 3 Pandean, especially in material measuring the weight of objects for Class II-A students.
	(Syajili & Maman Abadi, 2021)	Explain the effectiveness of the flipped classroom learning model in improving students' mathematical abilities during the	Applying the flipped classroom model in teaching mathematics can produce active classes because students can discuss and understand the material before attending class. Using the flipped classroom approach, the mathematics learning model is also effective in improving students'

No	Citation	Objective	Results
		COVID-19 pandemic.	mathematical abilities, understanding of cognitive thinking, and emotional aspects.
	(Wiragunawan, 2022)	Knowing the effectiveness of using LMS in improving student learning outcomes during online learning	The results of the literature review carried out include: (1) LMS is a platform that is very popular in online learning, indicated by a high level of trust reaching 82.2% (2) LMS is superior in terms of the diversity of features available, resulting in a better variety in learning process compared to other online platforms (3) Implementation of learning via LMS or a combination with LMS-based models has been proven to be able to increase activity, learning achievement and student motivation, with a "Good" assessment (4) Utilization of LMS can stimulate the level of independence in learning with a range between 78.8 to 81.5, which can be classified as a very high level.
	(Sakdah et al., 2021)	Seeing the effect of applying Kahoot as a learning medium on student learning outcomes	Based on research, there is a significant difference between learning outcomes before and after implementing the treatment. The results of hypothesis analysis using the Paired Samples Test show that the Sig (2-tailed) value is 0.000, which means the Sig value is <0.05. Therefore, H0 is rejected, and Ha is accepted. Thus, Kahoot media positively impacts the learning outcomes of class V students in Ecosystem material at the Permata Scholar Integrated Islamic Elementary School, Simalungun Regency.
	(Kurniawan et al., 2019)	Knowing the response of D-3 ship engineering students to using video-based learning in applied physics courses.	Based on the research results, most D3 Shipping Engineering students at the Surabaya State Shipping Polytechnic like or are curious about the video-based learning approach for applied physics courses. Student comments on this learning method vary according to the questionnaire results. Ship machinery engineering, class D3. Because video-based learning technology improves the teaching and learning process, it is considered appropriate for use in applied physics courses. Videos can be viewed by students at any time and from any location. Meanwhile, lecturers can teach different courses.
	(Shidiq, 2023)	To discuss the GPT Chat system and its impact on students' lack of creativity in writing skills.	Based on findings and conversations, GPT Chat, which can respond based on keywords entered by users, has the potential to impact the field of education and learning positively. However, it is important to note that not all of these resources positively influence students' learning abilities, especially when it comes to creative writing. Therefore, methods must be implemented to

No	Citation	Objective	Results
			prevent teachers from relying solely on online education, which students may misuse in doing their assignments. According to Cassidy (2022), one tactic that can be used is using paper as a medium as a form of process control and assessment when preparing assignments related to creative writing.
	(Iswanto & Jurianto, 2020)	To determine the development of an effective OER management model to meet the needs of IAIN Curup Library users	The OER management model at the IAIN Curup Library is successful, with evaluation results showing that the product is rated effective at 39 divided by 10. The IAIN Curup Library OER service is given an effectiveness rating of 4.23 based on user data about OER services. Several efforts have been made to introduce an OER management model at the IAIN Curup Library based on research findings covering various stages of product improvement. Experts in product development, librarians who manage OER services, and library visitors who act as service users participate in user education activity forums.
	(Sumartati, 2020)	To describe STEM concepts in Chemistry learning.	The research results show that several basic competencies in Chemistry subjects at Madrasah Aliyah/Senior High Schools can be integrated with the STEM approach through the STEM approach stages and purchasing projects for students. Thus, the application of the STEM approach to Madrasah Aliyah/SMA chemistry subjects can be carried out in order to prepare competent human resources for the 21st century.
	(Wulandari & Sari, 2022)	To describe whether social media can be a relevant alternative learning platform in today's digital era.	The research results concluded that social media meets the requirements for use as a learning platform in the digital era. The features on various social media can be used as supporting tools in the learning process. In this context, educators and students can collaborate in teaching and learning activities without being constrained by space and time constraints. Social media as a learning platform has become relevant in the digital era.
10	(Novaliendry et al., 2023)	To determine the validity, practicality, and effectiveness of the design and creation of mobile web learning media	Based on assessments and expert input, the Mobile Web-Based Mobile Learning field trial results have proven its feasibility and superiority. Mobile Web-based Mobile Learning can be used in the learning process.

Discussion

Blended learning is the most effective learning approach. Combining the advantages of online and face-to-face learning allows students to utilize rich and interactive online

resources while still getting direct guidance and interaction from the instructor, creating a holistic and top-notch learning experience. One of the Elsevier journals that researchers quoted stated that implementing blended learning had a positive effect on students during learning (Ifinedo et al., 2018). According to research conducted by Arifin & Abduh (2021), the use of the blended learning model has proven effective in increasing the learning motivation of Class II-A students at SDN 3 Pandean in the 2020/2021 academic year. The pre-cycle results showed that the average student motivation was 26.85%, but in cycle I, the percentage of motivation increased significantly to 63.88%, and in cycle II, motivation continued to increase until it reached 80.55%. These findings indicate that the blended learning approach can positively impact students' learning motivation, especially in learning material about measuring the weight of objects for Class II-A students at SDN 3 Pandean (Arifin & Abduh, 2021). Apart from that, according to (Rasheed et al., 2020) in his research, the Blended Learning model is the most widely used in education because of its effectiveness in flexible, timely, and sustainable learning. Another statement, according to the Sloan Consortium (Bizami et al., 2023), is that Blended Learning includes 30 to 79% of sending content online. To date, individualized online learning and its combination with traditional face-to-face teaching, which are commonly referred to as *flex*, *self-blend*, *fixed*, and *rotation*, among others, have been used by many studies. Some of these models are better than others.

Flipped Classroom is an extraordinary innovation in the world of education. In this model, students first explore learning material independently through online resources such as videos or reading materials. When students are in class, they can discuss, collaborate, and receive guidance from the teacher to deepen understanding. In this way, Flipped Classroom opens the door to more active and interactive learning, making students the main players in their learning process. According to (Kurniawan et al., 2023), this model can increase student independence. As stated in one of the studies conducted by Syajili & Abadi (2021), the effectiveness of the flipped classroom learning model in improving students' mathematical abilities during the COVID-19 pandemic was discussed. Applying the flipped classroom model in teaching mathematics can create a more active class because students can understand the material and discuss it before class. The research results also show that the flipped classroom approach in mathematics learning effectively improves students' mathematical abilities, increases understanding of cognitive thinking, and pays attention to students' emotional aspects. This approach has proven to be a relevant and effective solution in overcoming learning challenges during the COVID-19 pandemic by focusing on students' mathematical progress. The statements of the two previous studies above are reassured by the findings of one study, which states that, in general, the flipped classroom model provides positive academic results, such as increasing student learning motivation (Akçayır & Akçayır, 2018).

A Learning Management System (LMS) is a website-based platform designed to manage, organize, and provide resources for the learning and teaching process. Educational institutions usually use LMS to manage learning materials efficiently (Fitriani, 2020).

Previous research by Wiragunawan in 2022 revealed the effectiveness of using LMS in improving student learning outcomes during online learning. The results of the literature review included several interesting findings. First, LMS is very popular in online learning, with a trust level of 82.2%. Second, LMS excels in the diversity of features available, resulting in greater variety in the learning process compared to other online platforms. Third, implementing learning through LMS or a combination with an LMS-based model has been proven to increase activity, learning achievement, and student motivation with a "Good" rating. Finally, using LMS can stimulate a level of independence in learning with a range between 78.8 and 81.5, which can be classified as very high. These findings illustrate the great potential of LMS in supporting online education and providing significant student benefits (Wiragunawan, 2022).

Game-based learning is a learning method that focuses on using electronic games to achieve learning targets (Widiana, 2022). In a study in Malaysia, it was stated that Game-Based Learning (PBP), or what we usually know as game-based learning, is a platform to stimulate students to be more active during the learning process, and learning also feels fun (Khairuddin & Mailok, 2020). A previous study by Sakdah et al in 2021 evaluated the effect of implementing Kahoot as a learning medium on student learning outcomes. This research revealed a significant difference between learning outcomes before and after implementing this learning media. Hypothesis analysis using the Paired Samples Test shows that the Sig (2-tailed) value is 0.000, which means the Sig value is <0.05. Therefore, H₀ is rejected, and H_a is accepted. Thus, Kahoot media positively impacts the learning outcomes of class V students in Ecosystem material at the Permata Scholar Integrated Islamic Elementary School, Simalungun Regency. These findings demonstrate the strong potential of game-based learning approaches, such as Kahoot, in increasing learning effectiveness and creating more engaging learning experiences for students (Sakdah et al., 2021).

The use of videos in the learning process has an important role in supporting individual development. Videos assist students in skill development, understanding, and scientific research and encourage critical thinking and better interactions among fellow students. In an educational context, video enables a wider exploration of the potential in the digital world, overcoming the limitations of the real world. As a highly effective virtual learning medium, video can convey information in a stimulating way, increase student understanding, and prolong information retention (Sabljić et al., 2021). According to research by Kurniawan and his colleagues in 2019 regarding the response of D-3 Ship Engineering Engineering students to using video-based learning in applied physics courses, most students responded positively to this learning method. They felt interested and liked the video-based learning approach, with various positive comments. This shows that the application of video-based learning technology in applied physics courses is considered appropriate and positively impacts the teaching and learning process. Students can access video material according to their preferences, and for teaching lecturers, this reduces the hassle of repeating previously taught material. This approach provides flexibility and efficiency in the learning process (Kurniawan et al., 2019).

Artificial Intelligence-Based Education, Education Based on Artificial Intelligence (AI) combines AI technology and AI robots to improve the learning experience, especially in countries such as Canada, Chile, and South Korea that have invested in AIRE research, especially for underage students 13 years in Language and Science subjects. Using AI robots as tutors is becoming common in educational contexts (Chu et al., 2022). However, research by Shidiq (2023) discusses the impact of the ChatGPT system on students' creativity in writing skills. Although ChatGPT has a positive impact on learning, there are concerns that excessive use of this technology can reduce students' creativity in writing. Therefore, strategies such as using paper as a medium and control tool in assessing creative writing assignments, as proposed by Cassidy (2022), can be a solution to maintaining balance in learning (Shidiq, 2023).

Open Educational Resources (OER): Open educational resources (OER) are teaching, learning, and research resources that can be used freely by other parties because they are in the public domain or licensed for reuse (Kosasih et al., 2018). The OER management model at the IAIN Curup Library has been tested and is considered effective with an assessment result of 3.9, and the OER service is considered effective with a score of 4.23, based on user responses. During the research process, this OER management model was socialized through various activities, such as user education forums involving experts, librarians, and users of OER services (Iswanto & Jurianto, 2020).

STEM Model (Science, Technology, Engineering, and Mathematics), STEM education aims to connect science, technology, engineering, and mathematics in solving real-life problems. To improve conceptual understanding as well as reasoning and problem-solving skills, teachers need to adopt a linear model (Changtong et al., 2020). Research by Sumartati (2020) regarding the STEM concept in chemistry learning shows that basic chemistry competencies in Madrasah Aliyah/SMA can be integrated with the STEM approach through the STEM approach stages and student projects. The results of this research underline that applying the STEM approach in chemistry learning at Madrasah Aliyah/SMA can prepare competent human resources to face the challenges of the 21st century (Sumartati, 2020).

Social Media in Learning Many academics have encouraged using the Internet as an important educational tool, highlighting its key role in education. Students and academics have recently adopted social media such as Facebook, Twitter, YouTube, and blogging platforms in educational contexts. For example, faculty members use Facebook and YouTube for teaching purposes, such as uploading educational videos or learning materials. Tools like Twitter allow lecturers to share information and resources with students, while instant messaging and wikis help peer collaboration (Balakrishnan & Gan, 2016). Research conducted by Wulandari & Sari (2022) to evaluate whether social media can act as a relevant learning platform in the current digital era concluded that social media has met the requirements to be used as a learning platform. Various services offered by social media platforms can be used as a tool in the learning process. Interaction between educators and students can occur without space and time constraints, enabling flexible learning that can

be accessed anytime and anywhere via social media. Thus, using social media as a learning platform is relevant and in line with the demands of the current digital era.

Mobile Learning: According to "Portio Research," in 2013 and 2012, 1.2 million people worldwide used mobile applications, with projections until 2017 reaching 4.4 million users. This reflects the widespread use of mobile devices and applications worldwide. Mobile learning is a form of learning that allows students to learn independently without being bound by a certain time or place. Since 2000, mobile devices have become increasingly popular throughout the world as devices have become better, faster, and more affordable for various groups (Sönmez et al., 2018). Research conducted by Novaliendry and colleagues in 2023 aims to evaluate the validity, practicality, and effectiveness of the design and creation of mobile web-based learning media. Based on assessments and input from experts, as well as the results of field trials, Web-Based Mobile Learning is declared valid and practical and has been proven effective. Therefore, Mobile Web-based Mobile Learning can be used in learning (Novaliendry et al., 2023).

1. Advantages and Weaknesses of the Model

Blended learning offers advantages in terms of flexibility and interaction. This model allows students to learn independently and interact with teachers and classmates in face-to-face meetings. However, the weakness lies in the dependence on adequate technological infrastructure. The challenge of uneven internet access in Indonesia can hinder the implementation of this model. Additionally, effective integration of online and face-to-face learning requires careful monitoring. Flipped Classroom allows students to understand the material before class meetings, maximizing class time for discussion and practice. The main advantages are time efficiency and the development of better understanding. However, more detailed material preparation from the teacher is required, and students need access to prior learning resources, which can sometimes be challenging.

Learning Management Systems (LMS) make learning management, student progress tracking, and online interaction easier. Its main advantages are ease of use and organization. However, the downside is that teacher training is required to use the LMS effectively and maintain its technical capabilities. Game-based learning can motivate students with interactive learning experiences. The advantages are higher student engagement and fun learning. However, educational game development requires significant resources and time. Video-based learning can interestingly present material and support visualization. The advantage is ease of access and understanding. However, drawbacks may arise in terms of content quality and accessibility, especially for those with limited internet access.

Artificial Intelligence-Based Education provides learning personalization, appropriate feedback, and curriculum adaptation. The advantage is the potential to improve learning. The downside is that it requires a strong technological infrastructure and a deep understanding of artificial intelligence. Open Educational Resources (OER) can potentially increase educational accessibility and reduce costs. The advantage is the open resources available online. Disadvantages include challenges in monitoring resource quality and

copyright. The STEM (Science, Technology, Engineering, and Mathematics) model integrates scientific and technological subjects, develops critical thinking skills, and is relevant to future needs. The advantage is an interdisciplinary approach that can help students understand the real world. The downside is that it may require collaboration between teachers.

Social Media in Learning encourages collaboration, engagement, and social learning. The advantage is that it provides a platform for sharing and discussion. The downside is that it requires ethical and privacy monitoring and has the potential to be a nuisance if not used wisely. The Online Mentoring and Tutoring model provides individualized and personalized support. The advantage is added accessibility for students who need it. Disadvantages include the need for careful management and monitoring and stable internet access. The choice of educational model must consider the advantages and disadvantages of each, as well as the context and educational goals to be achieved.

Mobile learning (m-learning) offers flexible access and personalization of learning, allowing students to access learning materials anytime and anywhere and respond to individual needs. Advantages include self-paced learning, diverse learning resources, and real-time feedback. However, there are several disadvantages, such as unequal device access and stable internet connections, potential distractions, limited collaboration, and limited screen size. The success of mobile learning depends on careful thinking, good content, and attention to student needs and limitations, as well as aspects of privacy protection and data security.

2. Similarities and Differences

Learning models, which include Blended Learning, Flipped Classroom, Learning Management Systems, Game Based Learning, Video-Based Learning, Artificial Intelligence-Based Education, Open Educational Resources (OER), STEM Models, Social Media in Learning, and Mobile Learning, have several unique benefits and challenges in its implementation. While the benefits include increased student engagement, conceptual understanding, and collaborative skills, key challenges include technology infrastructure, good material preparation, thorough planning, adequate training, and necessary privacy and ethical protections. Its influence on student learning outcomes depends on good implementation, student needs, and desired learning objectives. In each model, careful effort and adequate support are the keys to success.

3. Benefits and Challenges

The learning models discussed have unique benefits and challenges in implementing them. Blended learning combines online and face-to-face learning, allowing students flexibility and learning at their own pace. However, the biggest challenge in this model is ensuring adequate technological infrastructure and thorough planning. Flipped Classroom shifts the teacher's role from the transmitter of information to the facilitator, increasing students' understanding of concepts. The challenge requires good material preparation and

strong independent study skills. Learning Management Systems (LMS) make material management and assessment easier, increasing teacher efficiency. However, the challenge involves effective usage training and consistent technical support. Game-based learning increases student engagement, creativity, and problem-solving. The challenge is developing high-quality games and ensuring the games support learning objectives.

Video-based learning visualizes concepts and provides access to material that is not accessible directly. The challenge is maintaining the right video length so as not to distract attention and ensure good accessibility. Artificial Intelligence-Based Education enables personalization of learning and analysis of student performance. The challenges involve protecting privacy and the need for accurate student data. Open Educational Resources (OER) increases educational accessibility by providing free access to learning materials. The challenge is selecting quality materials and ensuring consistent maintenance and updates. The STEM (Science, Technology, Engineering, and Mathematics) model prepares students for careers in STEM fields but requires adequate facilities and equipment as well as teachers with special skills.

Social Media in Learning facilitates collaboration and knowledge sharing but requires strict monitoring and guidelines to maintain student privacy and security. These models can influence student learning outcomes by increasing engagement, concept understanding, collaborative skills, and independence. The main challenges in implementing it are careful planning, sufficient resources, training, technical support, and attention to ethical and privacy aspects. The success of these models depends largely on matching students' needs and desired learning goals. Mobile learning (m-learning) offers benefits in the form of flexible access, personalization of learning, interactivity, multimodal support, and cost efficiency. However, it also faces challenges, including limited access and devices, distractions, limited collaboration, smaller screen sizes, security and privacy data, dependency on internet connection, good content development, and limited functionality. Successful implementation of m-learning depends on careful thinking, equitable access, attention to data security, and the development of interesting and interactive content to meet the needs of diverse students.

4. Implications and Recommendations

Several important recommendations exist for education stakeholders, teachers, and researchers who wish to adopt certain models or design new approaches to implementing technology-based education. First, training and skill development in the use of technology must be a priority. This ensures that they can utilize technology effectively in the learning process. Second, it is important to adapt educational models to local needs, considering technological infrastructure, levels of internet access, and unique challenges in each region. Collaboration and sharing of experiences between teachers and researchers are also encouraged to facilitate the exchange of ideas and best practices in using technology in education.

Additionally, ongoing evaluation is key to understanding the impact of technology use on learning. Data on improving learning outcomes, student engagement, and efficient use of resources must be continuously monitored. Creativity and innovation in designing new approaches that utilize technology must also be emphasized, along with the courage to try new things and think creatively when facing educational challenges. It is important to always adhere to ethical and privacy standards when using technology, especially student data. Student involvement in developing technology in learning must also be considered, considering their opinions and feedback.

Flexibility and readiness for change are must-haves because technological developments continue. Researchers should conduct in-depth research on the impact of technology-based educational models and publish the results of their research to share findings with the broader educational community. Finally, establishing partnerships with technology companies can support the development and use of technology in education, as technology companies often have valuable resources and knowledge. The application of technology in education is a dynamic process and requires commitment, adaptability, and cooperation from all stakeholders to achieve positive results and improve the quality of education.

D. Conclusion

In the context of education in Indonesia, there are a variety of the best technology-based models to be implemented in the world of education, which researchers have researched through literature studies. The best models in question include Blended Learning, Flipped Classroom, Learning Management Systems, Game Based Learning, Video-Based Learning, Artificial Intelligence-Based Education, Open Educational Resources - OER, STEM Model (Science, Technology, Engineering, and Mathematics), Social Media in Learning and Mobile Learning. The results of the literature analysis show that each model has its strengths and weaknesses. Blended learning, as a combination of face-to-face and online learning, provides flexibility but requires adequate technological infrastructure. Flipped Classroom increases class time efficiency but requires more detailed material preparation. Learning Management Systems make learning management easier but require good teacher training. Game-based learning motivates students, but game development requires significant resources. Video-based learning supports material visualization but requires ensuring the quality of the content. Artificial Intelligence-Based Education personalizes learning but requires a strong technology infrastructure. Open Educational Resources - OER increases educational accessibility but requires quality monitoring. The STEM model integrates science and technology and is relevant to future needs but requires an interdisciplinary approach. Social Media in Learning encourages student engagement but requires ethical and privacy monitoring. Meanwhile, mobile learning (m-learning) allows flexible and personalized learning with access anytime, anywhere, but has challenges such as inequality of access, distractions, limited collaboration, and small screen sizes. Its success depends on good planning, quality content, and data security.

The choice of a technology-based education model must be adjusted to educational goals, available resources, and student needs. Continuous monitoring and evaluation are needed to ensure these models' success in improving education quality in Indonesia. These conclusions provide valuable guidance for education stakeholders, teachers, and researchers in improving technology-based education in Indonesia.

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