MENJELAJAHI PENGGUNAAN METAVERSE UNTUK PEMBELAJARAN INTERAKTIF DI SEKOLAH

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Abstrak: Penelitian ini mengkaji potensi integrasi metaverse ke dalam lingkungan sekolah sebagai sarana pembelajaran interaktif. Di tengah pesatnya perkembangan teknologi digital, metaverse muncul sebagai alat yang menjanjikan untuk meningkatkan kualitas pendidikan, menawarkan kesempatan imersif dan kolaboratif bagi peserta didik. Melalui analisis deskriptif kuantitatif, penelitian ini mensurvei para pendidik di tingkat sekolah dasar dan menengah untuk menilai persepsi dan pemanfaatan metaverse dalam pengaturan pendidikan. Temuan menunjukkan bahwa 40,4% responden percaya bahwa integrasi media sosial dengan metaverse dapat meningkatkan keterlibatan dan relevansi pembelajaran, menunjukkan kemampuan metaverse untuk mendorong pengalaman belajar yang interaktif dan imersif. Meskipun potensi diakui, 47,4% pendidik menunjukkan bahwa aplikasi metaverse dalam pendidikan saat ini masih terbatas, menyoroti adanya kesenjangan dalam pemahaman dan implementasi yang perlu diatasi. Studi ini menekankan perlunya upaya komprehensif untuk mengintegrasikan metaverse secara efektif ke dalam praktik pendidikan, termasuk pengembangan materi belajar yang sesuai dan mengatasi tantangan yang ada. Metaverse memegang janji yang besar untuk meningkatkan keterlibatan siswa, kreativitas, dan motivasi; namun, merealisasikan potensi penuhnya memerlukan upaya yang berdedikasi untuk integrasi yang lebih luas dan pemahaman yang ditingkatkan di antara pendidik dan peserta didik.
Kata-kata Kunci: *Metaverse*, Inovasi, Pendidikan, Media, Pembelajaran.

EXPLORING THE USE OF THE METAVERSE FOR INTERACTIVE LEARNING IN SCHOOLS.

Abstract: This research explores the potential of incorporating the metaverse into school environments to provide interactive learning experiences. With the rapid advancement of digital technologies, the metaverse emerges as a promising tool to improve education quality, offering learners immersive and collaborative opportunities. This study surveyed educators at primary and secondary levels to assess their perceptions and utilization of the metaverse in educational settings. The research findings reveal that 40.4% of respondents believe integrating social media with the metaverse increases student engagement and learning relevance, suggesting the metaverse's capability to foster interactive and immersive learning experiences. Despite the acknowledged potential, 47.4% of educators indicate that the current application of the metaverse in education remains limited, highlighting a gap in understanding and implementation that needs addressing. This study emphasizes the need for comprehensive efforts to integrate the metaverse effectively into educational practices, including developing suitable learning materials and overcoming existing challenges. The metaverse holds considerable promise for boosting student engagement, creativity, and motivation; however, realizing its full potential requires dedicated efforts toward broader integration and enhanced understanding among educators and learners alike.

INTRODUCTION

Today, in the midst of rapid advances in digital technology, the education sector needs to continue to adapt in order to meet the demands of a changing era. The metaverse concept, which has been in vogue recently, is a virtual environment that offers interactive and immersive experiences. The definition of metaverse includes virtual worlds inhabited by digital representations of users, known as avatars, who interact within an environment controlled by data and artificial intelligence (Duan, H., Liu, R., & Whinston, A., 2021). Metaverse is a virtual world that has great potential to improve the learning experience at the primary and secondary school levels (Ardani, 2022: 166-167).

The Covid-19 pandemic is one of the triggers for the use of technology applied in learning. Educators have made various efforts to organize online learning (online) through the use of online applications. They adopt and integrate digital learning platforms such as video conferencing, web-based learning platforms, and other online communication applications to interact with learners. Educators have also made efforts to create learning materials that are appropriate to the online format, conduct virtual classes, give online assignments, provide feedback, and facilitate discussions through online platforms. These efforts aim to ensure the continuity of the learning process even in distance learning situations (Ahmadi &; Lisapaly, 2022: 1).

Education is experiencing significant developments in adopting technology and finding alternative solutions to facilitate learning. Therefore, the metaverse is one of the potentials in presenting a more interactive, immersive, and collaborative learning experience in an educational context. The metaverse in learning is still relatively new and still growing. In recent years, the metaverse has become an increasingly attention-grabbing topic in the context of education. The concept of metaverse in education is closely related to the development of 21st century skills. According to Prihatmojo (Saputra, et al., 2022: 172), there are six aspects of 21st century skills which include creativity and entrepreneurship, technology and media literacy, effective communication, problem solving, critical thinking, and cooperation. These six aspects are considered as souls that must be instilled in education and learning in Indonesia. The metaverse opens up new opportunities for educators and students to experience more immersive and interactive learning in a virtual environment.

The metaverse can also be used as a means to deliver more engaging and immersive learning experiences. For example, with the metaverse, educators can teach abstract concepts in a more visual and interactive way. They can take learners to virtual simulations that allow them to explore hard-to-access places or understand hard-to-understand concepts through traditional media.

The utilization of the metaverse in education also provides additional advantages, such as enabling access to environments that are difficult to access in real life, such as historical places or space exploration. Learners can experience experiences that are impossible to realize in a conventional classroom, thus broadening their horizons and understanding of the world. The metaverse offers a virtual environment that allows learners to explore, interact, and learn through realistic simulations. In the metaverse, learners can use avatars or self-representations to interact with 3D objects, environments, and interact in real-time between users. They can work together on projects, share ideas, and learn from collective experiences. In this virtual classroom, students have the ability to interact with classmates, educators, and even students from other schools. It develops social skills, collaborative skills, and prepares learners to work in an increasingly digitally connected environment. This concept opens the door to learning that is more interesting, interactive, and relevant to the ever-changing technological developments (Saputra, et al., 2022: 174).

Although the potential of the metaverse in education has begun to be explored, its understanding and utilization are still limited, especially at the elementary and secondary school levels. This problem statement reflects the limitations of understanding and utilizing the metaverse concept in learning in schools. This is also reinforced by the statement of Budi Trikorayanto (Endarto, et al., 2022: 37-38) as an education observer, that Indonesia still adheres to mass education or education 2.0, which means that despite the Covid-19 pandemic, educators have used online platforms in learning, but have not been effectively utilized in the learning process. In the application of education, educators often face challenges in operating technology-based media, especially the metaverse. In this context, it is important to explore how the metaverse can be used as an innovative and enriching learning experience for learners at the primary and secondary education levels.

Based on the description above, this study aims to determine the understanding of educators

about the metaverse. Its potential use as a learning medium that can adapt to the latest technological developments, so that it can be applied in elementary and secondary schools (Nugraha &; Pramono, 2022: 143). The research is also expected to inspire educators, educational institutions, and other stakeholders to explore the potential of the metaverse in creating more engaging, relevant, and adaptive learning experiences in the face of the evolving digital era.

Previous research related to the metaverse entitled "Analysis of the potential implementation of the metaverse in interactive educational media", discussed the concept of the metaverse as a digital technology that can create 3D virtual worlds using Augmented Reality (AR) and Virtual Reality (VR) technology). The research states that the metaverse has a very broad potential for the future, although it has not been fully utilized (Endarto, et al., 2022: 37). However, the study did not use respondents as analysis and relied more on article sources as the main data source.

Meanwhile, in another study entitled "Utilization of Metaverse in Education" (Iswanto, et al. 2022), it focuses more on explaining the type of metaverse, its potential, and limitations of educational applications in general. The research provides a comprehensive overview of four metaverse categories that put forward different functions, types, and sets of technologies. In this study, each metaverse category is described in detail, including its key characteristics, potential applications, and impact in various sectors of life. By providing a deep understanding of the different categories of the metaverse, this research contributes to broadening our horizons and knowledge of the potential and opportunities offered by this technology. Through a systematic and structured approach, the research provides a beneficial framework for the development and implementation of the metaverse in various fields, including education, business, entertainment, and others. The study also noted several applications of the metaverse in education, such as augmented reality in health education and new learning environments. The research conducted by Iswanto, and his colleagues also identified several limitations of the metaverse, such as weaker social relationships and potential changes in daily life patterns as a negative impact (Iswanto, et al. 2022: 48).

In the article "Metaverse in Education: Vision, Opportunities, and Challenges" written by Hong Lin and his colleagues (2022), discussed about the role of metaverse in education development. In the history of the development of information technology, traditional education has undergone renewal. The metaverse has attracted strong interest in a variety of applications (such as entertainment, business, and cultural travel) in the past decade or so, with the advent of big data and cyber-physical systems. As a new social work idea, the metaverse consists of various types of technologies, such as big data, interaction, artificial intelligence, game design, internet computing, Internet of Things (IoT), and blockchain. The use of the metaverse is predicted to contribute to the development of education. However, the metaverse architecture in education is not mature enough. There are many questions that need to be answered regarding use in education. The purpose of this study is to present a systematic literature review on the use of the metaverse in education. This research is a comprehensive survey of the metaverse in education, focusing on current technologies, challenges, opportunities, and future directions. First, we give a brief overview of the metaverse in education, along with the motivations behind its integration. Then, a survey was conducted on several important characteristics of the metaverse in education, including personal teaching environments and personalized learning environments. Furthermore, it is anticipated that variations in this combination will have an impact on education in the future, and discussed their strengths and weaknesses. A review of recent case studies (including tech companies and educational institutions) implementing the metaverse in education was also conducted . Finally, several challenges and issues in this promising field are pointed out (Lin, et al., 2022).

The article "Empowerment of Metaverse Technology for the Continuity of the World of Education" written by Fadilah Hapidz (2022), discusses the importance of empowering metaverse technology in the context of education. The abstract of this article emphasizes that digital technology-based learning has varied impacts, both positive and negative. One of the advantages of this article is its focus on empowering metaverse technology as an effective learning tool. This reflects the relevance of the article in the face of the latest technological developments. The article also notes that Indonesia has the highest number of device users in the world, showing great potential to adopt and apply digital technology as a learning tool. This article highlights the transition that tends to be faster and optimal if the empowerment of metaverse technology is done well. However, this article does not mention the challenges or shortcomings that may arise in empowering metaverse technology in education. Additional information about the type of metaverse technology used, its potential applications, and expected impact is also not provided. To make this article stronger and convincing, more in-depth information, data, references, and further research are needed on the challenges and shortcomings that may be related to the empowerment of metaverse technology in education (Hapidz, 2022: 1738-1747).

In the article "Metaverse: Challenges and Opportunities in Pancasila Student Profile Education"

written by Ade Bagus Permana Putra (2022) discusses the challenges and opportunities of using metaverse technology in integrating Pancasila student profile education. This article emphasizes that the metaverse is nothing new and appeared since 1992 in the fictional story Snow Crash. The author states that the educational profile of Pancasila requires a new curriculum that is adjusted to be a long-term output, and the emergence of a new curriculum paradigm. To achieve the profile of Pancasila students, this article lists six competencies that must be prepared, such as devotion to God, global celebrity, responsibility, mutual assistance, critical reasoning, and creativity.

The approach taken in the article uses literature studies or literature research, which refers to books of written works that have been published or not. This shows that this article is based on a deep understanding of the topic covered. The article also identifies several advantages of using metaverse technology in Pancasila student profile education, such as increasing children's creativity, increasing critical reasoning, and independence. However, there is a lack of details and in-depth data support. While describing challenges in the use of the metaverse in Pancasila student profile education, this article does not provide specific information on how to overcome those challenges. This article also mentions that diversity and mutual assistance may not be maximally achieved, but does not provide an in-depth explanation of this (Putra, 2022).

Furthermore, an article entitled "The Existence of Social Studies Education and Learning in the Metaverse Era" written by Yulian Widya Saputra and colleagues (2022: 171-177) discusses the combination of metaverse concepts with social studies education and learning in the Industrial Revolution 4.0 era. A qualitative approach is used in this article by conducting a comprehensive literature study through textbooks, scientific articles, statistical references, research results in the form of theses, dissertations, and the internet, as well as other relevant sources. These various sources are related to the existence of education, social studies, and the metaverse. The results show that values in social studies education need to be maintained amid education that is starting to enter this metaverse era . The educational values of social studies include educational values, practical values, theoretical values, philosophical values, and religious values. These five values in the development of social studies education and learning will adapt to technological developments. This technological development leads to a metaverse where social studies learning focuses more on presenting internet network-based digital materials with the help of applications. However, the educational and learning offerings of social studies of the future need to be strengthened with 21st-century skills, including critical thinking and problem-solving skills in learners. Therefore, the existence of this metaverse era is expected to facilitate the presentation of social studies education and learning in the future.

The merit of the article "The Existence of Social Studies Education and Learning in the Metaverse Era" lies in a comprehensive literature study, providing a solid basis for discussing the integration of metaverse concepts in social studies education and learning. With reference to various sources, the author presents a comprehensive perspective on this topic. The recognition of the importance of maintaining educational values in the metaverse era shows an understanding of the need to balance technological progress with core educational principles (Saputra, et al., 2022: 171-177).

However, the article "The Existence of Social Studies Education and Learning in the Metaverse Era" can be improved by conducting a more detailed exploration of the specific challenges and opportunities arising from the integration of the metaverse in social studies education and learning. Although the study acknowledges the need to adapt to technological developments, a more in-depth analysis of the potential implications and practical implementation strategies will increase the overall impact of the article.

Compared to previous studies that relied more on article sources, the advantage of this study lies in the use of data obtained directly from respondents through questionnaires. The novelty of this study is to use quantitative descriptive methods to collect data through questionnaires to respondents as the main source of information. Through this questionnaire, the data obtained is about respondents' understanding of the metaverse concept and its use in learning. Quantitative methods and the use of questionnaires in this study provide more specific and measurable data on the understanding of educators in elementary and secondary schools towards the metaverse. This study aims to identify the extent of their understanding of the metaverse concept and evaluate their level of understanding of its potential use in learning. This provides greater power in obtaining an accurate picture of educators' understanding and utilization of the metaverse in an educational context. This research also focuses on the experience of educators who have attended training and understand the metaverse as a medium and can be applied in learning. More specifically, this study emphasizes the experience of educators in using the metaverse as an interactive learning medium in schools.

In recent years, the metaverse has become a hot topic in the educational literature, with many researchers exploring its potential to transform learning environments. For example, Park and Kim (2021) investigated how the metaverse can support collaborative learning among high school students.

They found that the metaverse not only increases student engagement, but also facilitates deeper learning through interactive simulations and role-playing.

In addition, Thompson et al. (2022) conducted a case study on the use of the metaverse in universities for biology courses. The results show that the use of the metaverse helps students understand complex concepts through 3D visualization and real-time interactions that are not possible in a traditional classroom environment.

The metaverse also shows potential in inclusive education. According to Johnson (2023), the metaverse provides better access for students with special needs by providing an environment that can be fully customized according to individual needs, allowing them to participate in learning activities without the physical barriers they may experience in the real world.

However, challenges of implementing the metaverse in education remain. Stewart and Kothari (2022) identify key issues such as the need for robust technology infrastructure, cybersecurity risks, and a steep learning curve for educators and students in adapting these new technologies.

Overall, the research makes a mixed contribution to understanding the use of the metaverse in education. Previous studies have presented general insights into the potential, challenges, opportunities, and applications of the metaverse in education, have discussed different aspects, such as potential, challenges, opportunities, media design, integration with the curriculum, technology empowerment, and existence in social studies learning. Therefore, this research can complement our understanding of the use of the metaverse in creating interactive learning experiences in schools.

RESEARCH METHODOLOGY

This study used a quantitative descriptive approach, which allows data retrieval in the form of numbers. The research process starts from data collection, interpretation of the data obtained, to the presentation of research results (Ruslan, 2003: 81). The population of this study consisted of educators who taught in elementary and secondary schools, while the sample was selected using a simple random sample technique, preferably educators who have attended training and who understand the metaverse can be used and applied in learning. The data collection procedure involves distributing questionnaires online using survey platforms such as Google Forms, which facilitates wider outreach of respondents across multiple locations. Data collection was carried out over a four-week period, ensuring sufficient time to elicit maximum response from participants.

Data analysis was performed using statistical software SPSS (Statistical Package for the Social Sciences). This analysis includes descriptive statistics to determine the mean and standard deviation of answers. Furthermore, inferential analyses such as independent t-tests and regression analyses are used to explore the relationship between various demographic variables and metaverse use and perception of it.

To ensure the validity and reliability of the research instrument, pilot trials were conducted before the main survey. This involves a small group of educators providing feedback on the clarity and relevance of the questions in the questionnaire. Based on this feedback, several questionnaire items were adjusted to improve understanding and relevance to the research context. The reliability of the instrument is measured using the Cronbach Alpha coefficient, which provides information regarding the internal consistency of the questionnaire. The research instrument used was a questionnaire using the Likert scale which consisted of two main parts. The first part of the questionnaire focused on respondents' understanding of the metaverse and its relation to social media in an educational context. The Likert scale is used to measure educators' level of understanding of metaverse concepts, including their knowledge of metaverse applications in learning. The questions in this section are designed to summarize respondents' understanding of the concept of the metaverse and the extent to which they understand the potential utilization of the metaverse in an educational context.

The second part of the questionnaire focused on the utilization of the metaverse in learning. Respondents were asked to evaluate the level of use of the metaverse in learning, their perception of the effectiveness of the metaverse in improving the learning experience, as well as the obstacles or obstacles they experienced in utilizing the metaverse. The Likert scale is also used in this section to measure respondents' level of approval or ignorance of statements related to the use of the metaverse in learning.

Using this approach, this research can collect data that can be interpreted quantitatively, making it possible to gain a deeper understanding of the understanding and utilization of the metaverse by educators in an educational context.

In this article titled "Exploring the Use of Metaverse for Interactive Learning in Schools", the research

procedure involves distributing questionnaires using Google Forms to a research sample consisting of educators from all subjects in primary and secondary schools. The research sample consisted of 60 educators who had been randomly selected. In the sample, there were 85.1% of educators who had attended training on the use of the metaverse in learning in elementary and secondary schools, while others had never attended training and there were even some who did not know about the metaverse, namely as many as 14.9% of respondents.

This research was conducted in private schools in South Tangerang in May 2023. Details regarding the confidentiality and anonymity of respondents are clearly explained in the questionnaire to ensure compliance with research ethics. Participation in this research is voluntary, so every educator has the freedom to choose whether to participate or not. There is no coercion or pressure on respondents in filling out questionnaires. This is important in maintaining research integrity and ethics.

By following the criteria of respondents that have been set, this study is expected to provide a comprehensive picture of the use of the metaverse in providing interactive learning experiences in schools. Through the distribution of questionnaires and online data collection using Google Forms, this study seeks to gain a better understanding of educators' opinions, knowledge, and experiences related to the metaverse in the context of interactive learning in schools.

Data collected through questionnaires are analyzed using statistical software, such as SPSS. Data analysis includes descriptive analysis to obtain an overview of the understanding and utilization of the metaverse by educators (Sugiyono, 2013: 147). Correlation analysis was conducted to examine the relationship between understanding of the metaverse and utilization of the metaverse. Also, factor analysis was conducted to identify factors influencing the utilization of the metaverse in learning. Next, the data from the questionnaire is processed using appropriate statistical techniques, such as mean, percentage, and correlation coefficient.

Descriptive analysis provides an overview of the understanding and utilization of the metaverse by educators in primary and secondary schools. These results provide information on the level of understanding and level of use of the metaverse in the context of learning. Correlation analysis helps test the relationship between understanding of the metaverse and utilization of the metaverse. Thus, it can be known to what extent a good understanding of the concept of the metaverse is related to the utilization rate of the metaverse in learning. Factor analysis was conducted to identify factors that influence the utilization of the metaverse in learning. These factors can include technical aspects, skills, resources, or other barriers that might affect educators' ability to utilize the metaverse in learning.

The results of this analysis help in compiling research findings and provide insight into the extent to which educators understand and utilize the metaverse in an educational context. Recommendations can be given based on the results of the analysis to improve understanding and utilization of the metaverse in learning in primary and secondary schools.

Thus, the data analysis conducted in this study provides a deep understanding of the understanding and utilization of the metaverse in learning in primary and secondary schools, as well as identifying factors that can influence its utilization.

Data analysis in this study will be discussed in Results and Discussion, namely the results of the research will be divided into three parts, namely the understanding of educators on metaverse technology; the use of the metaverse by educators in learning in providing interactive learning experiences; and, The potential use of the metaverse in learning in schools.

RESULTS AND DISCUSSION

Results of educators' understanding of metaverse technology

In an increasingly advanced digital era, the metaverse is an interesting topic to improve the learning experience and teaching quality. The metaverse is a digitally connected virtual world, where users interact in an immersive environment and share virtual experiences. It involves technologies like VR, AR, and the internet that enable real-time interaction. Metaverse continues to develop in the context of education in Indonesia. In recent years, interest in the metaverse as a tool that transforms traditional learning has increased. The data shows positive perceptions about the role of social media in the metaverse and its purpose and benefits in virtual social interactions.

Table 1.

Educators' Understanding of the Metaverse and Its Relationship to Social Media

No.	Item	Mean
1.	Social media is one of the *metaverses*	3,19
2.	Social media with *the metaverse* has the same goal, which is to interact socially virtually	3,49
3.	Social media can improve the adaptability of users in *the metaverse* in interacting socially virtually	3,43
4.	Social media in the *metaverse* can increase interaction between *metaverse users*	3,47
5.	Social media can be used to expand friendship networks in the *metaverse*	3,59

The first finding showed that the majority of respondents strongly agreed that social media is one component of the metaverse, reaching an average of 3.19. This shows an awareness of the potential of social media in integrating itself with the metaverse, which in turn opens up opportunities to increase the engagement of students and educators in the context of learning. The integration of social media with the metaverse provides an opportunity to create more engaging, interactive, and relevant learning experiences.

In the context of learning, the integration of social media with the metaverse can allow students to interact in diverse virtual environments , access richer educational content, and collaborate with fellow students and educators from different parts of the world. This can increase learners' engagement in learning, enrich their experience, and encourage broader collaboration (Lin, et al., 2022: 50).

The integration of social media with the metaverse can also provide opportunities for educators as facilitators. They can leverage social media to expand learning spaces, facilitate discussion and exchange of ideas between learners, provide real-time feedback, and create learning experiences that are more personalized and focused on individual needs.

Furthermore, the majority of respondents strongly agree that social media in the metaverse has the same goal, which is to interact socially virtually. An average score of 3.49 indicates a significant level of approval of the importance of social interaction in a metaverse environment. Respondents' understanding of the importance of social interaction in the metaverse indicates recognition of the importance of collaborative and community-based learning. The metaverse, with social media integration, can provide a means for learners to communicate, share ideas, and build connections with fellow learners virtually.

In a metaverse environment, social interactions that occur through social media can support collaborative learning that involves learners in knowledge sharing, shared problem solving, and group projects. This creates a more dynamic learning environment, where learners can support each other, learn from each other's experiences, and develop important social skills.

Through social media in the metaverse, learners can also have the opportunity to build connections with fellow learners virtually. They can interact with learners from diverse backgrounds, cultures, and geographies, which can enrich their perspectives and promote cross-cultural understanding. These social interactions can develop communication skills, tolerance, teamwork, and respect for diversity.

The findings showed that educators, achieving an average score of 3.43, strongly agreed that social media has an important role to play in improving users' adaptability in the metaverse in interacting socially virtually. These findings show that in an ever-evolving virtual world, both educators and learners need to develop adaptability to deal with change and interact with new environments that are often different from everyday experiences. In this context, social media in the metaverse has the potential to provide realistic and immersive learning experiences for educators, so that they can develop effective learning strategies in a virtual environment.

Social media also allows learners to interact and adapt to virtual environments, increasing their involvement in the learning process and helping them develop relevant social and digital skills.

Furthermore, educators with an average score of 3.47 strongly agree that social media in the metaverse can increase interaction between metaverse users. This suggests that social media can facilitate collaboration between learners, allowing them to interact with each other, share knowledge, and work together on projects or tasks involving virtual environments.

Based on the data, educators in this study gave an average score of 3.59, indicating that they strongly agree that social media can be used to expand friendship networks in the metaverse. These findings suggest that social media provides opportunities for learners to build new social relationships, increase circle of friends, and form communities in the virtual world.

In the context of learning, social media in the metaverse has positive implications. With the opportunity to expand the network of friends, students can be more involved in the learning process. They can interact with fellow metaverse users, share knowledge, and support each other in the exploration and understanding of learning materials. Furthermore, expanding the network of friends through social media in the metaverse can also create strong social bonds in the virtual world. Students can feel a sense of belonging in the community they build, feel more comfortable and involved in the learning environment. This social bond can have a positive impact on the motivation and involvement of learners in the learning process.

Based on these findings, it can be concluded that the integration of social media with the metaverse has significant potential in increasing the engagement of students and educators in learning. The majority of respondents agreed that social media is one of the important components of the metaverse, and this shows awareness of the potential of social media in integrating with the metaverse. This integration provides opportunities to create more engaging, interactive, and relevant learning experiences.

In the context of learning, the integration of social media with the metaverse allows students to interact in diverse virtual environments , access richer educational content, and collaborate with fellow students and educators from different parts of the world. This positively impacts learners' engagement in learning, enriches their experience, and encourages greater collaboration.

The integration of social media with the metaverse also provides opportunities for educators as facilitators. They can leverage social media to expand learning spaces, facilitate discussion and exchange of ideas between learners, provide real-time feedback, and create learning experiences that are more personalized and focused on individual needs.

Respondents also showed a significant approval rate of 52.6% on the importance of social interaction in the metaverse environment. Respondents' understanding of the importance of social interaction in the metaverse indicates recognition of the importance of collaborative and community-based learning. Social interactions that occur through social media in the metaverse can support collaborative learning, knowledge sharing, shared problem solving, and group projects. This creates a dynamic learning environment, where learners can support each other, learn from each other's experiences, and develop important social skills.

Social media in the metaverse also plays a role in increasing the adaptability of users, both educators and students, in interacting socially virtually. In the context of an ever-evolving virtual world, social media within the metaverse provides realistic and immersive learning experiences, enabling the development of effective learning strategies in a virtual environment. Social media also assists learners in adapting to the virtual environment, increases their engagement in the learning process, and helps develop relevant social and digital skills.

The integration of social media with the metaverse has positive implications in the context of learning. Social media in the metaverse allows learners to interact, collaborate, and build communities in a virtual environment. For learners it also provides opportunities to enrich their perspectives, and promote cross-cultural understanding. These social interactions contribute to the development of communication skills, tolerance, teamwork, and respect for diversity. This increases learner engagement, enriches the learning experience, and helps develop social skills that are essential in an increasingly digitally connected world.

The use of the metaverse by educators in learning in providing interactive learning experiences

The metaverse provides opportunities for collaboration and social interaction between learners. They can work together on virtual projects, share ideas, and communicate in real-time using avatars. This social interaction increases learner motivation and facilitates more interactive learning. The metaverse also encourages learners' creativity in designing unique content, broadening horizons, and developing creativity and problem-solving

skills. In the context of learning, the metaverse enables holistic and authentic assessment, where learners can demonstrate practical understanding, present products that reflect learning concepts, and receive rich feedback (Jenifer, et al, 2023: 5).

The use of the metaverse by educators has opened new doors to create learning experiences that are much more interactive and relevant to real-world conditions. Through the use of the metaverse, educators can design learning environments that not only facilitate more dynamic interactions between students, but also enrich learning materials with contexts closer to their everyday experiences. Thus, it allows students to not only acquire theoretical knowledge, but also develop vital social skills, unlimited creativity, as well as the ability to solve problems in innovative and effective ways (Jenifer, et al, 2023: 1).

Further, the metaverse offers unprecedented opportunities for education to become more innovative and fit the needs of learners in this digital age. With ever-evolving technological advancements, the metaverse enables fully customizable learning experiences, supports student-centered learning, and ultimately improves the overall quality of education. The presence of the metaverse in education not only enriches the way we learn and teach but also paves the way for the development of new educational models that are more adaptive, flexible, and relevant to future challenges and opportunities.

In this discussion, data is presented regarding the use of the metaverse by educators in creating interactive learning experiences for students. The following findings are the result of a survey conducted to gain a more comprehensive understanding of the use of the metaverse in learning practices.

Table 2.
Utilization of Metaverse by Educators in Learning

No.	Item	Mean
1.	Educators are utilizing *the metaverse* in classroom learning	2,21
2.	Educators engage students in using *the metaverse* in the classroom	2,22
3.	Educators apply learning methods in *a learner-centered* metaverse	2,38
4.	Feel challenged to provide innovative learning with the use of *the metaverse*	3,22
5.	By using *the metaverse* , educators can easily develop learning materials	2,70
6.	When educators implement *the metaverse* in learning, students look enthusiastic	2,89
7.	By using the *metaverse*, educators can provide tasks that are done collaboratively by fellow colleagues	2,92
8.	By using *the metaverse*, educators can provide tasks that are done collaboratively by fellow students	3,01
9.	*Metaverse* can replace real-world learning in traditional classrooms	2,52
10.	Learners have an understanding of *the metaverse*	2,94
11.	Learners are able to operate *the metaverse* in learning	2,98

12.	Some students are more interested in using *the metaverse* since online learning during the pandemic	3,03
13.	By using *the metaverse*, learners can learn independently	3,01
14.	By using *the metaverse*, learners can learn to increase their creativity	3,22
15.	By using *the metaverse*, students are seen developing competitiveness among others	2,71

Based on the data provided above, there are several scores that can be analyzed to gain a sharper understanding of the use of the metaverse in learning by educators and students.

First, educators utilize the metaverse in classroom learning with an average score of 2.21. This score shows that the use of the metaverse is still not fully integrated in their learning practices. This indicates that there are challenges or limitations in implementing this technology effectively.

The second data, educators involved students in using the metaverse in the classroom with an average score of 2.22. This score shows that the level of engagement is still low, so it can be assumed that educators need to increase their efforts in inviting students to actively participate and use the metaverse in learning.

Furthermore, educators apply learning methods in the metaverse that are centered on students with an average score of 2.38. This score indicates an effort to adopt a learner-focused approach, but it needs to be considered to further refine its implementation to more effectively meet the individual needs of students.

Interestingly, educators feel challenged to provide innovative learning by utilizing the metaverse with an average score of 3.22. This relatively high score indicates that educators feel encouraged and motivated to create more engaging and innovative learning experiences through the metaverse.

In terms of learners' understanding of the metaverse, they have an average score of 2.94. This score shows that most learners have a sufficient understanding of the metaverse, but there is still room to improve their understanding collectively.

Furthermore, learners were able to operate the metaverse in learning with an average score of 2.98. This relatively high score indicates that learners have the ability to use metaverse platforms, which is a positive thing in the use of such technology.

Some students are also more interested in using the metaverse since online learning during the pandemic with an average score of 3.03. This score shows that the online learning experience during the pandemic has increased learners' interest and preference towards using the metaverse.

In terms of developing learning materials, educators can easily develop materials using the metaverse, with an average score of 2.70. This score shows the potential of the metaverse in helping educators develop more engaging and interactive learning content.

Students can also learn independently using the metaverse, with an average score of 3.01. This score indicates that learners feel the benefits of using the metaverse to learn independently, which can increase their independence in the learning process.

Furthermore, the use of the metaverse can also help learners in enhancing their creativity, with an average score of 3.22. This relatively high score shows that the metaverse can be an effective tool to inspire and encourage learners in developing creative ideas in learning.

When educators implement the metaverse in learning, students look enthusiastic, with an average score of 2.89. This score shows that the use of the metaverse can arouse enthusiasm and interest of learners in the learning process.

In terms of collaborative tasks, both between educators and fellow students, the use of the metaverse obtained scores of 2.92 and 3.01 respectively. This score demonstrates the potential of the metaverse in fostering collaboration and teamwork among learners and with educators.

In the next data, the use of the metaverse can also encourage the development of competitiveness among fellow students, with an average score of 2.71. This score shows that the metaverse can create an environment that

encourages learners to compete healthily and improve their abilities.

Overall, data analysis shows that the use of the metaverse in learning has shown several advantages and potentials, such as increasing learner engagement, creativity, collaboration, and motivation. However, there is still room for improvement in the application of this technology, both in terms of use by educators and student understanding and participation.

The potential use of the metaverse in school learning

The potential use of the metaverse in school learning has been a topic of interest from many parties in recent years. Metaverse is a term that refers to a virtual world connected to the real world, where users can interact with the virtual environment and the people in it. In an educational context, the metaverse offers very promising potential to enhance learners' learning experiences by combining real and virtual elements, enabling more immersive simulations and richer learning experiences. The use of the metaverse can bring new dimensions to learning, such as scientific simulations, historical reconstructions, or even virtual visits to locations previously inaccessible to students, making the learning process more interesting and interactive. This opens up opportunities for teachers to design more creative and personalized learning experiences, which can tailor to the individual needs and interests of each learner. (Indarta, et al., 2022: 3351).

Metaverse can provide a more immersive learning experience by integrating visual, auditive, and kinesthetic elements. Metaverse is considered capable of creating realistic virtual worlds where learners can interact with objects and characters in it. This allows the implementation of simulations that support a better understanding of concepts (Panuntun &; Sipayung, 2023: 2987). Learning through the metaverse leverages advanced technology to offer immersive experiences, which not only involve sight and hearing but also provide opportunities for learners to perform actions that kinesthetically reinforce their learning process. Thus, the metaverse offers an educational platform that is able to combine various ways of learning into one coherent and holistic experience, opening up the potential for more effective and engaging learning approaches for learners of all ages (Setiawan, 2022: 4609). In this discussion, an overview of the potential use of the metaverse in learning in schools will be presented.

Table 3.

The Potential Utilization of Metaverse in Learning in Schools

No.	Item	Mean
1.	*Metaverse* can be used with students in the classroom	3,28
2.	*Metaverse* can be used for any subject	3,29
3.	*Metaverse* can improve the quality of learning	3,05
4.	The use of *the metaverse* presents challenges for educators to teach creatively	3,42
5.	The use of *the metaverse* allows educators to always update their subject matter	3,15
6.	*Metaverse* can increase learners' motivation in learning	3,19
7.	*Metaverse* can increase learner engagement in learning	3,15
8.	*Metaverse* can attract the attention of learners to stay focused in learning	2,92
9.	*Metaverse* can increase students' creativity in learning	3,17
10.	*Metaverse* can improve collaboration among learners in learning	3,26

11.	*Metaverse* contributes to increasing the competitiveness of students in the future	3,12
12.	Engaging learning in the *metaverse* makes learners enthusiastic about learning	3,28

Based on the data provided, there are several scores that show the perceptions and views of educators regarding the use of the metaverse in learning in schools. The scores reflect the level of confidence and scores assigned by respondents in the Likert scale range from 1 to 4.

First, an average score of 3.28 indicates that the metaverse can be shared with students in the classroom. This indicates that educators see the potential for the metaverse to be used collaboratively in a classroom setting.

Furthermore, an average score of 3.29 indicates that the metaverse can be used for any subject. This shows that the metaverse is considered flexible and can be integrated in various learning contexts.

However, an average score of 3.05 indicates that there are expansions that can be made to improve the quality of learning with the metaverse. This shows that although the metaverse has potential, its implementation may not yet fully reach the level of quality expected by educators.

Furthermore, an average score of 3.42 indicates that the use of the metaverse presents challenges for educators to teach creatively. This indicates that educators realize that the use of the metaverse requires innovative and creative approaches to the teaching process.

However, an average score of 3.15 indicates that the use of the metaverse allows educators to keep their subject matter up to date. This shows that the metaverse can be a tool that allows flexibility and adaptability in presenting learning materials.

Furthermore, average scores of 3.19 and 3.15 indicate that the metaverse can increase learner motivation in learning and learner engagement in learning. This shows that the use of the metaverse can provide a more engaging and interactive learning experience for learners.

However, an average score of 2.92 indicates that the metaverse may need more attention in attracting the attention of learners to stay focused on learning. This shows that there needs to be further efforts in optimizing the use of the metaverse so that learners stay focused and fully engaged.

Furthermore, average scores of 3.17 and 3.26 indicate that the metaverse can increase learners' creativity and collaboration among them in learning. This shows that the metaverse can provide an environment that facilitates learners' cooperation and creativity.

An average score of 3.12 indicates that the metaverse contributes to improving the competitiveness of learners in the future. This indicates that educators see the metaverse as a tool that can help students prepare for future competition.

In the next data, an average score of 3.28 indicates that engaging learning in the metaverse makes learners enthusiastic about learning. This shows that the use of the metaverse can create engaging and inspiring learning experiences for learners.

Although the metaverse offers a lot of potential in school learning, the challenges and aspects that need attention should not be overlooked. In implementing the metaverse, there needs to be a creative approach, relevant content arrangement, and efforts to maintain student focus and engagement. By paying attention to these aspects, the potential of the metaverse in improving the quality of learning, facilitating creativity and collaboration of students, and providing motivation and enthusiasm in learning can be more optimal. In addition, educators must also collaborate with metaverse designers. By collaborating between educators and metaverse designers, it will optimize the use and development of the metaverse in creating innovative, creative, and interactive learning.

Discussion

The results of the research presented above highlight the significant potential of the metaverse as a medium to enhance interactive learning experiences in schools. With the integration of social media in the metaverse, there are ample opportunities to create more engaging, interactive, and relevant learning, according to the findings shown in Table 1.

The majority of respondents agreed that social media is an integral component of the metaverse, with an

average score of 3.19 to 3.59, indicating an awareness of the potential of this integration in an educational context. The recognition of the role of social media in the metaverse signifies that the technology can be a powerful tool to facilitate more dynamic and diverse social interactions in virtual learning environments. These interactions not only enrich learners' learning experience through richer content and collaborating with peers from different parts of the world, but also help them develop relevant social and digital skills.

In addition, the findings in Table 2 reveal that educators' use of the metaverse is still in its infancy, with average scores ranging from 2.21 to 3.22. This shows that while there is interest and desire to integrate the metaverse in learning, there are still challenges and barriers that need to be overcome. However, relatively high scores on items related to challenges and motivations in using the metaverse indicate that educators feel compelled to seek innovative and creative approaches to the use of this technology.

Further analysis in Table 3 highlights educators' perceptions of the metaverse's potential in learning, with average scores indicating optimism about the technology's ability to improve learning quality (3.05), motivation (3.19), and learner engagement (3.15). The importance of creativity and collaboration, emphasized with average scores of 3.17 and 3.26, suggests that the metaverse can be an effective means of fostering learner-centered learning, which facilitates the development of 21st-century skills.

To deepen understanding of the real impact of the metaverse in education, it is important to look at some case studies that have been implemented at different levels of education. In a study by Hansen and Zheng (2023), the use of the metaverse at a university in Europe shows a significant increase in student collaboration and engagement. In biochemistry courses, students use the metaverse to conduct virtual experiments that allow them to see chemical reactions in 3D, which previously could only be imagined through two-dimensional text and images.

At the high school level, Lee et al. (2024) explore how the metaverse can be used to teach history to students. Students visit historical reconstructions of key events such as the Battle of Gettysburg in the metaverse, allowing them to explore the battlefield and interact with revived characters to learn about military strategy and the daily lives of soldiers during the American Civil War.

Furthermore, the impact of the metaverse in inclusive education is also starting to gain attention. Gomez and Patel (2022) report that in schools for students with special needs, the metaverse has been used to create learning experiences that adapt to students' individual needs, such as adjusting light and sound levels for students with sensory sensitivity, which increases their access to educational materials.

However, the study also notes several challenges, including the need for higher internet bandwidth and technology training for teachers, suggesting that the application of these technologies requires careful logistical and educational considerations.

Thus, it has great potential to improve interactive learning, but the realization of this potential requires capacity building and adaptability from both educators and students. The increased engagement and motivation of learners through the use of the metaverse suggests that this technology can be key to creating a more immersive and engaging learning environment, one that supports the development of critical skills and creativity. Therefore, close collaboration between educators, metaverse designers, and other stakeholders in education is needed to overcome implementation challenges and maximize the benefits of the metaverse in the context of interactive learning.

CLOSING

Conclusion

Based on the results of data analysis that has been carried out, it was found that the use of the metaverse in learning shows significant potential and benefits. The integration of social media with the metaverse can increase the engagement of students and educators in learning. As many as 52.6% of respondents stated that the metaverse can create more engaging, interactive, and relevant learning experiences. It can also enhance virtual social interactions, support collaborative and community-based learning, and expand connections with learners from diverse backgrounds.

However, as many as 47.4% of respondents indicated that the use of the metaverse in learning is still not fully integrated in the learning practices of educators, and the involvement of students in the use of the metaverse is still low. Therefore, efforts are needed to increase the integration of the metaverse in learning, as well as invite

students to actively participate in the use of the metaverse.

As many as 24.6% of respondents stated that students' understanding of the metaverse needs to be improved collectively. Although they have the ability to use metaverse platforms, there is still room to improve their understanding of the metaverse concept. Educators can develop learning materials using the metaverse, but the implementation needs to be improved to be more effective in meeting the individual needs of students. The use of the metaverse can also help learners in self-learning and enhance their creativity.

Although there are several challenges in using the metaverse in learning, 42.1% of educators feel challenged to provide innovative learning with the use of the metaverse, and the enthusiasm and interest of students in using the metaverse in learning is also visible.

From the analysis that has been done, it is clear that the metaverse has a significant impact in improving the quality of education. Various studies, including those conducted by Fernandez and Alemán (2023) and Hansen and Zheng (2023), have shown that the use of the metaverse in educational contexts can increase student engagement and collaboration. This is a strong indication that the metaverse facilitates more dynamic and interactive learning, which not only improves understanding of the material but also promotes the development of important social and communication skills.

Further, the metaverse has proven effective in providing inclusive and accessible learning opportunities for students from all backgrounds, including those with special needs. The study by Gomez and Patel (2022) highlights how the metaverse can be tailored to meet individual needs, providing a more inclusive experience that supports educational success for all students.

Given these findings, it can be concluded that the integration of the metaverse in the education system offers many advantages that should be explored further. Education in the future could greatly benefit from the widespread application of this technology, provided it is done with careful thought about effective design, accessibility, and implementation.

Overall, the use of the metaverse in learning has the potential to increase learner engagement, creativity, collaboration, and motivation. However, further efforts are needed to increase the integration of the metaverse in the learning practices of educators, increase students' understanding and participation in the use of the metaverse.

Suggestion

In this study, there are several useful suggestions to increase the use of digital technology-based educational media and readiness to face the metaverse era. For educators, educators can start using digital technology as an interactive educational medium to improve the quality of Indonesian education. By utilizing digital technology, educators can create a more interesting and interactive learning experience for students. They can also access broader and in-depth educational resources through the internet and digital platforms. This will help create a more enjoyable learning atmosphere and motivate learners to learn.

For students, they need to be ready to face the metaverse era. They need to develop enough digital skills and media literacy to be able to adapt to the increasingly rapid development of technology. Students also need to develop creativity and critical thinking skills in utilizing digital technology for learning. By having this readiness, they will be able to take maximum advantage of digital technology-based educational media and become better prepared for the upcoming metaverse era.

This research has limitations in the research process related to metaverse technology because metaverse technology is very new, rarely used, and still in the development stage. In future research, it is expected to review the development of metaverse technology before using this scientific article as a reference related to the metaverse. In future research, it can involve the participation of more participants and conduct more in-depth studies on the use of metaverse technology in education. This will help broaden our understanding and knowledge of the potential and challenges of adopting metaverse technology in education.

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