Hipkin Journal of Educational Research | e-ISSN 1234-5678 & p-ISSN 1234-5678
Volume 1 No 3 (2024) 325-336

Hipkin Journal of Educational Research

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

Descriptive study of Metaverse application for education field in junior high school

Ade Cahyono[1], Irna Marwa[2], Yustika Priantina[3]
[1,2,3]Universitas Pendidikan Indonesia, Kota Bandung, Indonesia
adecahyono15@upi.edu[1], irna15@upi.edu[2], yustikapriantina@upi.edu[3]

ABSTRACT

The 5.0 era changed many aspects of human development, especially education. If the world of education does not give positive attention and response, the pattern and concept of life in the Metaverse era will be a big problem. The nation's children are the key to educational progress toward global change. Technology has become part of people's lives. This study will discuss the application of Metaverses in the field of education. This study will also examine how Metaverse can enrich and extend traditional teaching approaches, engage students in an intense learning process, and enhance students' understanding of complex concepts. This study uses the literature review method, where the researcher uses a series of activities related to a study method, such as collecting literature data, reading or recording, and managing materials from previous research. This Metaverse learning found that it can transform education and prepare students for a more technologically sophisticated future. Of course, this requires much support from various educational elements so that obstacles and challenges can be overcome well for the continuity of learning.

ARTICLE INFO

Article History:
Received: 30 Aug 2024
Revised: 18 Dec 2024
Accepted: 21 Dec 2024
Available online: 29 Dec 2024
Publish: 30 Dec 2024

Keywords:
education; metaverse; student; technology

Open access
Hipkin Journal of Educational Research is a peer-reviewed open-access journal.

ABSTRAK

Era 5.0 mengubah banyak aspek perkembangan manusia, terutama ranah pendidikan. Jika dunia pendidikan tidak memberikan perhatian dan respons yang positif, maka pola dan konsep kehidupan di era Metaverse akan menjadi masalah besar. Anak bangsa adalah kunci kemajuan pendidikan menuju perubahan global. Teknologi telah menjadi bagian dari kehidupan masyarakat. Studi ini akan membahas penerapan Metaverse dalam bidang pendidikan. Penelitian ini juga akan melihat bagaimana Metaverse dapat memperkaya dan memperluas pendekatan pengajaran tradisional, melibatkan peserta didik dalam proses pembelajaran yang sangat mendalam, dan meningkatkan pemahaman peserta didik tentang konsep-konsep yang kompleks. Metode yang digunakan dalam penelitian ini adalah metode study literature review yang di mana peneliti menggunakan serangkaian kegiatan yang berkenaan dengan suatu metode kajian pengumpulan data pustaka, membaca atau mencatat, serta mengelola bahan dari penelitian sebelumnya. Dalam pembelajaran Metaverse ditemukan bahwa pembelajaran ini dapat mengubah pendidikan dan mempersiapkan peserta didik dalam untuk masa depan yang lebih canggih secara teknologi. Tentunya hal tersebut membutuhkan banyak dukungan dari berbagai elemen pendidikan agar hambatan serta tantangan dapat diatasi dengan baik bagi keberlangsungan pembelajaran.

Kata Kunci: *metaverse; pendidikan; peserta didik; teknologi*

How to cite (APA 7)
Cahyono, A., Marwa, I., & Priantina, Y. (2024). Descriptive study of Metaverse application for education field in junior high school. *Hipkin Journal of Educational Research, 1*(3), 325-336.

Peer review
This article has been peer-reviewed through the journal's standard double-blind peer review, where both the reviewers and authors are anonymised during review.

INTRODUCTION

Education in Indonesia is still considered to be lagging behind at the national level because the facilities and quality of human resources or educators still do not meet national standards. This has an impact on the quality of education in Indonesia. Formal education in government schools still largely relies on face-to-face learning, utilizing traditional tools such as blackboards, books, chairs, and limited space. The lack of facilities can lead to a decline in the quality of teaching methods used by teachers. Two factors contribute to the low quality of education in Indonesia: internal and external factors. Internal factors include low individual motivation, limited individual awareness, and a lack of interest and enthusiasm among students to learn and continue their education. Additionally, there are external factors, including the teaching staff, infrastructure, economic conditions, and inadequate parental support (Nurmalasari et al., 2023).

This issue underscores the importance of implementing effective teaching methods for qualified educators, thereby enhancing motivation, awareness, and interest in learning. Education in Indonesia, which often lacks adequate facilities, can hinder effective teaching methods, so educators must continually seek more creative approaches and stay current with technological advancements (Permana *et al*., 2023). Significant efforts are required to improve the quality of education in Indonesia, which currently lags significantly behind global standards. One of the efforts to improve the quality of education is the implementation of Metaverse education enhancement training. The emergence of the Metaverse can be a solution to make learning activities more interesting (Hasannah *et al*., 2024). The integration of the Metaverse teaching method in Indonesian education has significant potential to improve the quality of learning.

The Metaverse teaching method can significantly increase educational satisfaction and students' interest in continuing to learn (Aditya, 2024). The metaverse, a virtual world that combines technologies such as augmented reality and virtual reality, can offer innovative solutions to overcome educational limitations caused by various internal and external factors (Khaira *et al*., 2024). If this technology is implemented, it can create a more immersive and interactive learning experience for students. Students in every school today are considered a generation capable of mastering technology, which means they must keep up with the times.

Teaching methods that utilize current technology can be continually updated to adapt to the evolving needs of students. However, in practice, educators or teachers are still burdened by the school administration system, rather than focusing on educating and shaping the character of students. Therefore, practical cooperation is necessary among the government, educators, parents of students, and students in developing this Metaverse teaching method. Reviewing these various issues, the author examines several aspects to determine how the Metaverse teaching method can enrich and expand conventional teaching methods, engage students in a more in-depth learning process, and enhance students' understanding of complex concepts.

LITERATURE REVIEW

The Essence of Learning Methods

Educators who serve as facilitators in learning must continually update their approach to conveying knowledge to students. This is inseparable from learning methods, which are techniques, strategies, and approaches used by educators to improve students' understanding and engagement. Learning methods are defined as techniques or strategies used to convey knowledge during teaching and learning activities, facilitating efficient learning outcomes (Ilyas & Armizi, 2020). In addition, learning methods are ways or programs implemented by educators to encourage students to learn actively and develop their potential

to the fullest (Nudin *et al*., 2022). Understanding this learning method is crucial today, given the impact of technological advancements and curricula tailored to students' abilities and interests. With technological advances, knowledge is conveyed and acquired through innovative learning methods that meet current needs. Learning methods that keep pace with technological developments can increase student engagement and the quality of learning (Ghifari *et al.*, 2022; Kurniawan *et al*., 2024; Widhiasti *et al.*, 2022). The concept of technology learning illustrates that technological developments can lead to increased efficiency (Haas *et al*., 2022). Therefore, balance and flexibility are essential in its application. When educators understand which learning methods are best suited to their students' needs, an effective learning environment can be created.

Skills that today's educators must possess

Rapid technological developments require all educators and teaching staff to keep up with changes and continue to adapt to the needs and interests of students in learning. Educators face several challenges and requirements today, including identifying aspects of socio-emotional skills, promoting inclusive education, and utilizing sustainable digital technology (Alimjonovna, 2024). The ability to utilize and keep pace with technological developments is crucial for enhancing learning efficiency and fostering innovative, sustainable student engagement. The abundance of digital resources available today requires educators to study and master them in depth so that they can effectively guide students in utilizing these resources. However, the existence of conventional learning methods provides a balanced approach that can be used to evaluate the skills that educators must possess from time to time.

Definition of Metaverse

Various forms of technological development today require all human resources worldwide to possess at least a minimum level of knowledge and mastery of technology use on an ongoing basis. The concept or term “Metaverse” is not a new concept that emerged during the COVID-19 pandemic, but rather an old concept that has existed since 1992 in the novel “Snow Crash” by Neal Stephenson. The word Metaverse combines the Greek prefix *“meta*,” meaning beyond, with the word “verse,” implying the universe, thus creating the concept of “beyond the universe.” (Jaimini *et al*., 2022). This universe involves its users connecting in a real and dynamic way through digital artifacts and attributes. In addition, the Metaverse is also described as a virtual space where users (as avatars) can interact in a three-dimensional environment with programmed assets and decentralized applications (Pooyandeh *et al*., 2022).

Another name for the Metaverse is Multi-User Virtual Environments (MUVE). The Metaverse is a virtual environment that originated from Massive Multiplayer Online Role-Playing Games (MMORPG), allowing avatars to interact within a 3D video game. This concept combines Augmented Reality (AR), Virtual Reality (VR), and the internet (Ikhsanuddin *et al*., 2024). Since the Metaverse is a comprehensive concept, it offers a solution to the limitations of 2D and 3D virtual technologies (Iswanto *et al*., 2022). Although described as a combined concept, the Metaverse, incorporating AR & VR, has different dimensions of focus. The Metaverse focuses on its service aspects, which provide long-term and sustainable social value and create a measurable environment capable of accommodating a larger number of people (Park & Kim, 2022; Xi *et al*., 2022). In the context of VRR, the Metaverse is often associated with science fiction imagery and sophisticated hardware, even though VR can actually be experienced through human imagination without any special equipment (Hemmati, 2022; Park & Kim, 2022).

The metaverse is defined as a shared virtual space that enables users to interact with one another in a digital environment through avatars or digital representations. The metaverse is a virtual space that

combines VR, AR, and blockchain technology to create an immersive, interactive experience where users can engage in various activities, including educational training and remote consulting (Augusta *et al.*, 2021; Humaira *et al.,* 2024). In other words, the Metaverse integrates virtual reality, online games, and media that enable users to interact digitally without any physical or geographical restrictions. This creates a learning space, similar to a real classroom, in real-time that can be accessed online without requiring physical presence in the classroom. Users can choose and own their own 3D avatars. An individual's chosen avatar in the Metaverse reflects their real-life identity (Kye *et al*., 2021). Selected avatars are typically associated with various social, economic, cultural, and other dimensions, reflecting the fields in which they are engaged in the real world. This convinces users that the Metaverse can also be utilized for educational learning activities. The use of the Metaverse in education enables students to gain a deeper understanding of the subject matter. This is because the virtual space of the Metaverse appears realistic, allowing students to examine teaching materials from various angles on a particular object being studied.

Junior High School Education

Junior high school education encompasses a pivotal phase in students' academic journey, with a primary focus on developing foundational skills and competencies. This stage can be seen in various educational developments and innovations aimed at improving learning outcomes and maximizing students' interaction skills from previous levels of education. The development of technology-based learning methods, particularly in education, has been proven effective in improving cognitive abilities and demonstrating the potential of multimedia resources at the junior high school level (Waruwu *et al*., 2024).

METHODS

This study employs a literature review to explore the concepts of the Metaverse, junior high school education, and Metaverse applications within the educational context. The primary references for the theoretical basis include the works of Alinata & Marsudi (2024). After establishing the theoretical foundation, the next step is to develop a Metaverse-based curriculum that will be implemented in junior high school education.

The literature review method is the primary approach used to explore the application of the Metaverse in junior high school education. By examining various literature sources, this study will detail the concept of the Metaverse, its impact on traditional learning paradigms, and its potential to transform students' skills and understanding. In addition, this study involves a series of literature collection and analysis activities, including materials related to previous studies that detail the application of technology in the educational context. The use of this literature review method is expected to provide a solid foundation for understanding the complexity of implementing the Metaverse in junior high school education. By detailing and analyzing previous findings, this study will contribute to the literature on the role of the Metaverse in creating adaptive and relevant education in an increasingly digital era.

RESULTS AND DISCUSSION

Results and discussion should be presented in the same section, clearly and concisely. The discussion section should contain the benefits of the research results, not a repetition of the results section. Tables or graphs should present original data accompanied by sources. The results of data analysis should be reliable in answering the research questions. References in the discussion should not repeat references in the introduction or literature review. Comparisons with previous research findings should be included.

Results

Table 1. Literature Review on the Metaverse

No	Article Title	Article Discussion Content	Author
1	*Potensi implementasi Metaverse sebagai media edukasi interaktif*	The results of this article's discussion explain the potential of the Metaverse as an educational medium, along with an analysis of the application of AR and VR-based Metaverse from a design perspective. Designers play a crucial role in creating educational media in the Metaverse era. Indonesia needs to transition towards an Education 4.0 system that utilizes digital technology-based educational media. The Metaverse is a digital technology that enables the creation of a 3D virtual world using AR and VR. The Metaverse, as a new medium, has considerable potential as an interactive educational medium. In addition, the article also discusses the use of AR and VR technology as educational media, as well as the role of designers in applying the concept of Metaverse technology as an interactive educational medium. The use of this technology offers opportunities in the field of education as a medium that supports the teaching and learning process. The design principles that should be applied in creating educational media in the Metaverse era, based on AR and VR technology, include layout, typography, color principles, and field and space perception. It is hoped that educators and designers can prepare themselves to face the Metaverse era, which will require competence in digital technology. This analysis also discusses the potential implementation of the Metaverse as an interactive educational medium, as well as the challenges and threats that may be encountered. Metaverse technology combines AR and VR into a single platform, offering great potential to support educational advancement. However, implementing the Metaverse requires adequate infrastructure and attention to educators' skills in using this technology.	Endarto & Martadi (2022)
2	*Proses Adopsi Metaverse Melalui Augmented Reality Yang Diterapkan Oleh Museum Digital Bekasi.*	On March 19, 2021, a digital museum (*Gedung Juang*) was opened in Bekasi. They applied the metaverse concept through AR, which displays objects in 2D and 3D, making the museum interactive for visitors. The AR created has a special feature in its sensor, namely the Kinect sensor. Augmented reality works by having visitors stand in front of the screen, where sensors detect their movements. Thus, the screen will automatically display or project content/material related to history. However, there are obstacles to implementing augmented reality in museums, such as visitors misusing the AR sensor, which can damage the sensor's ability to detect user movement. Furthermore, this damage results in lengthy sensor service and maintenance. The long service and maintenance time occurs because AR technology is still relatively rare, making service and maintenance references	Amalia *et al.* (2023)

No	Article Title	Article Discussion Content	Author
		difficult to access and requiring trial and error. In addition, this can also occur because the number of IT staff working at the Gedung Juang Museum is relatively small.	
3	*Pembelajaran Berbasis Metaverse-Virtual Reality Menggunakan Spatial.io dengan Model Discovery Learning Untuk Meningkatkan Pemahaman dan Minat Siswa*	In computer science classes covering the social impact of information technology, a teaching method using the concept of Metaverse-virtual reality with spatia.io as a virtual space is implemented. In the virtual space, student avatars collaborate, exchange ideas, and explore the room. The learning materials provided by the teacher consist of infographic galleries and video presentations. On the other hand, in the same virtual space, teachers monitor the activities carried out by student avatars. Not only that, teachers and students can also communicate through chat boxes and audio, even though the student avatars and teacher avatars are far apart. This implies that the Metaverse is a virtual learning space that can be accessed anywhere and at any time. The results of the study indicate that learning with the Metaverse-virtual reality spatia.io is highly effective in terms of student interest and deep understanding compared to conventional learning methods. This difference is evident in the average N-Gain Score of the experimental group (58.79%, indicating a level of effectiveness), which is higher than that of the control group (26.50%, indicating ineffectiveness). Thus, learning using the Metaverse-virtual reality with spatia.io has proven to be more meaningful for students than learning using conventional methods.	Rasyida *et al*. (2023)
4	*Pemanfaatan Metaverse di Bidang Pendidikan*	This journal explores the application of the Metaverse in the realms of education and technology. The Metaverse is recognized as one of the technologies with the most significant potential today, but its use for educational purposes is still rarely discussed. In this paper, the author aims to provide a clear definition of the Metaverse, its potential applications, and research issues related to the Metaverse in an educational environment. Additionally, the role of artificial intelligence (AI) in Metaverse-based education is also explored. The use of the Metaverse in education offers a new perspective on educational technology, providing students with new opportunities and training contexts. Many training programs or objectives that cannot be achieved in the real world can be carried out in the Metaverse. Additionally, there is a Lifelogging function that enables the recording of detailed life events in the Metaverse. Decentralized technologies, such as Blockchain, are also necessary to ensure that economic activities can be carried out safely and that others cannot alter personal property and logs in the Metaverse. In the context of education, AI can serve as an NPC tutor in the Metaverse, offering guidance and feedback to learners on their English writing. In the Metaverse, data is continuously collected from various physiological and behavioral sensors, including eye movements, viewing information, blink rate, head or controller (hand) movements, and orientation, as well as interactive content and conventional learning behaviors. This additional data can be very informative and helpful in understanding student behavior patterns and conditions in the Metaverse environment.	Iswanto *et al* (2022)

No	Article Title	Article Discussion Content	Author
5	Strategies for Constructing Career Initiation Education for Primary and Secondary School Students in the Metaverse	This journal discusses the construction of vocational enlightenment education strategies for elementary and secondary school students in the Metaverse. The Metaverse is a virtual environment consisting of cyberspace and virtual reality. This study aims to introduce vocational enlightenment education into the Metaverse environment to increase students' interest and enthusiasm in learning. This study identifies that vocational enlightenment education in the author's country began late and has several shortcomings, including abstraction, theorization, modeling, and rigidity, which make it challenging to integrate with the real lives of elementary and secondary school students. Therefore, this study attempts to introduce vocational enlightenment education into the Metaverse using life log technology and artificial intelligence. This is expected to help students record and analyze their learning processes, thereby gaining a deeper understanding of the interests and learning habits of elementary and secondary school students. In addition, this journal also discusses Lifelogging, a cultural behavior in which people record, store, and share their life experiences and information. Lifelogging is also related to the use of social media to record and share daily activities, as well as participating in other people's life records through browsing, commenting, and sharing opinions, thereby expanding a person's social sphere and horizons. Thus, this journal discusses the application of Life Log technology and artificial intelligence in vocational enlightenment education in the Metaverse, as well as its relationship with lifelogging and the use of social media in recording and sharing life experiences.	Cheng *et al* (2023)
6	Digital fashion innovations for the real world and Metaverse	The journal “International Journal of Fashion Design, Technology and Education” covers a range of topics related to digital innovation in the fashion industry. One of the studies discussed is the use of social media in product innovation for manufacturing and retail businesses in the fashion industry. This study also explores the application of CAD systems in 3D fashion accessory design. Additionally, this journal explores the application of AI in textile process control as an area of research and development that is expected to continue growing in the years to come. This journal also discusses the effectiveness of online fashion CAD teaching during the COVID-19 pandemic, which shows that students taught online achieved higher grades and results than those taught offline. Additionally, research explores the application of chatbots in fashion e-commerce and the utilization of eye-tracking in understanding fashion consumer behavior on smartphones. Thus, this journal offers broad insights into digital innovation in the fashion industry, as well as a deeper understanding of the role of technology in the fashion sector.	Sayem (2022)

Source: Scholar Article

Discussion

Based on the findings, this article outlines the revolutionary potential of the Metaverse in the context of education and the fashion industry. The emphasis on AR and VR-based applications, the role of designers, and practical challenges such as those faced by the Gedung Juang digital museum in Bekasi, are crucial points in understanding the impact of the Metaverse. Additionally, the discussion of the Metaverse's application in computer science and vocational education subjects provides a concrete picture of its effectiveness and potential benefits. Meanwhile, in the fashion industry, it is evident that digital innovations,

including the use of social media, CAD, AI, chatbots, and eye-tracking, have become the primary drivers of change. However, along with great opportunities, there are also practical challenges and ethical considerations that need to be addressed. Thus, the integration of the Metaverse and digital technology in various fields requires a collective effort to maximize its positive potential and overcome existing obstacles.

The Application of Metaverse in Junior High School Education

The application of the Metaverse in education represents a transformative approach that leverages the virtual world to enhance students' learning experiences. This can offer immersive, interactive, and innovative educational opportunities that can surpass traditional learning methods. The Metaverse can integrate various educational applications such as virtual field trips, simulations, and the provision of engaging learning environments. If this digital space is adequate in the learning process, it will foster critical thinking and collaboration skills that are essential in modern education. According to the Metaverse, it can be applied in education by creating a multi-sensory three-dimensional environment (stimulating real life), increasing student engagement, and providing learning experiences.

Junior high school education integrated with Metaverse technology presents innovative opportunities to improve learning experiences and outcomes. This is because the Metaverse can foster engagement, creativity, and collaboration among students. The application of Metaverse technology in junior high school education has been shown to improve academic performance significantly (Chen & Huang, 2024). This is because the Metaverse can foster engagement, creativity, and collaboration among students.

The Benefits of the Metaverse in Education

The application of the Metaverse in education can enrich and expand conventional or traditional learning methods by creating a digital (3D) environment where avatars can represent educators and students, thereby increasing student engagement and understanding. This can enhance learning outcomes by integrating advanced technology with traditional methodologies (Elman, 2024).

The Metaverse, as a transformative platform in education, offers students the opportunity for in-depth learning through interactive experiences. The immersive nature of the Metaverse enables students to explore subject matter in innovative ways, resulting in a more profound learning experience. When students engage in activities and in-depth discussions in the Metaverse environment, their commitment to learning also increases (Al Yakin, 2023). Additionally, this learning model, which incorporates the Metaverse, enables students to overcome the complex problems they encounter during the learning project (Janul & Sunendar, 2024). Specifically, aspects of virtual collaboration and digital communication are factors that influence the depth of student learning. Therefore, the practical application of the Metaverse can facilitate students' learning experience by fostering a more interactive and communicative learning environment.

The metaverse has demonstrated various potentials in improving students' understanding of more complex learning concepts by providing an interactive and immersive learning environment. This technology enables visualization and student engagement in the learning environment, thereby promoting understanding and information retention (Putra *et al.*, 2024).

Challenges and Obstacles in Implementing the Metaverse in Education

Integration in the Metaverse in secondary education will certainly face various challenges and obstacles in the implementation process. Several critical challenges arise when applying Metaverse technology in

secondary education, including user data security issues and ethical violations of intellectual property rights (Maria, 2023). On the other hand, several obstacles in implementing Metaverse-based learning include technological limitations, accessibility issues, teacher training needs, and curriculum integration (Pahmi & Junfithrana, 2024). Additionally, policymakers should give greater attention to addressing various technical obstacles and the lack of facilities for accessing Metaverse-based learning. Overcoming these challenges and obstacles is crucial to ensuring an inclusive and safe educational environment.

CONCLUSION

This learning method, which utilizes Metaverse technology, can overcome various educational limitations by providing an interactive learning experience that maximizes student engagement and enhances their understanding of complex concepts, particularly in junior high school education. Rapid technological developments require educators and students to adapt to a technology-based learning process in the Metaverse. However, its implementation requires support from various parties, such as schools, the government, educators, and students. This is the key to overcoming the challenges and obstacles that may arise in the future. For future research, it is recommended to conduct detailed research on the direct application of Metaverse-based learning to identify the actual obstacles and challenges faced.

AUTHOR'S NOTE

The author would like to thank all those who contributed to the writing of this article. The perfection of this article would not have been possible without the criticism, suggestions, and valuable input from research colleagues and fellow researchers. Thank you for your constructive contributions, which have enriched the discussion and analysis. Thank you to all parties for their cooperation and dedication. Hopefully, this article can make a positive contribution to the advancement of science and serve as a source of inspiration for readers.

REFERENCES

Aditya, M. A., Wijayanto, R., Danuarta, B. (2024). Media pembelajaran Metaverse sebagai tujuan meningkatkan kualitas pendidikan. *Jurnal Sistem Informasi dan Ilmu Komputer, 2*(1), 175-179.

Al Yakin, A., & Seraj, P. M. I. (2023). Impact of Metaverse technology on student engagement and academic performance: the mediating role of learning motivation. *International Journal of Computations, Information and Manufacturing (IJCIM)*, *3*(1), 10-18.

Alimjonovna, S. M. (2024). Current challenges and requirements for the professional competence of educators in the modern world. *International Journal of Pedagogics, 4*(5), 27-31.

Alinata, R. H., & Marsudi, M. (2024). Using roblox as a promotional media Metaverse school SMP Negeri 3 Sumenep. *Malcom: Indonesian Journal of Machine Learning and Computer Science*, *4*(1), 57-70.

Amalia, R. S., Arindawati, W. A., & Kusumaningrum, R. (2023). Proses adopsi Metaverse melalui augmented reality yang diterapkan oleh Museum Digital Bekasi. *Innovative: Journal of Social Science Research*, *3*(3), 529-542.

Augusta, M. O., Syeira, C. P. O., & Hadiapurwa, A. (2021). Penggunaan teknologi blockchain dalam bidang pendidikan. *Produktif: Jurnal Ilmiah Pendidikan Teknologi Informasi, 5*(2), 437-442.

Chen, C. M., & Huang, M. Y. (2024). Enhancing programming learning performance through a Jigsaw collaborative learning method in a Metaverse virtual space. *International Journal of STEM Education*, *11*(1), 1-24.

Cheng, Y. (2023). Strategies for constructing career initiation education for primary and secondary school students in the Metaverse. *Vocational Education*, *12*(5), 796-807.

Elman, M. (2024). Inovasi pembelajaran pendidikan agama islam berbasis Metaverse. *Dirosat: Journal of Islamic Studies*, *9*(1), 97-108.

Endarto, I. A., & Martadi, M. (2022). Analisis potensi implementasi Metaverse pada media edukasi interaktif. *Barik*, *4*(1), 37-51.

Ghifari, Y., Amanda, D. A., & Hadiapurwa, A. (2022). Analysis effectiveness of online learning during the COVID-19 pandemic. *Curricula: Journal of Curriculum Development, 1*(2), 115-128.

Haas, R., Sayer, M., Ajnovic, A., Auer, H. (2022). Technological learning: Lessons learned on energy technologies. *Wires Energy and Environment, 12*(2), 1-20

Hasannah, N., Afina, A. F., Nuraeni, P., & Hadiapurwa, A. (2024). Is education possible in the metaverse especially in Indonesia?. *Hipkin Journal of Educational Research*, 1(1), 13-24.

Hemmati, M. (2022). The Metaverse: An urban revolution. *Tourism of Culture*, *2*(7), 53-60.

Humaira, A., Haq, M. J., & Fitri, T. N. (2024). Metaverse in higher education. *Hipkin Journal of Educational Research, 1*(1), 87-100.

Ikhsanuddin, M., Hidayat, M., Setiawan, R., & Budiyono, S. (2024). Analysis of the potential of the Metaverse in the education sector in Indonesia. *Mister: Journal of Multidisciplinary Inquiry in Science, Technology, and Educational Research*, *1*(3), 734-738.

Ilyas, M., & Armizi, A. (2020). Metode mengajar dalam pendidikan menurut Nur Uhbiyati dan E. Mulyasa. *Al-Liqo: Jurnal Pendidikan Islam*, *5*(2), 185-196.

Iswanto, N. I. P., Widhiantoro, D., Munawar, Z., & Komalasari, R. (2022). Utilization of Metaverse in education. *Jurnal Teknologi Informasi Komunikasi (e-Journal), 9*(1), 44-52.

Jaimini, U., Zhang, T., Brikis, G. O., & Sheth, A. (2022). imetaversekg: Industrial Metaverse knowledge graph to promote interoperability in design and engineering applications. *IEEE Internet Computing*, *26*(6), 59-67.

Janul, E., & Sunendar, D. (2024). The contribution of project-based learning to improve basic literacy at junior high school. *Inovasi Kurikulum*, 21(2), 807-818.

Khaira, M., Lesmana, D. C., Agustina, P., & Saputra, D. (2024). Utilization of the metaverse in the context of interactive learning. *Hipkin Journal of Educational Research*, 1(2), 151-162.

Kurniawan, A. R., Sistiyani, S., & Qolbi, Z. F. Efficient learning strategies: Student attraction to entrepreneurship lessons using technology. *Curricula: Journal of Curriculum Development, 3*(1), 125-142.

Kye, B., Han, N., Kim, E., Park, Y., & Jo, S. (2021). Educational applications of Metaverse: possibilities and limitations. *Journal of Educational Evaluation for Health Professions*, *18*(1), 1-13.

Maria, K. (2023). Navigating the Metaverse business and legal challenges: Intellectual property, privacy, and jurisdiction. *Journal of Metaverse, 3*(1), 87-92.

Nudin, B., Akbar, I., Roy, M., Dewantoro, P., H. (2022). Learning method of Ibnu Khaldun. *KnE Social Sciences, 1*(1), 69-85.

Nurmalasari, N., Hidayat, T., Rosadi, I., Yunita, R., & Holisoh, E. (2023). Faktor-faktor penyebab rendahnya minat melanjutkan ke perguruan tinggi di SMK Miftahul Ulum Cimerak. *J-Staf: Siddiq, Tabligh, Amanah, Fathonah*, *2*(1), 120-130.

Pahmi, S., & Junfithrana, A. P. (2024). Integrasi teknologi virtual reality dan kearifan lokal batik dalam pembelajaran Matematika bagi guru sekolah dasar. *Jurnal Abdi Nusa*, *4*(3), 315-326.

Park, S. M., & Kim, Y. G. (2022). A Metaverse: Taxonomy, components, applications, and open challenges. *IEEE Access*, *10*(1), 4209-4251.

Permana, B. S., Insani, G. N., Reygita, H., & Rustini, T. (2023). Lack of educational facilities and infrastructure in Indonesia. *Aurelia: Jurnal Penelitian dan Pengabdian Masyarakat Indonesia, 2*(2), 1076-1080.

Pooyandeh, M., Han, K. -J., & Sohn, I. (2022). Cybersecurity in the AI-Based Metaverse: A Survey. *Applied Sciences*, *12*(24), 1-23

Putra, D. R., Marzuq, I., & Putri, S. T. N. E. (2024). Potential of the metaverse in enhancing learning experiences. *Hipkin Journal of Educational Research, 1*(3), 275-286.

Rasyida, R., Nurdin, E. A., & Rasim, R. (2023). Pembelajaran berbasis Metaverse-virtual reality menggunakan spatial.io dengan model discovery learning untuk meningkatkan minat dan pemahaman siswa. *Jurnal Pendidikan Tambusai*, *7*(2), 15875-15882.

Sayem, A. S. M. (2022). Digital fashion innovations for the real world and Metaverse. *International Journal of Fashion Design, Technology and Education*, *15*(2), 139-141.

Waruwu, L., Mesrawati, A., Harifa, O. (2024). Evaluasi penggunaan teknologi informasi dalam pembelajaran di smk: tantangan, peluang dan solusi. *Journal of Education Research, 5(3),* 3790-3799.

Widhiasti, A., Putri, A., Fanani, M. A., Salim, N., & Kurnia, Y. R. (2022). Analysis of learning components in implementation of educational process in schools. *Curricula: Journal of Curriculum Development, 1*(2), 219-234.

Xi, N., Chen, J., Gama, F., Riar, M., & Hamari, J. (2023). The challenges of entering the Metaverse: An experiment on the effect of extended reality on workload. *Information Systems Frontiers*, *25*(2), 659-680.