Hipkin Journal of Educational Research

http://ejournal-hipkin.or.id/index.php/hipkin-jer/

Analysis of the effectiveness and potential of the as a learning media tool in the modern era

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ABSTRACT

Education is changing rapidly along with developments in science and technology. *Metaverse*, an interactive 3D virtual space concept, offers excellent potential as an effective learning medium. However, challenges such as lack of interaction between students and teachers and commitment to aligning technology with actual learning needs also arise. To overcome this challenge, collaboration is needed between various parties, including educational institutions, the government, the technology industry, teachers, and parents. Proper training, equitable access, careful planning, and technology security awareness are essential to integrating *Metaverse* into learning. The potential of *Metaverse* in education is enormous, especially in improving critical thinking skills, communication abilities, and the use of technology for students in the modern era. However, to utilize this potential optimally, a deep understanding is needed from teaching staff and related parties in designing and implementing metaverse-based learning. *Metaverse* has a significant role in advancing education and achieving a better future. The research results show that the metaverse is very useful in the continuity of education, where students play a direct active role in more creative and innovative activities; this adapts to the current curriculum and is implemented directly in the metaverse.

ABSTRAK

Pendidikan mengalami perubahan dengan cepat seiring dengan perkembangan ilmu pengetahuan dan teknologi. , sebuah konsep ruang virtual 3D yang interaktif, menawarkan potensi besar sebagai media pembelajaran yang efektif. Namun, tantangan seperti kurangnya interaksi antara peserta didik dan pendidik serta komitmen dalam menyelaraskan teknologi dengan kebutuhan pembelajaran sebenarnya juga muncul. Untuk mengatasi tantangan ini, diperlukan kolaborasi antara berbagai pihak, termasuk lembaga pendidikan, pemerintah, industri teknologi, pendidik, dan orang tua. Pelatihan yang tepat, akses yang merata, perencanaan yang matang, dan kesadaran akan keamanan teknologi menjadi langkah penting dalam mengintegrasikan dalam pembelajaran. Potensi dalam pendidikan sangat besar, terutama dalam meningkatkan keterampilan berpikir kritis, kemampuan komunikasi, dan pemanfaatan teknologi bagi peserta didik di era modern. Namun, untuk memanfaatkan potensi ini secara optimal, diperlukan pemahaman yang mendalam dari tenaga pendidik dan pihak terkait dalam merancang dan mengimplementasikan pembelajaran berbasis . memiliki peran yang signifikan dalam memajukan pendidikan menuju masa depan yang lebih baik. Hasil dari penelitian yang dilakukan menunjukkan bahwa metaverse sangatlah berguna dalam keberlangsungan pendidikan di mana peserta didik berperan aktif secara langsung dalam kegiatan yang lebih kreatif dan inovatif, hal ini menyesuaikan bagaiamana kurikulum yang ada pada saat ini dan diimplementasikan secara langsung bagaimana metaverse tersebut.

Kata Kunci: era modern; media pembelajaran; Metaverse; teknologi

INTRODUCTION

Education can be described as a process of changing the attitudes and behaviors of an individual or group of people, aimed at maturing humans through teaching, training, methods, processes, and educational actions. The rapid advancement of science and technology has caused the world to change quickly and dynamically. Various supporting factors and important aspects of life indirectly compel humans to adapt more rapidly to the developments in science and technology. In particular, as technology continues to advance, knowledge becomes increasingly accessible, representing a form of digital transformation, exemplified by the development of the Metaverse. The Metaverse is described as creating real-life experiences in a virtual space through the utilization of technology (Siyaev & Jo, 2021). Closely related to Augmented Reality (AR) and Virtual Reality (VR), the Metaverse has attracted global attention in recent years.

The adoption of Metaverse technology is similar to a learning model called gamification, which has evolved into an innovative Metaverse platform that allows individuals to experience real-life scenarios within a virtual environment. The Metaverse enables students to explore new worlds and gain immersive learning experiences in a virtual setting (Hasannah et al., 2024). Various features of Metaverse technology help users perceive virtual spaces more realistically, with tools and devices enhancing the sense of adventure within the digital environment.

Considering the rapid technological advances reshaping lifestyles, particularly in education, the education sector must continually adapt to technological progress to maintain high-quality educational standards. By leveraging technology, teaching quality, learning processes, and school management can be improved, contributing to an overall increase in education standards (Kartini, 2023). Technology is now essential for supporting learning at all educational levels, ensuring that students and educators stay up-to-date with the latest scientific knowledge and educational innovations. Adaptation is required for both students and educators, as successful integration of Metaverse learning depends on enhancing digital literacy. Additionally, parents, as key facilitators in students' growth and development, must also learn and adapt to align with the new learning process (Dewi, 2024).

As a relatively new technology, the Metaverse is beginning to make an impact in the educational sector. Its concept is believed to overcome existing limitations in education, particularly challenges faced in online teaching and learning, which can now be addressed effectively through the Metaverse (Kim & Kim, 2023). The effectiveness of Metaverse in learning activities continues to grow alongside technological development, providing realistic simulations and reconstructing experiences that are otherwise impossible in the physical world (Putri et al., 2024).

The purpose of this study is to examine the effectiveness and relevance of this research in relation to the development of Metaverse technology. Digital-based learning is increasingly essential, particularly in subjects that can integrate with these technologies, aiming to make the delivery of material more meaningful and to enrich students' learning experiences. Educators need to assess how the use of Metaverse technology can support the teaching and learning process. Through this research, the study seeks to explore the sustainability and potential opportunities for integrating Metaverse technology into school-based learning.

LITERATURE REVIEW

Current changes are evolving rapidly over time, and often, without realizing it, some efforts and transformations result in outcomes that differ significantly from previous needs. This gap between actual needs and expectations pushes individuals and organizations to seek practical solutions to bridge the existing disparities.

In this context, the gap lies in the critical role of educators in the learning process. One of the primary responsibilities of an educator is to deliver learning materials to students in an effective manner. Educators with competence and creativity in using various teaching media must consider how to utilize both digital and conventional media (Febriyanti et al., 2021). Educators need to adapt to the media preferences of students to meet learning needs, analyzing what students require to support the learning process in the classroom, including leveraging modern technologies such as the Metaverse.

Educational media serve as tools and resources to support classroom learning activities. Their presence aims to enhance student engagement and participation during the learning process (An, 2021). The use of current teaching media should align with available technologies so that schools do not fall behind in terms of scientific and technological advancements. It is crucial in the educational process to introduce changes in how educators teach and how students learn. Conventional educational media, including textbooks, blackboards, and other physical teaching aids, have been used in classrooms for a considerable time. However, with the advancement of interactive technology, digital learning media has become increasingly necessary. Electronic devices can now be considered a valuable option for implementing digital teaching media, which has grown in popularity due to their interactive and engaging nature.

Concept of the Metaverse

The concept of the Metaverse represents a comprehensive shared online space that mirrors the real world in a 3D digital form. What makes the Metaverse particularly interesting is that users can interact with digital objects and other users, create their own avatars to engage in activities as if in the real world, and design digital objects and spaces for various purposes (Chairunissa et al., 2022). In practice, the Metaverse enables interaction even without face-to-face contact, supporting virtual spaces as venues for exchanging ideas or simply chatting with friends.

In a broader sense, the Metaverse is understood as a platform that provides a wide range of conveniences, serving as an alternative to direct social interactions. It is a virtual world that transcends spatial boundaries and is interconnected online. Users are represented by avatars when entering virtual spaces to engage in various activities such as gaming, attending meetings, conducting economic transactions, traveling, attending concerts, and many more (Sumayah et al., 2023).

Interactive Multimedia in the Metaverse

Interactive multimedia refers to multimedia that allows an interactive relationship between the media and its users. It can serve as a learning medium that enhances students' understanding and positively influences their learning outcomes (Panjaitan et al., 2020). Digital-based interactive multimedia has become a learning medium worth exploring to support teaching and learning activities.

Conventional learning media also have their respective advantages and limitations. When using digital or conventional media, consider the context of the material, learning objectives, and the learners' needs for available learning resources. For topics that require visualization, multimedia can help students understand real-world conditions without needing to visit the location directly.

Various types of media can support the learning process, including educational videos, audio, animations, illustrations, and traditional printed materials (Abdulrahaman et al., 2020; Cairncross & Mannion, 2001). This highlights how interactive multimedia can be effectively utilized in learning, particularly within the Metaverse, which serves as a virtual space accessible anytime and anywhere, providing ease of access to information in various formats.

Analysis of Modern Metaverse Technology Needs

The development of educational technology highlights that one of the current challenges in innovation is in learning methods, where all educators are expected to utilize and leverage information technology to improve the quality of education in schools (Aspi & Syahrani, 2022). Teaching methods in Indonesia need to be enhanced as a solution to create a more competent and millennial generation.

The advancement of technology has a significant impact on education, as it serves as a tool, a source for acquiring knowledge, and a means to access a wide range of information and data without limitations. However, several aspects remain unaddressed in the implementation of Metaverse technology as a medium or tool to enhance the quality of learning in schools (Amalia et al., 2023). This issue arises due to the absence of a thorough needs analysis at schools, leading to confusion in applying this technology, especially in the Indonesian context.

METHODS

This study employs the Systematic Literature Review (SLR) method. In the Indonesian context, a systematic literature review is an approach to reviewing literature that structurally identifies, evaluates, and interprets all existing research. Using this method, the researcher conducts a structured review and identifies journals that meet the steps established at each stage. Additionally, this study examines literature books in accordance with the theories discussed, particularly within the scope of Technology and Learning. Besides literature sources from books, the research also analyzes scientific articles from both reputable and non-reputable journals.

The type of data used in this study is derived from library research. Library research is a method used to collect data or sources related to the topic under investigation. The study then employs descriptive analysis to examine the obtained data. Descriptive analysis involves describing facts and subsequently analyzing them not only to describe, but also to provide sufficient understanding and explanation.

RESULTS AND DISCUSSION

Metaverse as a Learning Media

In reality, we can observe that learning has undergone significant changes in terms of teaching methods and the materials taught. Research on current learning practices highlights the effectiveness of media as

a key concern due to its crucial role in facilitating understanding and student engagement. The media has a significant influence in creating an engaging, dynamic, and effective learning environment (Faqih, 2020). This illustrates the essential role of learning media, requiring both instructors and students to understand contemporary concepts in virtual learning.

Furthermore, advances in technology have made learning more accessible and flexible, enabling it to occur anywhere. However, it is essential to consider and study how technology can effectively support learning carefully. Sometimes, technology becomes an end in itself rather than a tool to achieve the actual learning objectives. Addressing these challenges requires collaborative efforts among educational institutions, government, technology industries, educators, and parents. Proper training, equitable access, careful planning, and awareness of technology safety are essential steps in overcoming challenges to technology use for learning (Kurnia, 2022).

The Metaverse, with its concept of virtual spaces and easy access to resources, positions itself as a highly effective learning medium. The metaverse represents a breakthrough in 3D virtual space technology, and its rapid growth and application have generated significant interest and popularity across various fields (Setiawan, 2022). Given its role as a virtual space for learning, Metaverse demonstrates strong adaptability to educational concepts. Its implementation in education is critical due to the abundance of technological innovations and the demand for more creative and novel approaches. Educators, as a central element in the learning process, become the primary agents in developing and applying these innovations. They are expected to create a more enjoyable and creative learning environment, aimed at developing students' talents and interests, while supporting their physical and psychological growth (Ayuningtyas et al., 2022).

Figure 1. Learning Through Metaverse
Source: PortalBelajar, 2022

In Figure 1 above, the implementation of learning through the Metaverse is illustrated, showing a virtual room designed to resemble a real discussion space for teaching and learning closely. Avatars serve as characters that can be moved and interact with other avatars within the virtual room. The concept of the Metaverse in educational implementation presents both challenges and opportunities that must be addressed collaboratively, particularly in relation to the readiness of the surrounding environment (Lin et al., 2022).

The Metaverse holds great potential as an innovative and compelling learning medium. The following provides an overview of how the Metaverse can function as a learning platform (Inceoglu & Ciloglugil, 2022; Kye et al., 2021; Mystakidis, 2022).

1. High Interactivity
   In the Metaverse, learners are not just passive observers but active participants in the learning experience. They can interact with the virtual environment, objects, and other characters, enhancing engagement and understanding of the subject matter.

2. Realistic Simulations
   The Metaverse enables the creation of highly realistic simulations of various situations and contexts, including historical explorations, scientific experiments, and practical exercises in daily life. Learners can gain valuable insights through direct experiences that closely resemble real-life situations without incurring any real-world risks.

3. Global Accessibility
   Through Metaverse platforms, learners from diverse parts of the world can connect and learn together, overcoming geographical limitations. This enables cross-cultural collaboration and broad knowledge exchange.

4. Personalized Learning
   The Metaverse enables personalized learning experiences tailored to the unique needs and preferences of each learner. Educators can provide learning experiences aligned with individual learning styles, interests, and skill levels.

5. Creativity and Innovation
   Within the Metaverse, learners can develop their creativity by creating content, designing environments, or devising solutions for complex problems. This stimulates critical, creative, and innovative thinking.

6. Monitoring and Evaluation
   Metaverse platforms can provide detailed data on learner interactions and performance, allowing educators to monitor progress and evaluate learning outcomes more effectively, both individually and in groups.

7. Safety and Security
   The use of the Metaverse in education requires attention to safety and privacy. Platforms must provide appropriate controls to protect learners from inappropriate use or exposure to unsuitable content.

By combining these potentials, the Metaverse can serve as a highly effective learning medium, offering immersive, interactive, and enjoyable educational experiences for learners in today's digital era.

Challenges of Using the Metaverse

The use of the Metaverse has a significant impact on the implementation of learning. The Metaverse, along with its challenges and opportunities in education, can enhance the overall educational process (Stanoevska-Slabeva, 2022). Audio-visual-based education is currently the most popular application of the Metaverse in learning. For example, in experiential learning, it is not sufficient to merely observe and read; learners must also engage with and experience the material. This means that learning becomes more effective when direct learning experiences or simulations occur (Mau & Mau, 2023).

Experience in using the Metaverse is necessary to minimize potential issues during its implementation. By actively leveraging the characteristics of the Metaverse, educators can maximize opportunities for learners to explore broader learning experiences (Zhang et al., 2022). This can provide unique experiential value due to the increasing complexity of technologies. The Metaverse enables the design of new experiences that transcend space and time, utilizing unlimited spaces and data (Göçen, 2022). A key solution to these challenges is how both educators and learners can actively utilize the characteristics of the Metaverse in the learning process. The primary issue lies in how educators and learners can effectively integrate Metaverse-based learning into the educational system. These challenges must be anticipated and carefully considered by schools and government authorities to ensure that the concept of the Metaverse can be successfully applied in the educational context.

In today's learning, especially in Indonesia, the shift to the Merdeka Curriculum presents a particular challenge in integrating the concept of the Metaverse. The Merdeka Curriculum is a learning approach that allows students to express their natural talents in a relaxed, creative, and enjoyable manner without excessive pressure (Suparyati et al., 2024). In line with this, the Metaverse concept closely aligns with the implementation of the Merdeka Curriculum. In the field of education, utilizing the Metaverse provides a unique learning experience, enhances the effectiveness of current educational technologies and media, and supports the development of personal skills and increased self-confidence through the simulations provided (Aditya et al., 2024). To harmonize the Metaverse concept with the Merdeka Curriculum, several considerations must be addressed to ensure that the learning experience is both relevant and beneficial for students.

1. Understanding the Concept of the Metaverse
   The Metaverse is a virtual space encompassing a continually evolving digital world, where users can interact with the environment and other people as they would in real life. It involves technologies such as VR, AR, and digital platforms to create deeply interactive experiences.

2. Integration with the Merdeka Curriculum
   The Metaverse can serve as a tool for interactive learning, enabling students to engage directly in simulations and experiences that help them understand complex concepts in a more practical and hands-on manner.

3. Collaboration and Communication
   The Metaverse facilitates collaboration and communication among students from different locations. It enables them to work together on projects and group tasks, fostering social and collaborative skills.

4. Immersive Experiences
   Through VR and AR, students can experience situations or visit places that are otherwise difficult to access in real life. For example, they can explore historical buildings, planets, or microorganisms within a safe and immersive virtual environment.

5. Creativity and Innovation
   The Metaverse offers students a space to explore their creativity through creating digital content, designing virtual environments, or developing applications and games. This encourages students to be innovative and think critically in solving complex problems.

6. Digital Skills Development
   Using the Metaverse in education also helps students develop essential digital skills for the modern era. They learn to navigate digital environments, manage information, practice media literacy, and use technology responsibly.

7. Monitoring and Control

Integrating the Metaverse into the Merdeka Curriculum requires attention to supervision and control. Educators must ensure that technology use not only adds educational value but is also implemented with consideration for security, ethics, and student well-being.

By considering these aspects, the use of the Metaverse within the Merdeka Curriculum can enhance students' learning experiences, prepare them for the increasingly digital demands of the future, and support a vision of education that is inclusive and innovative.

The Potential of the Metaverse in Education

Learning through the Metaverse offers several positive potentials. As technology advances significantly, the Metaverse has also developed, demonstrating its real potential in the field of education. The use of technology inherently creates unique opportunities for students, which can be effectively integrated into the learning process. Interaction within the Metaverse adds additional value, as students do not merely learn theoretically but can also utilize technological tools to deepen their understanding and engage more actively with learning materials. Overall, learning in the Metaverse using an experimental learning strategy approach can be an innovative and effective step in enhancing students' critical thinking skills, communication abilities, and technological proficiency in a continuously evolving modern era (Alfaridzi et al., 2023).

Educators must leverage the potential of the Metaverse to bring out latent abilities in students. The Metaverse is no longer a novel or difficult concept to grasp. Its technology holds significant potential to support the advancement of Indonesia's education sector in the future. This potential is evident in the application of Metaverse technology as a medium in the learning process, given its capability to integrate technology seamlessly. Additionally, the Metaverse can serve as a solution for distance learning, although successful implementation requires commitment to ensure optimal execution (Setiawan, 2022).

The potential of the Metaverse in education is highly diverse. The following are some key aspects of its potential:

1. Interactive Learning Experiences
   The Metaverse enables more interactive and immersive learning through the use of VR and AR technologies. Students can participate in realistic simulations and immersive experiences, such as virtual visits to historical sites or space exploration.

2. Collaboration and Remote Learning
   The Metaverse enables students from diverse locations to collaborate on learning. They can meet in virtual spaces for group discussions, collaborative projects, or even virtual classes conducted by educators from various locations.

3. Flexibility in Learning
   With the Metaverse, learning becomes more flexible, as students can access learning materials and engage in learning activities at any time and from anywhere, according to their preferences. This also supports students with physical or mobility limitations to remain actively engaged in learning.

4. Development of Digital Skills
   Utilizing the Metaverse in education enables students to develop the essential digital skills necessary in today's digital era. They learn to navigate digital environments, manage information, develop media literacy, and use technology responsibly.

5. Development of Soft Skills

Through the simulations provided by the Metaverse, students can develop and enhance their social skills, communication, leadership, and teamwork abilities. They can engage in realistic scenarios and practice these skills in a safe and controlled environment.

6. Increased Engagement and Motivation
   The Metaverse offers engaging and enjoyable learning experiences, which can boost student engagement and motivation. The ability to explore captivating virtual worlds and engage in engaging activities makes learning more appealing to students.

In conclusion, the Metaverse holds significant potential to transform the way learning is conducted, improve educational accessibility and quality, and prepare students to face the increasingly digital demands of the future.

CONCLUSION

The Metaverse has become a primary focus in education due to its significant potential as an effective learning medium. Changes in teaching approaches and curricula emphasize the importance of media in facilitating student understanding. The use of the Metaverse offers an engaging and interactive learning environment with 3D virtual spaces, allowing students to interact deeply with learning materials. Challenges include limited educator-student interaction and aligning technology with learning needs. Collaboration among various stakeholders, including educational institutions, government, and the technology industry, is necessary to address these challenges. Training, equitable access, careful planning, and awareness of technology security are essential in integrating the Metaverse into learning. The Metaverse's potential to enhance student skills and advance education requires a thorough understanding and practical experience in its implementation by educators and relevant parties. Thus, the Metaverse plays a crucial role in the evolution of education toward a better future and serves as an alternative solution to various challenges in the learning process.

AUTHOR'S NOTE

The author declares that there is no conflict of interest regarding the publication of this article. The author affirms that all data and content in the article are original and free from plagiarism.

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