Impact of Metaverse in Educational Environment

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Abstract

The purpose of this review is to define metaverses and to explain their potential and limitations for pedagogical applications in educational environment. The Metaverse has infinite possibilities as a new social communication space. In other words, the Metaverse is a post-reality universe, an eternal and permanent multi-user environment that combines physical reality and digital virtuality. Regarding the educational use of the metaverse, the following future tasks are proposed: First, teachers need to carefully analyze how students understand the metaverse. Next, teachers should design classes that encourage students to collaboratively and creatively solve problems and complete projects. Third, an educational metaverse platform should be developed to prevent the misuse of student data.

Keywords: metaverse in education environment; social interaction; student

Introduction

The Metaverse is based on technologies that enable multisensory interactions with virtual environments, digital objects, and people. In other words, the Metaverse is a post-reality universe, an eternal and permanent multi-user environment that combines physical reality and digital virtuality. When it comes to online distance learning, Metaverse has the potential to address the fundamental limitations of his web-based 2D e-learning tools (Mystakidis, 2022). This study states that the metaverse affects the educational environment, that is how students interact with their surroundings (Arofah et al., 2023). One way that Metaverse is expected to be a standard for students’ comprehension and can improve students’ learning skills. Nevertheless, this study highlights the role of the metaverse in the social impact on teachers and students dynamically and adaptively (LAM et al., 2021).

The development of metaverse technology should follow community social interaction, particularly in the post-pandemic era (Aditama, Atmoko, Hidayah, et al., 2023). However, the Metaverse has a significant impact on how students connect with others, which is psychologically related to mental health. The competency of the kids may suffer from this condition. The state of one's mental health will impact their quality of life and social interactions in a variety of ways (Situmorang, 2023). The usage of technology affects social interaction in the classroom. Educational pedagogy is a highly specialized area of study, and the introduction of technological advancements has led to periodic changes. Educational metaverse environments also allow users to collaborate on projects, discuss and share ideas, access resources from around the world and interact in a virtual setting. (Akour et al., 2022)

Methodology
Metaverse research is reviewed through a systematic literature search based on the type of research that existed before. In evaluating and synthesizing discussions and findings of previous research, emphasize accuracy and completeness (Taylor, 2010). The goal is for a balanced and objective analysis based on different perspectives, which are then juxtaposed based on previous writings about the potential of the metaverse in the learning process. Literature analysis is considered an effective tool for researchers to identify and understand topics relevant to practice. In addition to literature review, qualitative interviews can also be used as a source of research data (Marrone & Hammerle, 2017). This approach will be in-depth across cases: Based on a picture of the results in a particular phenomenon in different ways and intensities. The goal of this process is to create a complete picture of the phenomenon and gain insight into the causative factors. Therefore, insights into the consequences of using the metaverse in education must be unearthed which is then analyzed using the results of a literature review.

Result and Discussion

Digital education platforms (such as Moodle, Blackboard, and edX) allow learners to take advantage of asynchronous learning experiences. Virtual meeting platforms (Zoom, WebEx, etc.) have supported learners and teachers to overcome spatial boundaries and participate in synchronous learning. Despite the availability of many digital tools for online education, existing technology is unable to accurately simulate the learning experience provided by face-to-face classroom instruction. The idea of virtual three-dimensional worlds has been around since tools like the Open Simulator Project, Second Life, and VR head-mounted displays (such as the Oculus Rift) came onto the market. However, virtual worlds in educational services are unable to replicate face-to-face learning experiences because they are unable to convey the cognitive and emotional experiences that occur through gestures, body language, co-presence, social interaction, and engagement.

The metaverse roadmap categorizes the metaverse into 4 types: augmented reality, lifelogging, mirror world, and virtual reality based on these 2 axes. Table 1 summarizes the definitions, characteristics, application fields, and use cases of each type (Kye et al., 2021). The use of the metaverse in education has the potential to improve the functionality of online learning experiences and enable education providers to create online learning environments that mimic face-to-face instruction. Recent educational disruptions have highlighted the importance of finding ways to recreate physical learning experiences to address the challenges posed to education systems by the pandemic (Pappas & Giannakos, 2021). Therefore, the use of Metaverse in education, compared to previous technologies, facilitates more interaction between users and their surrounding environment, simulates emotional and cognitive experiences, and improves overall face-to-face can better mimic the educational experience of The implementation of education in the metaverse is still in its infancy, given that AI-powered adaptive learning systems are not yet widespread and the use of IoT for seamless virtual interaction in real space remains rare (Chandra & Leenders, 2012).

Using the Metaverse in education allows students and educators to interact in a virtual world while mimicking the social and emotional realms of the physical world. When students join the Metaverse for educational purposes, they are able to seamlessly interact with each other, educators, and the environment. To design a metaverse platform for education, it is important to have a clear understanding of the elements of face-to-face education and how they can be replicated in the virtual world. Challenges in this regard may include, for example, simulating the social interaction of avatars in the metaverse embodying the gestures and body language of learners and teachers. Imitation raises the question of how the features of the metaverse are designed to best simulate the learning environment. While learners and educators can design their own avatars in the Metaverse, it is important to allow individuals to convey sensory information such as facial expressions in the virtual world, allowing educators to understand students' body language. Metaverse expands the number of learning
opportunities by allowing educators to provide students with hands-on training using scenarios not available in the physical world. For example, it is possible to simulate the high-speed driving of a racing driver, allowing students to gain experience as a driver. Such practical scenarios allow students to experience the relevance of introduced theories and understand new meanings, enriching their learning experience through action, creativity and real-world experience (Kabudi et al., 2021; Zhang & Liu, 2021).

Table 1. Four types of the metaverse

<table>
<thead>
<tr>
<th>Type of Metaverse</th>
<th>Definition</th>
<th>Features</th>
<th>Applications</th>
<th>Use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Reality</td>
<td>Building a smart environment by utilizing location-based technologies and networks.</td>
<td>Recording information about objects and people using augmented technology</td>
<td>Smartphones, vehicle HUDs</td>
<td>Pokemon Go, Digital Textbook, Realistic Content</td>
</tr>
<tr>
<td>Lifelogging</td>
<td>Technology to capture, store, and share everyday experiences and information about objects and people</td>
<td>Virtual maps and modeling using GPS technology</td>
<td>Wearable devices, black boxes</td>
<td>Facebook, Instagram, Apple Watch, Samsung Health, Nike Plus</td>
</tr>
<tr>
<td>Mirror World</td>
<td>It reflects the real world as it is, but integrates and provides external environment information.</td>
<td>Based on interaction activities between avatars that reflect the user’s ego</td>
<td>Map-based services</td>
<td>Google Earth, Google Maps, Naver Maps, Airbnb</td>
</tr>
<tr>
<td>Virtual Reality</td>
<td>It reflects the real world as it is, but integrates and provides external environment information.</td>
<td></td>
<td>Online multiplayer games</td>
<td>Second Life, Minecraft, Roblox, Zepeto</td>
</tr>
</tbody>
</table>

Figure 1. Potential to use metaverse for future teaching and learning (Onu et al., 2023)

Metaverse allows educators to extract information about the reactions and interactions of the 10,000 students in their classroom. Using literature about the virtual world, students were able to convey some of their emotions through their avatars. Research shows that difficult
questions increase student attention and suggests that educators feel more empowered when they are able to analyze student responses to their teaching practices. Insights gained from the use of eye tracking data support the development of new user input interaction methods for learning and gaming experiences for both children and adults (Papavlasopoulou et al., 2021).

Metaverse expands the number of learning opportunities by allowing educators to provide students with hands-on training using scenarios not available in the physical world. For example, it is possible to simulate the high-speed driving of a racing driver, allowing students to gain experience as a driver. Such practical scenarios allow students to experience the relevance of introduced theories and understand new meanings, enriching their learning experience through action, creativity and real-world experience (Sharma & Giannakos, 2020).

![Figure 2. (A, B) Diagram of 4 types of the metaverse (Kye et al., 2021)](image)

As existing learning formats develop further, new questions arise, such as how the Metaverse can facilitate new formats of training and when Metaverse lessons should be combined with face-to-face lessons. In the education field, the stages of a student's competency development involve social interaction among peers. The effects of technology use have penetrated social interaction and mental health (Situmorang, 2023), like in the educational environment, presented as a barrier to student competency development. Technology addiction in children is on the rise, which affects their social and psychological well-being. This essay advocates the improvement of student mental and social health in the metaverse era. Classrooms provide space for students to interact with others (Putra et al., 2023). Consequently, the classroom trains students' social skills by communicating and collaborating with other students. More advanced technologies, such as virtual classrooms, were presented to adapt after the Covid-19 outbreak, (Bastian et al., 2023) purposed to provide distance interactions for safety measures, and not to replace the role of humans and his/her surrounding physical interaction.

In the future, the effectiveness of education will depend on how much it helps students become better thinkers and decision-makers (Aditama, Atmoko, Muslihati, et al., 2023). The metaverse is an instrument for accomplishing the future development of human competency. As a result of technological disruption, the metaverse offers a simpler role that allows people to increase their talents without losing sight of the core of what it is to be human. The scale of
operational capability development is recommended for group training of teachers to improve teacher competence, especially in the Internet and Technology (Rasmani et al., 2023). The reading readiness of children undergoing interactive ICT learning exerts a greater influence compared to those undergoing non-interactive ICT learning (Nasution et al., 2020). This development then has an impact on teachers to be able to think and act rationally. And the advancement of technology as a tool ought to go hand in hand with human growth. (Dwivedi et al., 2022). For example, the use of technology in early childhood education such as Smart Adventure games is influential and effective for early childhood reading and writing skills (Dwiyanti et al., 2018).

Conclusion

The use of the metaverse in education is expected to revolutionize existing learning approaches by expanding learning methods and opportunities for learners, educators, and education providers. These include the design of metaverse features, new forms of his learning, changes to teaching and assessment methods, availability and training on the use of associated devices, etc. We draw on the literature on the predecessors of the Metaverse (i.e., virtual worlds) to consider aspects of the use of the Metaverse in education that require further research, and to discuss the major changes that can be expected when using the Metaverse. And in the future it can be applied in every learning level of education.

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References


