

Systematic Literature Review: The Effectiveness of Technology In Education

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 Submitted: 2024-12-10; Accepted: 2025-02-25; Published: 2025-06-05

Abstract— Education in the digitalization era has undergone significant changes using technology-based learning media. This research aims to analyze the effectiveness of the application of technology in the context of education in the digital era. This needs to be done because the development of technology is very rapid and makes users, in this case, educators, need to be very careful in choosing effective technology to the needs and conditions that exist in their respective schools. The method used in this research is Systematic Literature Review (SLR) whose data is collected using publish or perish software which then selected thirty related journals to be discussed. Based on the results of the research conducted, it was found that the application of appropriate technology can increase student engagement, concept understanding, and learning motivation, this is indicated by the increase in student scores which experienced a significant increase. The conclusion of the research can be used as a guide for further research and can be used by teachers and educators in choosing the appropriate application of technology. Of course, the application of technology that can be applied to each school or university is different, this is because each technology applied requires different preparations. Each technology discussed in this study has its advantages and disadvantages. This also needs to be considered in the application of technology because the procurement of facilities requires a large amount of money.

Keywords— Effectiveness, Applied Technology, Educational Technology, Education, Digitalization Era

I. INTRODUCTION

Education is learning or learning of knowledge and skills that are done or done by humans to know the things that will be done in the world of work (Ade Sofyan & Amin Hidayat, 2023). Conventional learning methods are currently felt to be no longer by the changes in the era of the Industrial Revolution, learning methods should be a way of delivering educators to students in the learning process in the classroom, learning using applications is an

educational innovation to answer the challenge of the availability of varied learning resources (Silvanus & Ridwan, 2022). The problem of low quality of education is a serious challenge at various levels of education. A quality of education that is not optimal can hinder the development of competent and innovative human resources, thus impacting the nation's competitiveness in the global arena. Continuous efforts to improve the quality of education are very important to realize a developed and prosperous society (Haq et al., 2023). The rapid development of information and communication technology in the era of globalization encourages humans to continue to hone their abilities and competencies to be able to adapt to the demands of the modern era. The integration of information and communication technology in the world of education has revolutionized the way humans access and manage information. Easy internet access allows anyone to obtain diverse and up-to-date learning resources. The 21st century demands that individuals have a variety of competencies, ranging from critical thinking skills and digital literacy to the ability to collaborate and innovate. Along with the development of technology and the development of the educational curriculum, educators must be able to master various kinds of learning media to be able to create learning that is by the times. Educators must be able to develop media that can support success in achieving lesson objectives (Afrilia et al., 2022). Education is required to equip students with these skills. Digital literacy proficiency includes the ability of individuals to utilize technology to search, evaluate, and use information effectively. Interactive learning that utilizes digital technology allows dialogue between students and learning materials so that the learning process becomes more active and interesting. By using interactive learning media, students can set the rhythm of learning according to their respective abilities and learning styles (Elfin Enjoy, 2024).

Education is a long-term investment that aims to improve the quality of life of individuals and communities. An effective educational process will produce graduates who are highly competitive, creative, innovative, and able to face global challenges. This is in line with the mandate

of Law Number 20 of 2003 which places the development of individual potential as the main goal of education (Nurhayati & Imron Rosadi, 2022).

Technology comes from the word techne which means expertise and logia which means knowledge. In this era of digitalization, humans are highly dependent on technology. The world of education is required to keep up with technological developments to improve the quality of education in the learning process. The application and adaptation of technology in learning activities is a must in facing the challenges of change in the era of globalization because the development of information and communication technology influences the learning process (Belva Saskia Permana et al., 2024). The application of interactive media can increase students' enthusiasm for learning because learning is not only centered on teachers (Elfin Enjoyi, 2024). The use of digital technology in the learning process provides an active learning experience, builds knowledge, encourages problem-solving skills, and explores deeper knowledge for students (Belva Saskia Permana et al., 2024). One of the main advantages of using interactive learning media is its ability to present information in various visual and multimedia forms. Rich visualizations and multimedia content can help elementary school students better understand difficult and complex concepts (Utomo, 2023). Although, technology-based learning provides greater flexibility and accessibility, technical challenges and infrastructure needs need to be considered for the use of technology to run smoothly and support student learning success (Solomon Leuwol et al., 2023).

Many studies measure student learning outcomes after the application of technology but lack research on how technology can affect student motivation and activeness in the learning process. In this study, the level of effectiveness of the application of technology to increase students' motivation and agility in the learning process will be discussed based on literature studies from previous journals. With proper implementation, interactive learning media can be an effective tool for achieving better educational goals in the ever-evolving digital era (Utomo, 2023).

II. METHODS

A. Systematic Literature Review

Systematic Literature Review (SLR) is a research approach that aims to answer specific and comprehensive research questions through a critical synthesis of all relevant empirical evidence. This method allows researchers to identify research gaps, evaluate the quality of evidence, and draw more objective conclusions compared to traditional literature reviews (Nasution et al., 2023).

B. Research Question

The specifics of the chosen topic are taken into account when formulating the research question. The research research questions are listed below:

1. RQ1: In the 2022-2024 period, what types of technology are applied to the world of Education?
2. RQ2: What technologies are often applied in the world of Education from 2022 to 2024?
3. RQ3: Is the technology that has been applied to the world of education effective?

C. Search Process

The search process for related journals uses the publish or perish software version 8.16.4790.9060, and the database source used is Google Scholar with a website address <https://scholar.google.com/>. The search process is used to identify sources related to the keywords used, namely: Effectiveness, Applied Technology, Educational Technology, Education, Digitalization Era.

D. Inclusion and Exclusion Criteria

In this process, it is carried out to determine whether the data collected is related to the research. Studies will be selected if the following criteria are met:

1. The data used covers 2022 to 2024.
2. The data used comes from the website URL <https://scholar.google.com/>.
3. The data used is limited to the application of technology in the world of education.

E. Quality Assessment

Aims to assess the quality of the literature sources that have been collected. The criteria used in this study are as follows:

1. Q1: Will this journal article be published in 2022-2024?
2. Q2: Does this journal discuss the application of technology in the world of Education?

F. Journal Article Search Process

In this stage, the researcher uses Publish or Perish software. This research uses data sources from Google Scholar. With the search using the publish or perish application like in Figure 1.

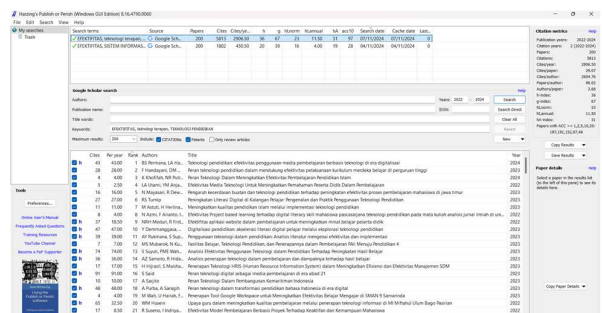


Figure 1. Journal search process using Publish or Perish software

The result of this process is to produce several articles that may be relevant to the research being discussed. After conducting a search process, then select the article. The articles found are selected according to the predetermined Quality Assessment (QA) criteria.

III. RESULTS AND DISCUSSION

Based on the 30 related journals cited, the data was analyzed qualitatively and then concluded to achieve the goals of the research. The following is an explanation of the results of journal reviews conducted on 30 related journals.

A. Search Process Results

From the search results on the Publish or Perish software, 200 journal articles were obtained on Google Scholar. After the Quality Assessment was carried out, 30 related journal articles were obtained that met the specified Quality Assessment.

B. Data Collection Results

The results of the literature study are then presented in Table 1.

Table 1. Systematic Literature Review Results

| No. | Types of Technology | Technology Description | Effectiveness | Journal Writer |
|-----|---------------------------|---|---|--|
| 1. | Blockchain | <i>Distributed ledger technology offers opportunities for digital certificates and information exchange over computer networks.</i> | This technology can be used to solve the problem of Education. Such as managing student exam questions, validating answers, and maintaining record integrity, security, and consistency. | (Hendriyati dkk., 2023) |
| 2. | Game | <i>Integration of game mechanics that have the goal of providing user engagement, fun, and user loyalty.</i> | Gamification-based technology can improve and motivate educators and students to build a more transparent, safe, and enjoyable educational environment. | (Ade Sofyan & Amin Hidayat, 2023; Hendriyati Haryani dkk., 2023) |
| 3. | Interactive Multimedia | <i>Interactive media is a media formed from a combination of various technologies, presenting innovations in various forms of media controlled through computers.</i> | The implementation of this interactive multimedia-based learning media is very beneficial, especially for teachers, teachers no longer give lectures all day, teachers easily control students who do not pay attention and also teachers are greatly facilitated in achieving learning goals. In addition, students also get convenience when understanding the teaching materials explained by the teacher so that students feel more motivated, and enthusiastic, and students' curiosity about learning materials is also increasing. | (Belva Saskia Permana dkk., 2024; Suyuti dkk., 2023; Afrilia dkk., 2022; Utomo, 2023; Meduri dkk., 2022; Sarnoto dkk., 2023; Cahyaningtias & Ridwan, 2021; Handayani dkk., 2023; Salomo Leuwol dkk., 2023; Pangestu dkk., 2022; Belva Saskia Permana dkk., 2024) |
| 4. | AR (Augmented Reality) | <i>Visual technology that projects computer-generated information to the eye is done by integrating a virtual environment into a real or virtual 3d virtual object.</i> | The use of media using AR can stimulate a mindset of critical thinking about problems and events that exist in daily life. From the media used, it is hoped that students will try to criticize existing problems and have imagination and activeness in participating in learning. AR can effectively train critical thinking skills in cognitive skills in the form of interpretation, analysis, evaluation, conclusion, and explanation. In addition, AR media can also increase students' imagination. | (Socrates & Mufit, 2022; Sugiarso dkk., 2024) |
| 5. | AI (Artificial Intelegen) | <i>This technology is a potential solution to increase efficiency and effectiveness in the education system,</i> | AI has great potential to improve the efficiency and effectiveness of the education system. Some types of AI that can be used in education include chatbots, AI tutor systems, student engagement analysis | (Afrita, 2023; Kisno dkk., 2023; Mambu dkk., t.t.) |

| | | | | |
|-----|----------------------|--|--|--|
| | | | systems, and plagiarism detection systems. AI can assist teachers in managing student data more efficiently, providing personalized learning, providing effective feedback, and improving overall teaching effectiveness. With advanced data analysis capabilities, AI helps teachers identify learning patterns, recognize individual student needs, and efficiently adjust teaching methods. AI recommendations also help teachers in developing better teaching strategies. | |
| 6. | VR (Virtual Reality) | <i>It is a technology that can create a virtual environment that can be felt by its users, whose interactions are simulated by computers.</i> | The use of Virtual Reality media can effectively increase student motivation and learning outcomes. | (Tsaqib dkk., 2022) |
| 7. | Google Site | <i>It is one of Google's products that is used as an internet-based digitization media to create creative content that is used as a site, this can be used by educators in teaching a learning management system to students.</i> | Google Sites can be used as a medium or learning method in the classroom, especially in the 21st century and the technological industrial revolution, with the presence of Google Site media or methods, it is hoped that students will be more interested in following the learning process at various levels of education. | (Pubian & Herpratiwi, 2022; Silvanus & Ridwan, 2022) |
| 8. | Wordwall | <i>It is an application that can be in the form of images, or other objects such as diagrams, which can be used as a medium and evaluation tool for online learning.</i> | The Wordwall application helps students remember the material being taught, able to increase students' motivation and enthusiasm in learning. In the use of e-learning-based applications in learning, this research contributes to future learning activities by using the latest applications. | (Lubis & Nuriadin, 2022) |
| 9. | Hybrid Learning | <i>It is a learning method that is applied to face-to-face and online-based learning. This is done with 50% face-to-face learning and 50% online classes.</i> | Hybrid learning can effectively improve the learning process of students after the implementation of hybrid learning, coupled with the statement that students are successful in achieving the set learning goals, students are active in participating in the ongoing learning, and students are complete in preparing facilities that support learning. | (Rusyada & Nasir, 2022) |
| 10. | E-Modul | <i>It is a set of learning tools consisting of several parts, namely materials, evaluation questions, instructions for use, and a specially designed and systematic summary of material that can help a more interesting learning process and achieve the expected competencies.</i> | The use of E-Modules is effective in helping students in the learning process and can be used to learn independently. The E-Module is flexible in its use and can be used anywhere and anytime. So it is very effective for students in helping them to learn. | (Putri Kumalasani & Eilmelda, 2022) |
| 11. | Google Lens | <i>It is an application that detects images are that automatically connected to the Google search engine. Students can use this to identify various things.</i> | The use of Google Lens media applied in this study helps the learning process with the Discovery Learning model. An effective learning process such as the use of the Discovery Learning | (Sofian dkk., 2022) |

learning model in the learning process can make students excited about learning activities while increasing learning outcomes. The character of the Discovery Learning learning model that makes students active makes students more understanding of the material than using a non-student-centered learning model. As a result, students become easier to remember and understand the material shown by the increase in learning outcomes.

C. Results of Data Analysis

The results of the discussion above will discuss the research question (RQ) and talk about the findings of the research conducted between 2022 and 2023.

1. RQ1: In the 2022-2024 period, what types of technology are applied to the world of Education? Based on the description above, several technologies are found that are quite often used in the 2022-2024 period and are shown in the figure 2.

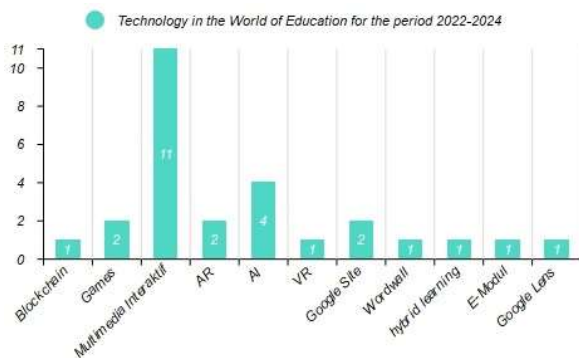


Figure. 2. Technology Chart in the World of Education

2. RQ2: What technologies are often applied in the world of Education from 2022 to 2024? Based on the previous discussion, it can be concluded that in the 2022-2024, period several applications are quite widely discussed, including:
 - a. Interactive multimedia: in this study, interactive multimedia is a type of technology that is widely used, based on the journals cited the use of interactive multimedia such as audio-visual media, based on research 11 journals mention interactive multimedia in it.
 - b. AI: there is AI which is discussed in 4 journals.
 - c. Games, AR, and Google Sites: the use of AR and Google Sites is discussed in 2 journals cited in the study.
3. RQ3: Is the technology that has been applied to the world of education effective?

Based on the results of the journal review carried out, it was found that various technologies

applied to the world of education have a very high level of effectiveness in increasing students' motivation and interest in learning, this is shown in several journals that were reviewed, showing that the value of students who use technology support in learning has increased significantly.

In addition to the advantages obtained, several disadvantages and challenges need to be an important concern for schools and educational institutions in the process of applying technology. One example can be seen as follows:

"There is a possibility of misuse of technology utilization by some students. For example, using technology to play excessive games which results in a decrease in focus in learning which results in a decrease in student achievement" (Ade Sofyan & Amin Hidayat, 2023).

IV. CONCLUSION

The application that was widely applied based on the 30 journals cited was interactive multimedia. From the results of the literature review, the application of technology in the world of education shows that technology can increase the effectiveness of the learning process and be able to increase students' motivation and interest in learning. The use of technology-based learning methods has a positive influence on student learning motivation. This is because technology can help create a more engaging, interactive learning environment and provide a more effective and efficient learning experience. Students responded positively to the application of interactive learning media that can be used in the learning process.

The advice that can be given by the researcher is that the application of the right technology to the conditions in the field is very important. This is because procurement for a technology requires a large cost and a long and complicated preparation process. Therefore, the selection of the right technology is very important in increasing effectiveness and increasing the chances of achieving learning goals. Apart from that, another thing that needs to be considered is the improvement of the ability of educators. This is also very important because applying any type of technology requires experts in the process of implementing it. If the ability of educators is not directly proportional to the technology applied, it will result in the technology applied becoming ineffective. Based on the

results of the above research, the technology that is highly recommended by the author is interactive multimedia. This is based on 11 journals that cite interactive multimedia as research material and show that interactive multimedia is highly recommended to be applied to the world of education. And it needs to be noted as mentioned by Suyuti that "In its use, technology cannot be used as the only factor in improving student learning outcomes, because other factors are still needed such as learning methods, learning environments, and teacher quality. Therefore, the use of technology in education needs to be integrated with effective and supportive learning methods, as well as the development of teacher quality in implementing technology in the classroom. In addition, schools and the government also need to pay attention to the aspects of infrastructure and accessibility of technology so that its use can be optimized to improve student learning outcomes equally".

What can be recommended for further research is to pay attention to various other types of technology that may have the same great potential and may even be greater in increasing effectiveness in the learning process. Search from a wider range of sources and a more in-depth analysis process to get maximum results.

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