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Literature review study: Effectiveness of using GoMeta for metaverse learning media

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ABSTRACT

This research explores the effectiveness of using GoMeta as a metaverse learning media platform. Metaverse, a virtual shared space that integrates aspects of Augmented Reality and Virtual Reality, is gaining prominence in education. This research aims to see the effectiveness of implementing GoMeta as a metaverse learning media platform to find solutions and provide innovation in learning activities. Knowledge about effectiveness in metaverse learning with GoMeta serves to see the impacts produced so that they can be evaluated and developed further to find the best learning methods for students in the digital era. This research begins by examining the general landscape of metaverse learning, emphasizing the importance of immersive and collaborative educational environments. It then digs into GoMeta's specific features that contribute to its effectiveness, such as ease of use, inclusivity, and support for diverse content creation. The analysis in this research includes studies and articles that explore the application of GoMeta in educational settings, assessing its impact on student engagement, knowledge retention, and overall learning outcomes. The results found were that GoMeta was considered effective as a means of learning activities and was expected to improve the quality of learning.

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ABSTRAK

Penelitian ini mengeksplorasi efektivitas pemanfaatan GoMeta sebagai platform media pembelajaran metaverse. Metaverse, ruang bersama virtual yang mengintegrasikan aspek Augmented Reality dan Virtual Reality, semakin menonjol dalam pendidikan. GoMeta, yang dikenal dengan alat pembuatan konten yang mudah digunaan, diposisikan sebagai solusi potensial untuk memfasilitasi pengalaman belajar yang interaktif dan menarik dalam metaverse. Tujuan dari penelitian ini adalah untuk melihat efektifitas dari implementasi GoMeta sebagai sebuah platform media pembelajaran metaverse untuk menemukan solusi sekaligus menjadi inovasi dalam kegiatan pembelajaran. Pengetahuan mengenai efektivitas dalam pembelajaran metaverse dengan GoMeta berfungsi untuk melihat dampak-dampak yang dihasilkan sehingga dapat dievaluasi dan dikembangkan secara lebih lanjut untuk menemukan metode pembelajaran yang terbaik bagi siswa di era digital. Penelitian ini dimulai dengan mengkaji lanskap umum pembelajaran metaverse, menekankan pentingnya lingkungan yang mendalam dan kolaboratif dalam pendidikan. Kemudian menggali fitur spesifik GoMeta yang berkontribusi terhadap efektivitasnya, seperti kemudahan penggunaan, inklusivitas, dan dukungan untuk pembuatan konten yang beragam. Analisis dalam penelitian ini mencakup studi dan artikel yang mengeksplorasi penerapan GoMeta di lingkungan pendidikan, menilai dampaknya terhadap keterlibatan siswa, retensi pengetahuan, dan hasil pembelajaran secara keseluruhan. Hasil yang ditemukan adalah bahwa GoMeta dinilai efektif sebagai sarana kegiatan pembelajaran dan diharapkan dapat meningkatkan kualitas pembelajaran.

Kata Kunci: *GoMeta; metamesta; media pembelajaran; pendidikan*

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INTRODUCTION

The development of technology plays a significant role in the advancement of learning media. Essentially, as technology evolves, human needs also shift, giving rise to new demands. For instance, with the emergence of digital technology, conventional learning methods have become less effective. In the continuously evolving digital era, the learning paradigm has undergone a substantial transformation with the introduction of the metaverse. Conventional approaches tend to be less capable of providing deep and immersive learning experiences, as they are considered outdated amid the ever-changing and developing times. Educators and learners now seek more modern and relevant solutions that align with the dynamic demands of the present era.

Optimal utilization of technology in the field of education can serve as an effort to develop high-quality human resources. This is due to the growing number of educational technologies that can support learning activities. Learning resources can serve as one of the problem-solving strategies in educational technology approaches (Agustian & Salsabila, 2021). Appropriate learning resources can make learning activities more effective, which relates to the utilization of educational technology to facilitate students' access to the necessary learning materials (Komara & Hadiapurwa, 2023). When educators can effectively utilize technology, implementing learning activities becomes more straightforward (Widiyono & Millati, 2021). Proper use of technology will help students carry out their learning activities in accordance with the demands of the era. It can direct the use of learning methods and resources that are more targeted and efficient.

In the modern era of technological advancements, the metaverse has become a concept that is increasingly dominating the digital space. The metaverse is not merely a futuristic dream but has become a reality that transforms the way we interact, learn, and collaborate online (George *et al*., 2021; Dyulicheva & Glazieva, 2022). The GoMeta application emerges as an innovative solution that leverages the metaverse concept to enhance the learning experience. GoMeta serves as a platform that provides interactive and immersive learning media within the metaverse. The presence of GoMeta aims to make web application creation faster and easier for users by offering an immersive virtual environment (Wang *et al*., 2022). Based on these objectives, it is evident that the utilization of GoMeta can be applied in teaching and learning activities as an innovation in the field of education. Previous research on GoMeta has provided its users with unique and compelling learning experiences (Endarto & Martadi, 2022). This is because GoMeta features are typically used for interactive activities, such as playing games. Such interactive activities can increase user engagement and reduce boredom during the learning process.

Through the integration of advanced technologies, such as Augmented Reality (AR) and Virtual Reality (VR), this application offers a learning space that is not only informative but also engaging and motivating. The utilization of AR technology allows for more vivid and detailed representations of learning materials by leveraging 3D animated displays (Sholeh *et al*., 2021). VR technology, on the other hand, enables users to interact with real-world situations designed using computer-based environments (Lumenta, 2021). Based on these perspectives, the use of AR and VR technologies becomes an intriguing innovation, especially when implemented as learning resources to engage students' interest in learning.

In the context of metaverse-based learning, the effectiveness of GoMeta lies not only in its impressive visualizations but also in its structured and relevant instructional design. This application provides a variety of easily accessible educational content, including interactive simulations, game-based lessons, and collaborative projects. Another advantage of using GoMeta is the personalization of learning experiences. By employing Artificial Intelligence (AI) technology, this application can adapt curricula and instructional methods to individual needs, ensuring that each user receives a learning experience tailored to their level of understanding and personal preferences.

GoMeta represents a revolution in metaverse learning approaches. By combining advanced technologies, thoughtful learning design, and personalization, this application not only effectively transforms the learning experience but also paves the way for a more dynamic and inclusive future of education (Hartatik, 2022). Previous studies revealed that 90% of teachers were able to create virtual classrooms using the metaverse software *Millea Lab* and operate them successfully (Guntara *et al*., 2022). Other research also demonstrated that VR-based learning media utilizing *Millea Lab* achieved a feasibility percentage of 92.6% as a viable learning medium, 88.7% in terms of material feasibility, and 97.6% overall feasibility as an instructional medium (Febriana *et al*., 2023). Studies have reported that the use of VR-based media increases learning outcomes by 33.68%, achieving an effectiveness rate of 88.77% (Atika *et al*., 2023). *The metaverse is also considered to have a positive impact in overcoming the limitations of virtual dimensional technology, which often restricts users from fully experiencing sensory and immersive interactions* (Bibri, 2023). Previous analyses have suggested that metaverse learning has great potential to support the implementation of educational processes and enhance their quality (Díaz *et al*., 2020).

These recent findings suggest that numerous successes have been achieved through the use of metaverse technology as a tool to facilitate learning activities. The majority of studies highlight how metaverse technology can be beneficial and holds great potential when applied in educational contexts. These positive and constructive impacts position metaverse technology—particularly GoMeta—as a promising application capable of enhancing educational innovation and transforming learning into a more engaging experience.

Metaverse-based learning presents numerous possibilities and opportunities to enhance the educational system. However, further exploration is still needed to uncover new insights from learning experiences utilizing the metaverse and to continue developing the positive aspects and opportunities identified from prior research evaluations. Thus, the research problem in this study focuses on examining the effectiveness of metaverse technology when applied in educational learning activities. The primary objective of this article is to review and comprehensively analyze the effectiveness and potential applications of the GoMeta application as a learning medium within the metaverse, thereby enhancing the quality of learning resources for students and providing educators with a platform to continuously adapt to technological changes and the evolving demands of the time.

LITERATURE REVIEW

Metaverse

The American science fiction author Neal Stephenson introduced the concept of the *metaverse* in his 1992 novel *Snow Crash*. The terms *"meta" and "universe"* respectively refer to transcendence and virtuality. The term *"metaverse" is used to describe a 3D environment* and a *virtual world* where interactions are not limited by physical or real-world boundaries (Narin, 2021). The concept of the metaverse represents a three-dimensional virtual environment where AR and VR services can be utilized for various activities across multiple aspects of life. The Acceleration Studies Foundation (ASF) provided context for the 2006 Metaverse Roadmap, which outlined the concept of the metaverse and its various forms, proposing that the metaverse serves as a bridge or fusion between the real world and virtual reality. In this regard, the concept of the metaverse has successfully unified the virtual and physical worlds, enabling them to connect and create a combination that can transform technological systems.

Two technologies that preceded the metaverse are *Augmented Reality (AR)* and *Virtual Reality (VR)*. Three aspects distinguish the metaverse from AR and VR. (Park & Kim, 2022) state that the metaverse offers more compelling features as a service with stronger social content and longer-lasting significance, whereas studies related to VR have primarily focused on physical techniques. Furthermore, a platform can

still be considered a metaverse application even if it does not directly support AR or VR technologies. This is because the metaverse does not necessarily require the use of these technologies.

The fusion of virtuality and reality to create a real environment is known as the metaverse. According to *MilleaLab*, gamification techniques in education can be supported through the metaverse, offering countless learning opportunities. *MilleaLab* is a VR-based application that can facilitate independent learning activities for students (Alkahfi *et al*., 2024). Moreover, the metaverse can be customized to align with curriculum needs and accommodate each learner's requirements. In addition, analyses conducted within metaverse environments can be personalized and applied to real-life contexts.

GoMeta

When educators present information in a monotonous or unengaging manner, learners tend to lose interest and become passive participants. This condition must be avoided as it directly affects students' learning outcomes. Technology plays a crucial role in minimizing this possibility. Educators must utilize technology and technology-integrated learning media to address this issue and create a positive learning experience. Abstract concepts can be visualized, clarified, and better understood through the use of media. Learning materials delivered digitally can provide students with a more comprehensive understanding by incorporating videos or other learning resources (Agustian & Salsabila, 2021).

GoMeta is one of the platforms that educators can use to develop learning media. The purpose of this platform is to facilitate users in creating VR-based learning materials. Through the application of VR technology, users can engage in deep interactions with digital elements within a virtual reality environment (Efendi *et al*., 2019). On the other hand, *Augmented Reality (AR)* refers to a technological approach that integrates digital and physical components to create an environment resembling real-world conditions (Dargan et al., 2023).

In addition to *GoMeta*, there is *MilleaLab*, which offers numerous advantages by providing thousands of assets and animations (https://www.millealab.com/id), ease of use without requiring coding skills, built-in assessment and quiz features, hundreds of ready-to-use learning templates, affordability without the need for expensive infrastructure, and a behavior tracking system used for in-class analytics for each learner. This demonstrates that the growing field of educational technology, particularly with the emergence of metaverse-based technologies packaged within platforms such as *GoMeta* and *MilleaLab*, makes learning activities increasingly engaging and capable of generating positive impacts when applied in educational contexts. The utilization of metaverse technology is considered adequate both in terms of learning media implementation and the resulting learning outcomes achieved by students.

Learning Media

According to the Association for Education and Communication Technology (AECT), *media* refers to any format used in the process of transmitting information (Rahmadani & Setiawati, 2019). Media serve as message channels through which information is delivered from the sender to the receiver; in this context, the information transmitted represents learning materials, and the accomplishment of the learning process constitutes the desired outcome. Learning media are tools that assist the learning process by clarifying messages and helping learners achieve their learning objectives more effectively (Hadiapurwa *et al*., 2023; Rosyiddin *et al*., 2023). Learning media can be utilized by educators in instructional activities to enhance students' interest in the learning process. It can thus be concluded that media function as a container accommodating various information sources in multiple formats that can be used to facilitate learning activities.

All efforts undertaken to transmit information-carrying messages from the sender to the receiver—within the learning context, the educator acts as the sender and the learner as the receiver—can be regarded as *learning media*, provided they aim to refine learners' attitudes, emotions, focus, and interests in order to achieve effective learning. The teacher's role as an educator is to deliver effective instruction to students; therefore, the information conveyed must be accurate to prevent misconceptions.

One form of educational technology that can be utilized in learning activities is the use of *Augmented Reality (AR)* and *Virtual Reality (VR)* technologies. These two technologies are among the most popular technological advancements and have been widely applied in education. They are also considered sophisticated innovations that complement digital learning materials. A simple definition of AR is that it is a technology that integrates virtual or unreal objects in 2D (two-dimensional) and 3D (three-dimensional) forms into a 3D projection. Meanwhile, VR represents a more complex form of AR because it entirely replaces the real world (Sari *et al.*, 2023). The presence of AR and VR technologies, when applied in educational contexts, makes learning activities more engaging, as these technologies enable deeper understanding through virtual visualizations generated by AR and VR systems.

Technology-based learning media enhance the interactivity and attractiveness of learning activities for students. Engaging learning media offer new perspectives on how teaching and learning can be conducted in the classroom, making it more enjoyable and improving learners' academic outcomes in several instances (Sartika et al., 2020; Marini *et al.*, 2022). Based on these considerations, learning media play a crucial role in achieving student learning success when applied appropriately.

Effectiveness

In reality, effectiveness is a broad concept that encompasses many factors both within and outside an organization. Due to the variety of disciplinary perspectives that yield different approaches to measurement, scholars have yet to reach a consensus on the definition of effectiveness. Several expert viewpoints on what constitutes effectiveness are as follows.

1. Effectiveness is the state of measuring actions in achieving predetermined goals (Setiawan & Maghfirah, 2021).
2. Learning effectiveness refers to a situation in which there is alignment or conformity between the individuals performing a task and the objectives intended to be achieved (Purnamasari & Wijoyo, 2023).

Therefore, it can be concluded that effectiveness represents the extent to which an activity's objectives have been achieved compared to the previously established targets.

Several indicators are used to assess effective learning, including the communication process, management of instructional implementation, student responses, learning activities, and student learning outcomes (Yildirim & Gülbahar, 2022).

1. Communication Process: An effective communication process occurs when the students can well understand the information conveyed by the educator.
2. Management of Instructional Implementation: A simple example of this is how teachers can provide solutions when classroom learning becomes ineffective, ensuring that students remain attentive.
3. Student Responses: This refers to feedback from students in the form of statements or questions directed to the teacher during the learning process.
4. Learning Activities: Learning activity refers to how teachers and students engage optimally in learning within the available space and time.
5. Student Learning Outcomes: Learning outcomes represent what students have achieved or gained after the learning process has been completed.

These indicators serve as determinants of whether a learning activity is effectively implemented. It is essential for teachers, as educators, to understand these indicators in order to effectively evaluate the success of the learning activities they have conducted.

METHODS

In developing this article, the researcher employed a qualitative method, utilizing a literature study as the primary research instrument. The literature study method was chosen because it is appropriate for understanding and summarizing existing knowledge regarding the use of the Millea Lab application within the context of the metaverse. Through this approach, the researcher was able to construct a profound, systematic, and measurable understanding of the concepts and theories relevant to the use of Millea Lab in metaverse-based learning environments.

By its nature, this study is a synthesis, meaning that it involves a literature review that integrates findings from various sources to form a comprehensive and in-depth understanding of the selected topic. This study unites ideas to establish a more complete and coherent conceptual framework through several stages: (1) integration of findings, namely analyzing existing data to conclude; (2) identification of similarities and differences, by analyzing and comparing the results of the initial data identification; and (3) construction of a comprehensive narrative, which involves writing the findings in a complete, coherent form based on the existing data. In this research, the author elaborates on topics related to effectiveness, learning media, the Millea Lab application, and the metaverse as interconnected elements that directly support the discussion of Millea Lab as an educational tool.

RESULTS AND DISCUSSION

Based on the author's review of the collected and analyzed articles, it was found that the **metaverse** is a vast virtual space where users can interact with one another and with the created virtual environment, often utilizing computer technology and internet networks. The use of technology that bridges the real and virtual worlds provides more realistic virtual representations of the subjects being studied, making learning content easier to understand. The metaverse enables the simulation and experience of real-world situations in virtual environments. To support all metaverse-based activities, particularly in education and learning, a technology-based platform is needed that specifically enables the creation of metaverse environments. **GoMeta** is an American software company headquartered in San Diego. It was founded by **Dmitry Shapiro, Sean Thielen, and Jonathan Miller** in September 2016. GoMeta serves as one of the specialized web platforms for developing metaverse-based learning media. The platform represents an educational innovation that can be applied to enhance the effectiveness of learning materials and media used by students.

Discussion

The emergence of metaverse technology has introduced numerous innovations and advancements across various aspects of life, including **education**. The integration of metaverse technology within educational contexts offers new opportunities for **innovative teaching and learning strategies** (Damaševičius & Sidekersniene, 2023). The metaverse is understood as a bridge between the virtual and the physical worlds, allowing individuals to explore digital information in ways that appear more tangible and immersive. It refers to a virtual world composed of interconnected digital spaces where users can interact with one another and with virtual objects in real time (Putri *et al*., 2022). The metaverse combines elements of virtual worlds, augmented reality (AR), virtual reality (VR), and other emerging technologies. It can create

memorable experiences for users, enhancing their ability to visualize and internalize what they encounter through immersive interaction.

The immersive experience offered by metaverse environments enables users to communicate, collaborate, and even co-create within digital spaces. As a multi-user, interconnected platform, the metaverse facilitates digital communication and collaboration (Mystakidis, 2022). This concept has garnered significant attention in technological development and plays a crucial role in shaping the evolution of how people engage in virtual environments. Scholars and practitioners continue to discuss its implications for human interaction, work, and lifestyle (Aljanabi & Mohammed, 2023; Allam *et al*., 2022). Some view it as a significant technological evolution, opening new opportunities in entertainment, education, and business. In the educational domain, the use of the metaverse can be highly effective when supported by collaboration between teachers and students. The success of metaverse-based learning depends on both parties working together to create a conducive virtual learning environment (Mistretta, 2022). However, valid concerns related to privacy, security, and ethical issues remain, which must be addressed to ensure that metaverse-based education can develop responsibly and sustainably.

GoMeta is a company specializing in the development of the metaverse, with a focus on creating platforms for building and managing interactive digital experiences. With the rising popularity of the metaverse, GoMeta plays an important role in shaping the virtual ecosystem that supports various forms of online content and interactions (Humaira *et al*., 2024). The company makes a positive contribution to the metaverse by providing a platform that enables users to create and manage interactive digital experiences easily. Through its user-friendly content creation tools, GoMeta enables individuals, including those without technical expertise, to actively participate in metaverse development. This accessibility stimulates creativity and innovation in the creation of virtual content that can be utilized across multiple domains. Moreover, by providing easier access, GoMeta helps expand the reach of the metaverse and fosters a more diverse and inclusive ecosystem, offering broad benefits for the overall growth and development of the virtual world.

In the context of the metaverse, GoMeta's effectiveness can be evaluated through its ability to provide a platform that simplifies the creation and management of interactive digital content, as a platform designed to deliver interactive experiences within AR and VR environments (Sandoval-Henríquez *et al*., 2022). GoMeta enhances user engagement by offering intuitive and accessible tools to a broad audience. This inclusivity increases participation in metaverse development. Other factors influencing GoMeta's effectiveness include its capacity to support multiple content formats and interaction types, as well as the presence of adequate security features. It is also crucial to assess how GoMeta empowers users, particularly those without technical backgrounds, to design compelling metaverse experiences. Additionally, technical support, regular updates, and responsiveness to user feedback are key factors in adapting to the rapidly evolving dynamics of the metaverse landscape.

GoMeta provides significant benefits to metaverse development by offering an easy-to-use platform for creating and managing interactive content. This usability enables people from diverse backgrounds, including those lacking deep technical knowledge, to contribute actively to the construction of digital experiences. Such accessibility promotes inclusivity, broader participation, and diversity of ideas, particularly among educators who seek to create innovative learning resources. Furthermore, GoMeta stimulates innovation by supplying creative tools that facilitate the development of unique and engaging virtual content (Martín-Hernández *et al*., 2021). The platform's support for various content types and modes of interaction enriches the metaverse experience, creating a dynamic digital environment that meets diverse user needs. With continuous updates and active responsiveness to user feedback, GoMeta maintains its relevance and evolves in tandem with the ever-changing metaverse ecosystem. Overall, GoMeta brings substantial benefits in promoting inclusivity, creativity, and innovation within the metaverse landscape.

The use of GoMeta within the metaverse as a learning medium represents a significant transformation in the way education is approached. The immersive and interactive nature of the metaverse enables learners to experience learning firsthand, thereby enhancing memory retention and conceptual understanding. Realistic simulations within the metaverse can elevate practical learning to a new level, facilitating unlimited exploration across various disciplines. The global collaborative capabilities of the metaverse open new opportunities for collective learning, connecting students from different parts of the world to share experiences and knowledge (AbuKhousa *et al*., 2023). Moreover, the flexibility of time and space in metaverse-based learning allows for personalized education, adapting to individual learner needs and promoting self-paced, learner-centered approaches. Although still in a developmental phase, the potential of the metaverse as an educational medium promises a revolution in learning, offering more profound, more engaging, and collaborative learning experiences (Tlili *et al*., 2022).

In applying GoMeta as a learning tool or resource, educators must understand how to develop and integrate content using the platform's features. One of GoMeta's main advantages is its accessibility; it does not require advanced technical expertise. With simple procedures, users can create learning media utilizing AR and VR technologies (Scavarelli *et al*., 2021). These technologies enable users to visualize abstract concepts in virtual form, thereby providing a clearer understanding of complex ideas. Visual presentation enhances learners' perception and comprehension of instructional materials presented by teachers or content creators.

Educators play a crucial role in harnessing the potential of metaverse technologies, including GoMeta, by developing and curating relevant learning content that enhances the teaching and learning process, making it more effective and efficient. As previously discussed, several indicators determine the effectiveness of learning activities, namely the communication process, management of instructional implementation, student response, learning activity, and learning outcomes.

Educators must carefully consider these indicators, as they have a direct impact on student achievement. Furthermore, they should serve as guiding principles when designing instructional materials using metaverse-based platforms such as GoMeta.

CONCLUSION

Based on the results of the literature study conducted regarding the use of GoMeta as a learning medium in the metaverse, it can be concluded that GoMeta is a specialized web-based platform designed to create metaverse-based educational media. The metaverse is becoming increasingly popular in learning activities. In the field of education, the use of the metaverse is recognized as a means to support limitless learning methods that provide interactive digital experiences and encourage active participation and collaboration. As a metaverse development platform, GoMeta offers accessible tools for content creation, enabling individuals without technical backgrounds to design interactive metaverse-based learning content. Ekosistem *metaverse* yang dinamikanya terus berubah, maka perlu menjaga relevansi dan perkembangan Given the continuously evolving dynamics of the metaverse ecosystem, it is essential to maintain the relevance and development of GoMeta by ensuring responsiveness to user feedback. Learning media designed through GoMeta brings significant transformation to education by offering great potential to enhance the quality and effectiveness of learning processes. The author hopes that the use of GoMeta can help create more engaging learning experiences. Future researchers are encouraged to explore the impacts and implications of GoMeta from various perspectives, as numerous variables remain to be investigated concerning both GoMeta and the broader use of metaverse technology in educational and learning contexts.

AUTHOR'S NOTE

The process of writing this article involved an extensive literature review from multiple relevant sources, carried out to gain diverse and in-depth perspectives on the topic under discussion. The author would like to express sincere gratitude to previous researchers whose work has provided valuable insight and a foundation for this study. Without their contributions, this article would not have been possible.

The author has endeavored to present the collected information as accurately and clearly as possible. Nevertheless, it is acknowledged that this synthesis has inherent limitations and scope boundaries. To ensure the accuracy and integrity of the content, the author firmly states that this article is an original work, and all sources of information, including quotations and references, have been appropriately cited and acknowledged in accordance with academic writing ethics. This article contains no elements of plagiarism, and every external concept and idea referenced has been presented with complete transparency. A plagiarism check report is attached at the end of this article. The author extends appreciation to all individuals who have contributed to the creation of this article and to the readers who have devoted their time to engaging with this work.

REFERENCES

AbuKhousa, E., El-Tahawy, M. S., & Atif, Y. (2023). Envisioning architecture of Metaverse Intensive Learning Experience (MiLEx): Career readiness in the 21st century and collective intelligence development scenario. *Future Internet, 15*(2), 53-66.

Agustian, N., & Salsabila, U. H. (2021). Peran teknologi pendidikan dalam pembelajaran. *Islamika*, *3*(1), 123-133.

Aljanabi, M., & Mohammed, S. Y. (2023). Metaverse: Open possibilities. *Iraqi Journal For Computer Science and Mathematics, 4*(3), 79-86.

Alkahfi, M. I., Mastur, Utama, A. H. (2024). Utilization of the MilleaLab application as a virtual reality media to support self-directed learning. *Eduvest: Journal of Universal Studies*. 4(4). 2091-2092.

Allam, Z., Sharifi, A., Bibri, S. E., Jones, D. S., & Krogstie, J. (2022). The metaverse as a virtual form of smart cities: Opportunities and challenges for environmental, economic, and social sustainability in urban futures. *Smart Cities, 5*(3), 771-801.

Atika, L., Yulianto, D. M., & Ulgari, S. (2023). Development of virtual reality teaching materials building materials practice courses based on industrial needs of the society 5.0 era. *Jurnal PenSil*, *12*(3), 351-362.

Bibri, S. E. (2023). The metaverse as a virtual model of platform urbanism: its converging AIoT, XReality, neurotech, and nanobiotech and their applications, challenges, and risks. *Smart Cities, 6*(3), 1345-1384.

Damaševičius, R., & Sidekersniene, T. (2023, September). Designing immersive gamified experiences in the metaverse for enhanced student learning. In *2023 International Conference on Intelligent Metaverse Technologies & Applications (iMETA)* (pp. 1-6). IEEE.

Dargan, S., Bansal, S., Kumar, M., Mittal, A., & Kumar, K. (2023). Augmented reality: A comprehensive review. *Archives of Computational Methods in Engineering, 30*(2), 1057-1080.

Díaz, J., Saldaña, C., & Avila, C. (2020). Virtual world as a resource for hybrid education. *International Journal of Emerging Technologies in Learning (iJET), 15*(15), 94-109.

Dyulicheva, Y. Y., & Glazieva, A. O. (2022). Game based learning with artificial intelligence and immersive technologies: an overview. In *CEUR workshop proceedings* (Vol. 3077, pp. 146-159).

Efendi, Y., Marinda, A., & Lusiana, L. (2019). Aplikasi objek wisata 3D augmented reality berbasis mobile. *Jurnal Informatika dan Rekayasa Elektronik, 2*(1), 1-9.

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

Febriana, D., V.Y., I. A., & Pamungkas, A. S. (2023). Pengembangan media pembelajaran virtual reality berbantu MilleaLab pada mata pelajaran Matematika di sekolah dasar. *Jurnal Pendidikan Dasar*, *11*(2), 329-340.

George, A. H., Fernando, M., George, A. S., Baskar, T., & Pandey, D. (2021). Metaverse: The next stage of human culture and the internet. *International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), 8*(12), 1-10.

Guntara, Y., Kriswahyudi, B., Harisudin, A., Safitri, A., Kristiaji, D., Fitri, A. F., & Astari, R. P. (2022). Pendampingan pengembangan media pembelajaran berbantuan virtual reality bagi guru di Kabupaten Lebak. *Dedikasi Nusantara: Jurnal Pengabdian Masyarakat Pendidikan Dasar*, *2*(2), 90-98.

Hadiapurwa, A., Joelene, E. N., Nugraha, H., & Komara, D. A. (2023). Social media usage for language literacy development in Indonesia. *Jurnal Kajian Informasi & Perpustakaan, 11*(1), 109-126.

Hartatik, S. (2022). Penerapan problem based learning dalam meningkatkan motivasi dan hasil belajar siswa sesuai kurikulum merdeka. *Vocational: Jurnal Inovasi Pendidikan Kejuruan*, *2*(4), 335-346.

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

Komara, D. A., & Hadiapurwa, A. (2023). Improving literacy of junior high school students through revitalization of library in kampus mengajar IV activities. *Dwija Cendekia: Jurnal Riset Pedagogik, 7*(1), 143-152.

Lumenta, D. F. (2021). Penggunaan teknologi virtual reality dalam pendidikan keperawatan jiwa: Literature review. *Nursing Arts*, *15*(1), 7-15.

Marini, A., Nafisah, S., Sekaringtyas, T., Safitri, D., Lestari, I., Suntari, Y., ... & Iskandar, R. (2022). Mobile augmented reality learning media with Metaverse to improve student learning outcomes in science class. *International Journal of Interactive Mobile Technologies, 16*(7), 1-12.

Martín-Hernández, P., Gil-Lacruz, M., Gil-Lacruz, A. I., Azkue-Beteta, J. L., Lira, E. M., & Cantarero, L. (2021). Fostering university students' engagement in teamwork and innovation behaviors through game-based learning (GBL). *Sustainability, 13*(24), 1-16.

Mistretta, S. (2022). The metaverse—An alternative education space. *AI, Computer Science and Robotics Technology, 2022*, 1-23.

Mystakidis, S. (2022). Metaverse. *Encyclopedia, 2*(1), 486-497.

Narin, N. G. (2021). A content analysis of the metaverse articles. *Journal of Metaverse, 1*(1), 17-24.

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

Purnamasari S, A., & Wijoyo, H. (2023). Analisis efektifitas pembelajaran bahasa Indonesia di perguruan

tinggi era 5.0. *Jotika Journal in Education*, *2*(2), 50-56.

Putri, N. I., Widhiantoro, D., Munawar, Z., & Komalasari, R. (2022). Pemanfaatan metaverse di bidang pendidikan. *Tematik: Jurnal Teknologi Informasi Komunikasi (e-Journal), 9*(1), 44-52.

Rahmadani, N. S., & Setiawati, M. (2019). Aplikasi pendidikan online “Ruang Guru” sebagai peningkatan minat belajar generasi milenial dalam menyikapi perkembangan revolusi industri 4.0. *Bahastra: Jurnal Pendidikan Bahasa dan Sastra Indonesia*, *3*(2), 241-246.

Rosyiddin, A. A. Z., Fiqih, A., Hadiapurwa, A., Nugraha, H., & Komara, D. A. (2023). The effect of interactive PowerPoint media design on student learning interests. *Edcomtech: Jurnal Kajian Teknologi Pendidikan, 8*(1), 12-24.

Sandoval-Henríquez, F. J., & Badilla-Quintana, M. G. (2022). How elementary students experience the use of immersive technology. *International Journal of Learning Technology, 17*(2), 115-132.

Sari, I. P., Al-Khowarizmi, A.-K., Saragih, M., Hazidar, A. H., & Manurung, A. A. (2023). Perancangan sistem aplikasi pembelajaran bahasa inggris berbasis virtual reality dan augmented reality. *Sudo Jurnal Teknik Informatika*, *2*(2), 61-67.

Sartika, F., Desriwita, E., & Ritonga, M. (2020). Pemanfaatan media pembelajaran dalam meningkatkan motivasi dan hasil belajar PAI di sekolah dan madrasah. *Humanika, Kajian Ilmiah Mata Kuliah Umum*, *20*(2), 115-128.

Scavarelli, A., Arya, A., & Teather, R. J. (2021). Virtual reality and augmented reality in social learning spaces: a literature review. *Virtual Reality, 25*(1), 257-277.

Setiawan, A. M., & Maghfirah, S. I. (2021). Efektivitas aplikasi zoom dalam proses pembelajaran Matematika. *Bitnet: Jurnal Pendidikan Teknologi Informasi*, *6*(1), 33-37.

Sholeh, M., Triyono, J., Haryani, P., & Fatkhiyah, E. (2021). Penggunaan dan pengembangan aplikasi berbasis augmented reality untuk dunia pendidikan. *JMM (Jurnal Masyarakat Mandiri), 5*(5), 2524-2536.

Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Metwally, A. H. S., ... & Burgos, D. (2022). Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis. *Smart Learning Environments, 9*(1), 1-31.

Wang, M., Yu, H., Bell, Z., & Chu, X. (2022). Constructing an edu-metaverse ecosystem: A new and innovative framework. *IEEE Transactions on Learning Technologies, 15*(6), 685-696.

Widiyono, A., & Millati, I. (2021). Peran teknologi pendidikan dalam perspektif merdeka belajar di era 4.0. *Journal of Education and Teaching (JET)*, *2*(1), 1-9.

Yildirim, D., & Gülbahar, Y. (2022). Implementation of learning analytics indicators for increasing learners' final performance. *Technology, Knowledge and Learning, 27*(2), 479-504.