Transforming Education in Indonesian Higher Education Through the use of Metaverse to Improve Learning Quality

Slamet Panuntun[1], Yoannes Romando Sipayung [2]

[1]Islamic Education, STAI Walisembilan of Semarang, Ki Mangunsarkoro Street No. 17, Semarang, Central Java, Indonesia

[2]S1 Informatics Engineering, Ngudi Waluyo University, Diponegoro Street No. 186, Ngablak, Gedanganak, East Ungaran District, Semarang Regency, Central Java, Indonesia

ABSTRACT: Essentially, technology can make things easier for humans to do. Government agencies, companies, and other institutions use technology, including educational institutions. During the COVID-19 pandemic, one of the technologies that has been widely discussed so far, the metaverse, emerged. The metaverse has great potential in the field of education. By leveraging the metaverse, educational institutions can create virtual environments that include elements such as Augmented Reality and Virtual Reality. In Indonesia, the metaverse concept and its application in education are still in the development and exploration stages. Metaverse can be used as a platform for holding lectures and teaching virtually. The application of the metaverse in higher education is still being developed and researched to better understand the potential and associated challenges. However, with the development of technology that continues to develop, the metaverse can be an innovative way to enhance the learning experience. The method used in this study was a qualitative method based on a literature review. Articles were obtained from Google Scholar or Harzing's Publish or Perish application. The process of searching for articles used the keywords "metaverse", "metaverse education", and "metaverse in higher education". There were 15 scientific articles obtained from various national journals, spanning 2020-2023. The obtained articles were then analyzed using the Bibliometric method. The bibliometric method can assist researchers to better understand the contents of the bibliography, as well as the directions and trends discussed in each article that has been collected.

KEYWORDS: Metaverse, Education, Higher Education

I. INTRODUCTION

Advances in technology today are inextricably linked to people's lives. We now have access to information from all over the world as a result of technological advancements (globalization). If the saying "the world is bigger than your backyard" was once true, it should now be changed to "the world is not bigger than your backyard" because fast access to information in various parts of the world makes this world seem narrower. Now we can see what is happening in America, for example, even though we are in Indonesia (Wahyudi & Sukmasari, 2018).

Technological progress is currently very fast and rapid, including in Indonesia. The existence of technology can essentially make it easier for humans to do something. Government agencies, companies, and other institutions use technology, including in educational institutions. Several years ago, the COVID-19 pandemic had a significant impact on various fields in Indonesia, particularly the education sector. Educational institutions must be encouraged to use technology for distance learning. Schools and colleges are adopting digital platforms, applications, and other software to support online learning. During the COVID-19 pandemic, one of the technologies that has been widely discussed so far, the metaverse, emerged. The term metaverse has gained popularity in recent years as major technology companies such as Facebook, Microsoft, and Google, as well as game developers, have expressed interest in the concept.

The metaverse, first described in author Neal Stephenson's novel "Snow Crash" in 1992, has become a concept used to describe 3D (three-dimensional), VWs (virtual worlds) in which people interact with each other and their environment without the physical limitations of the real world (Narin, 2021). Users in the metaverse can engage in a variety of activities such as gaming, social interaction, shopping, working, attending events, and so on. Metaverse environments are frequently set up as 3D worlds with landscapes, buildings, objects, and other virtual entities. Metaverse has great potential in the field of education.

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The Metaverse allows educational institutions to create a virtual replica of a school or campus. In this way, students, teachers, and employees can communicate and interact as quickly as if they were in the same room, using video calls or video conferencing (Contreras et al., 2022). The use of metaverse in education can result in rich, interactive learning experiences. By leveraging the metaverse, educational institutions can create virtual environments that include elements such as Augmented Reality and Virtual Reality.In Indonesia, the metaverse concept and its application in education are still in the development and exploration stages. Although there have been several attempts to utilize virtual and Augmented Reality technologies in learning, the use of metaverse is still limited. However, with the advancement of technology and the growing interest in innovative learning approaches, the metaverse could be of great potential in the future. Several educational institutions in Indonesia are starting to explore the use of the metaverse as a means to create a more interactive learning experience. Application in tertiary education is currently in the early stages of exploration but has shown promising potential. Metaverse can be used as a platform for holding lectures and teaching virtually. Not only that but metaverse can also be used to create virtual laboratory rooms and simulations in a variety of educational settings. Students, for example, in a virtual medical science simulation, can practice medical diagnoses and procedures in a safe and controlled environment.

The metaverse era raises various challenges to the implementation of the education system in higher education. Generation Z is familiar with the principles of the metaverse. They are proficient in using and utilizing technology, so they are prepared to carry out learning activities or lectures using technologically advanced online systems. The metaverse, which is borderless or unlimited space, poses significant challenges that must be addressed. Some of the challenges of the metaverse era, including the presence of users as individuals in society in the virtual world are represented by avatars. Individuals are busy monitoring avatar activity all the time and reducing activity in the real world (Dr. Argyo Demartoto, 202 C.E.).

The application of the metaverse in higher education is currently still being developed and further explored to understand the potential and associated challenges. However, with the advancement of technology that continues to develop, the metaverse can be an innovative way to enhance the learning experience. To improve the quality of education through the metaverse, it is important for us to study the metaverse in depth. Unfortunately, in Indonesia, the use of metaverse-based education is still not popular. The purpose of this study was to evaluate the suitability of using metaverse in the context of learning in universities. In addition, this study aimed to provide broader insights into the potential use of the metaverse in creating innovative future education.

II. RESEARCH METHOD

The method used in this study was a qualitative method based on a literature review. According to Walidin, a qualitative method is a process method for understanding human or social phenomena by developing a comprehensive and complex picture that can be presented in words, reporting detailed views obtained from informant sources, and carrying out the research in a natural setting (Fadli, 2021). Meanwhile, the literature review includes descriptions of theories, results, and other research literature obtained from references used as the foundation for research activities, literature reviews are derived from journals, articles, or other publications that contain the same topic as raised by the researcher, in order to produce a new piece of writing relating to a particular topic (Bojonegoro, 2022). As a result, articles were obtained via Google Scholar or Harzing's Publish or Perish application. The process of looking for articles used the keywords "metaverse", "metaverse education", and "metaverse in higher education".
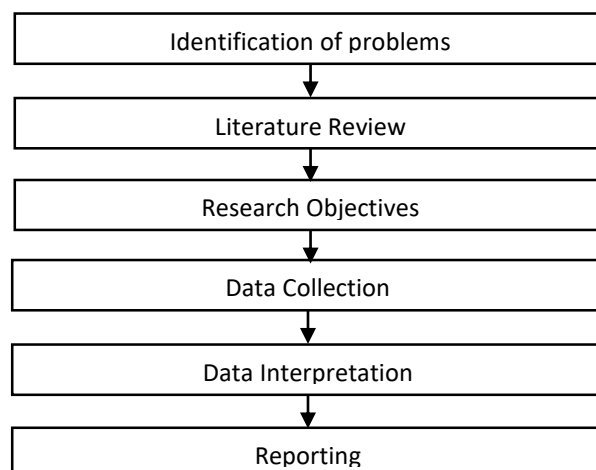

Figure 1. Stages of the Qualitative Method (Fadli, 2021)

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III. RESULTS AND DISCUSSION

There were 15 scientific articles obtained from various national journals, spanning 2020-2023. The obtained articles were then analyzed using the Bibliometric method. Bibliometrics is defined as being able to measure or analyze books/literature using a mathematical and statistical approach (Royani & Idhani, 2018). The Bibliometric method may assist researchers study the contents of the bibliography, knowing the directions and trends being discussed from each article collected between 2020 and 2023. The 15 articles that have been examined are listed below:

Table 1. Article Review Results

No.	Title	Review Results
1.	Analysis of Potential Implementation of Metaverse in Interactive Educational Media *(Analisis Potensi Implementasi Metaverse pada Media Edukasi Interaktif)* (Akbar Endarto & Martadi, 2022)	This article discussed the potential implementation of metaverse technology as an interactive educational medium, employing a descriptive study method with a literature research approach and analyzing metaverse based on AR and VR from a design standpoint. This article also explored how the metaverse works, the benefits of using Augmented Reality (AR) and Virtual Reality (VR) in education, and the challenges and risks associated with metaverse technology. The conclusion is that while metaverse technology has great potential as an interactive educational medium, adequate infrastructure, training, and regulation are required to reduce risk and ensure equal access.
2.	Analysis of the Use of Metaverse Technology on Memory Formation in the Learning Process *(Analisis Penggunaan Teknologi Metaverse terhadap Pembentukan Memori pada Proses Belajar)* (Mulati, 2022)	This article discussed the use of metaverse technology in the learning process and its potential impact on memory formation in students. This article analyzed the effectiveness of the metaverse in memory formation based on Aristotle's law of association and highlights the benefits and risks of using this technology in education. While the potential of metaverse technology for memory formation in learning is promising, this article also emphasized the importance of control and digital literacy in ensuring responsible use.
3.	Analysis of Metaverse Potential in the Education Sector in Indonesia *(Analisis Potensi Metaverse pada Dunia Pendidikan di Indonesia)* (Setiawan, 2022)	This article discussed the use of bibliometric analysis to identify trends and patterns in the growth of scientific research on the metaverse of education. The analysis revealed that the metaverse of education has been actively debated by researchers in the last two years. This article also highlighted the advantages and potential challenges of implementing metaverse technology in education. The conclusion suggested that further research is required to thoroughly examine the metaverse potential in education in Indonesia.
4.	From Immersive to Metaverse: Learning and Technology Gaps in Application in Agricultural Education *(Dari Immersive ke Metaverse: Kesenjangan Pembelajaran dan Teknologi dalam Penerapan di Pendidikan Bidang Pertanian)* (Asfarian et al., n.d., 2022)	This article discussed the analysis of the gap between immersive technology implementation and mature metaverse in agricultural education. It concluded that most of the learning content and technology design elements of the metaverse have not been fully utilized. There are many implementation gaps between the current implementation of the mature metaverse. In addition, the education of the mature metaverse is complex and expensive. This study suggested careful long-term planning and identifies use cases for metaverse implementation in education. The authors encourage more research into the metaverse's potential for agricultural education.
5.	Readiness and Impact of Using Metaverse Technology in Education *(Kesiapan dan Dampak Penggunaan Teknologi Metaverse dalam Pendidikan)* (Salim et al., 2023)	This article discussed the impact of technology, particularly the metaverse, on education in Indonesia. This article emphasized the importance of quality education and the challenges faced by educators in adapting to technological advances. It also highlighted the significance of positive thinking and understanding change in effectively utilizing technology. This article concluded that metaverse technology has enormous potential in education, with the potential to increase motivation and expand traditional teaching practices.

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6.	Metaverse Potential and Opportunities in the Education Sector *(Potensi dan Peluang Metaverse Dalam Dunia Pendidikan)* (Bonafix & Nediari, 2022)	This article discussed the metaverse's potential and opportunities in education. Metaverse is a cutting-edge three-dimensional space technology that combines the real world and a sophisticated digital world. This article examined the challenges and impact of the metaverse in education, as well as how it can address emerging limitations in online learning. Although it has many advantages, the metaverse also has challenges such as freedom and students' readiness to enter the world of the metaverse. This article also emphasized the importance of collaborating between technology and educational research in order to create an effective and innovative metaverse educational platform.
7.	Metaverse: Learning Media in Society 5.0 Era to Improve Education Quality *(Metaverse: Media Pembelajaran di Era Society 5.0 untuk Meningkatkan Kualitas Pendidikan)* (Pangestu & Rahmi, 2022)	This article discussed the use of the metaverse as a learning medium in the era of Society 5.0 in order to improve the quality of education in Indonesia. Metaverse can be used in the skills-learning process to improve the quality of education in Indonesia. This article examined various aspects of using metaverse and other technologies in education, including strategies for preparing students for Society 5.0, the use of virtual reality in online learning, the potential of the metaverse in education, game-based learning with artificial intelligence and immersive technology, and the development of educational applications using augmented reality. This article also emphasized the possibilities and limitations of using metaverse in education, as well as the need for teachers to develop their competency in using this technology.
8.	Metaverse and Learning the History of Islamic Culture In Madrasah: Challenges And Opportunities *(Metaverse dan pembelajaran sejarah kebudayaan Islam di madrasah: tantangan dan peluang)* (Fauzian, 2022)	This article discussed the application of metaverse technology, particularly augmented reality (AR), in teaching Islamic culture and civilization in madrasah. This study aimed to analyze the implementation of the metaverse in teaching SKI and identify challenges and opportunities for teaching SKI in the metaverse era. The results revealed that using AR technology to teach SKI benefits students by improving education quality, student motivation, and media literacy. However, limited access to technology is a challenge. This article argued that digitalization is required for education to be able to adapt to technological advances and meet changing demands.
9.	Metaverse: Challenges and Opportunities in Education *(Metaverse: Tantangan dan Peluang dalam Pendidikan)* (Indarta et al., 2022)	This article discussed the challenges and opportunities of the metaverse in education, as well as how this technology is applied in education. Metaverse is considered to be capable of overcoming educational limitations, such as limited class capacity due to the pandemic, limited distance and time to enter class, and others. This article also discussed the benefits and risks of using metaverse in education, as well as the importance of integrating game-based learning and artificial intelligence with metaverse technologies to enhance cognitive and social skills in education. Meanwhile, there are some challenges that need to be overcome. Metaverse has the potential to improve the learning experience and educational quality in the future.
10.	Transformation of the Madrasah Education System in the Metaverse Discourse on the Indonesian Ministry of Religion Program *(Transformasi Sistem Pendidikan Madrasah dalam Wacana Metaverse pada Program Kemenag RI)* (Putri, 2022)	This article discussed the transformation of the Madrasah education system into a metaverse discourse in the future, the challenges faced, and the fundamental factors that make the metaverse discourse exist in Madrasah education. This article also discussed MadrasahLand as an innovation platform resulting from the transformation of the Madrasah education system into the metaverse. However, there are still a number of obstacles impeding its progress. This article also discussed the advantages and disadvantages of using metaverse technology in education, as well as the creation of MadrasahLand, a virtual platform for Madrasah education.

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11.	Metaverse as an Effort to Face Educational Challenges in the Future *(Metaverse Sebagai Upaya Menghadapi Tantangan Pendidikan di Masa Depan)* (Ujang Cepi Barlian, Nana Ismelani, 2022)	This article investigated the potential of the metaverse in education as a means of addressing future challenges. The metaverse is a virtual world in which users interact through digital avatars. This article described the metaverse concept and its potential applications in education, as well as the advantages and challenges of using it. This article also emphasized the importance of incorporating technological advancements into education in order to remain globally competitive.
12.	Utilization of the Metaverse in Education *(Pemanfaatan Metaverse di Bidang Pendidikan)* (Iswanto et al., 2022)	This article discussed the metaverse concept and its educational potential, as well as its limitations. This article also discussed four different metaverse categories, including augmented reality, lifelogging, mirror world, and virtual reality, as well as their implications for education. While the metaverse has the potential to revolutionize education and social communication, there are also privacy and data protection concerns that must be addressed. This article also analyzed the educational and entertainment applications of metaverse technology, as well as privacy and security concerns.
13.	Empowerment of Metaverse Technology for the Sustainability of the Education Sector *(Pemberdayaan Teknologi Metaverse Bagi Kelangsungan Dunia Pendidikan)* (Sultan & Tirtayasa, 2022)	This article discussed the potential of metaverse technology in increasing the sustainability of education in Indonesia. Metaverse is a 3D virtual world that makes use of augmented reality, virtual reality, and video technologies. However, the implementation of metaverse-based education still faces many challenges such as limited infrastructure and technology. This article also analyzed the challenges and limitations of the metaverse, as well as the potential use of augmented reality in education. Nonetheless, if used properly, the metaverse has the potential to significantly advance education.
14.	Implementation of Tri Kaya Parisudha's Teachings in Character Education in the Metaverse Generation *(Implementasi Ajaran Tri Kaya Parisudha dalam Pendidikan Karakter pada Generasi Metaverse)* (Mustofa & Novianto, 2022)	This article discussed the implementation of Tri Kaya Parisudha's teachings in character education for the metaverse generation. This article emphasized the importance of character education in facing the challenges of the metaverse era and the role of schools and teachers in shaping individual character. The concept of Tri Kaya Parisudha in Hinduism is also explained as a guide for good behavior and character building. This article also examined the rejection of the Hajj Metaverse by the Indonesian Ulema Council and the implementation of character education in Madrasah Tsanawiyah and Hindu teachings.
15.	Metaverse: Upcoming Education Concepts *(Metaverse: Konsep Pendidikan yang Akan Datang)* (Aripidi et al., 2022)	This article explored the metaverse concept in education and its potential to overcome the limitations of traditional online learning. This article employed qualitative methods with a literature review to gather data from various sources. The results revealed that the metaverse evolves over time and can be utilized to make online learning more interactive and flexible. This article also examined the history of online education and the impact of the COVID-19 pandemic on the education system. This article concluded that the metaverse has the potential to revolutionize education and create new opportunities for learning. However, while the metaverse has many educational benefits, it should be viewed as an additional tool rather than a substitute for traditional learning.

The results of the 15 articles demonstrate that the use of metaverse has significant benefits and potential in education, and can significantly increase educational progress. However, digitalization is required for education to be able to adapt to technological advances and meet changing demands.

As can be seen in Figure 1, the trend of research on the metaverse in education is illustrated based on articles from 2020-2023. The figure shows that much research has been conducted on education in the context of the metaverse and its relationship with technology-based learning. It is hoped that this will have a positive effect on educational quality in the future.
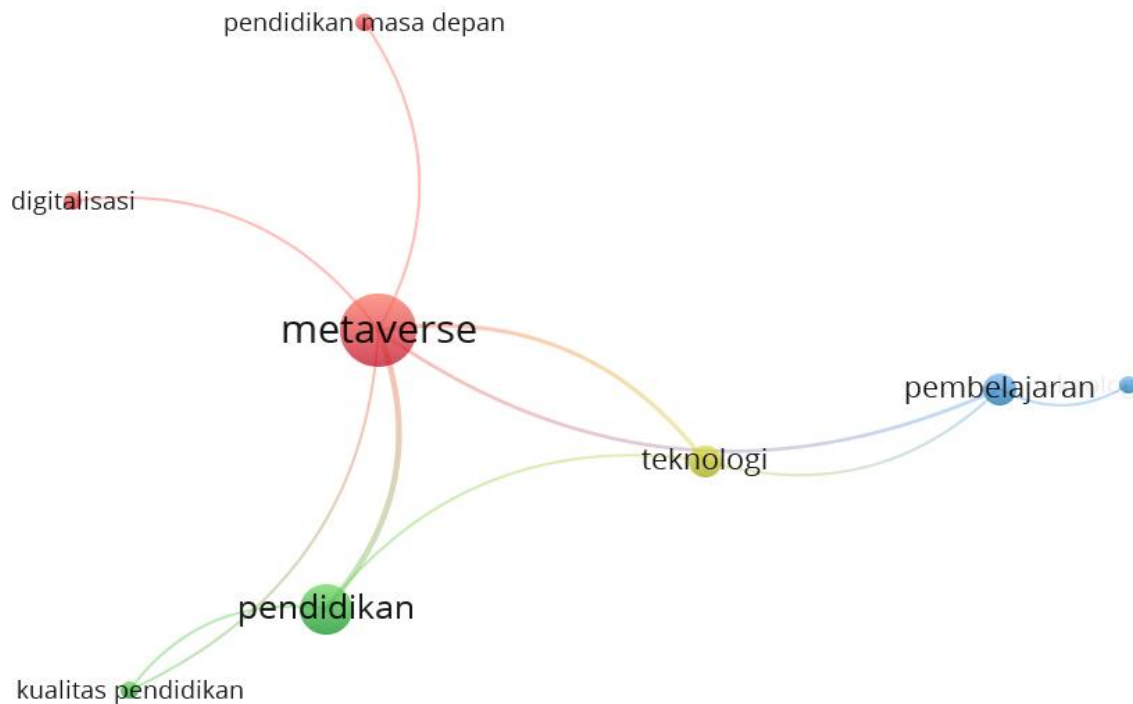
Figure 1. Visualization of Metaverse Trends in Education

IV. CONCLUSIONS

Based on the analysis of the research results regarding the metaverse in education, it is concluded that the application of the metaverse in education in Indonesia has great opportunities and potential to support the learning process. Although the concept of the metaverse and its application in education is still being developed and explored in Indonesia, technological advancements and growing interest in innovative learning approaches indicate that the metaverse has promising potential in the future. To improve the quality of education through the metaverse, we must conduct extensive research on the metaverse, including developing human resources, adequate infrastructure and access, and collaboration between educational institutions and industry partners in developing the use of the metaverse in education. Furthermore, digitization is required so that education can adapt to technological advances and meet the changing demands of the times.

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