

## Reflections of Metaverse-Based Education on E-Learning

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### Abstract

After the COVID-19 pandemic, both teachers and learners have reached a new understanding in the use of technology. With the change in the understanding of education, their access to technology has become a necessity. The adoption of Internet technologies as a learning tool facilitated the adoption of the metaverse environment. One of the most frequently mentioned problems in distance education is the inadequacy of communication and interaction between users. Metaverse has become more popular in this process with the interaction opportunity it offers to users. Metaverse is based on the interaction of technologies, which include virtual environments and objects that provide close to real life experiences. Learners who are physically in different places can come together in the perception of reality in the metaverse universe and be in the teaching process and interact with each other and socialize. Especially in the multi-user interaction world of metaverse, it is possible for learners to develop their sense of presence and to provide high interaction among learners. Moreover, the learners being active participants and being able to convey their feelings easily support their existence in the environment with high attention and interest. This study aimed to explain the reflections on e-learning by presenting a perspective on the use of metaverse in educational environments. In this direction, the word metaverse is explained, the current situation is examined and the reflection of metaverse based education on e-learning is discussed.

**Keywords:** *Education, Online learning, Virtual reality, Augmented reality*

### Introduction

With the change in the understanding of education, access to technology has become a necessity, not a privilege. Both teachers and learners have reached a new level of understanding in the use of information and communication technologies, especially due to the changing educational needs after the COVID-19 epidemic. The adoption and use of

Internet technologies as a learning tool has facilitated the adoption of the Metaverse<sup>2</sup> environment. The decrease in communication among learners with distance education and the lack of interaction has made the concept of metaverse more common (Lee, 2021). Metaverse can be said to be revolutionary for teachers and learners, and in this context, it is predicted that it will greatly change the teaching processes.

Metaverse is a digital universe accessible through virtual reality (VR) and augmented reality (AR) technology. It was put forward by science fiction writer Neal Stephenson in 1992 (Stephenson, 2014). The metaverse, derived from the words "meta" and "universe" (Cheng et al., 2022), was created by the emergence of a new class of enhanced social interaction beyond entertainment (Wright et al., 2008). It is a cyber environment where users can interact with their avatars (virtual identities) that offer an integrative and immersive experience (Chohan, 2022; Ko et al., 2021). This environment creates a new reality and collaborative environment, provides interaction opportunities for cultural, information and economic production and supports the integrated use of different advanced technologies (Kuş, 2021). The new digital reality, called Metaverse, has been described by Facebook as the "next generation" of the internet (Huynh-The et al., 2022). Mark Zuckerberg, the founder of Meta, a pioneer in the field of virtual universe, stated that the metaverse environment will become a mainstream technology in the next 5 to 10 years and our physical reality will merge with the digital universe (The Verge, 2021). In other words, an emphasis was placed on an alternative digital reality where people work, play and socialize.

Metaverse is based on the interaction of technologies that include virtual environments and objects that offer close to real-life experiences. It is a layer created between users and reality (Alang, 2021). Regarding this layer, Dionisio et al. (2013) stated that the importance of the metaverse concept will increase and VR and AR technologies will be discussed more in parallel with the metaverse. In this direction, before looking at the reflections of the metaverse environment in education, it would be appropriate to examine the concepts of augmented and VR, which are at the center of the metaverse environment.

Educational applications designed with AR technologies can improve the learner's perception of the real world. Video, graphics, etc. items developed with AR technology are supported by computer-generated sensory inputs (Graham et al., 2013). Schoenfeld (2016)

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<sup>2</sup> Metaverse is a concept that contains many parameters and is defined through meanings such as virtual universe, fictional universe, meta universe, virtual world, virtual layer, multi-sensory universe, new generation cyber environment.

states that AR applications as an educational tool show that they can improve the performance and analytical skills of learners, and that these applications also increase the motivation and participation levels of the learners. VR is an interactive and multi-sensory world that uses computer simulation (Schuemie et al., 2001). VR is an innovative approach to facilitate learning and remembering, supported by tactile technologies, and created with game-based learning techniques (Butt et al., 2018). In educational applications created with VR, learners are expected to interact between their senses and reality.

Metaverse is a new environment for education with the possibilities it offers. It is liberal in creating and sharing, and new experiences and high immersion can be provided through virtualization (Kye et al., 2021). On the other hand, it is a new field for social communication (Javaid et al., 2020; Matthews et al., 2021) and it is expected to change education processes; because the metaverse and the AR it offers, artificial intelligence and blockchain technologies are expected to facilitate learning. It has also been confirmed that autonomous learning can be developed using VR and AR technologies (Lopes & Gonçalves, 2021). In this context, in educational practices developed in the metaverse environment, not only online learning activities should be at the forefront, but a holistic perspective including pedagogy should be provided (Jeon & Jung, 2021). In other words, it should offer an educational environment where pedagogy is prioritized and technology and educational content are designed according to learner characteristics and subject context.

### **Reflections of Metaverse Based Education on E-Learning**

Metaverse based education includes facilitating elements for learning such as learning by doing and experiencing, and learning by combining different disciplines. According to Mystakidis et al. (2021), metaverse based education provides an interesting and immersive learning experience by combining different disciplines. For example, in chemistry teaching, studies on different subjects can be done with learners in a virtual laboratory environment. By creating an interactive laboratory within the scope of biology course, instructional activities can be carried out with real life scenarios and scenario based learning environments can be created (Wolfram, 2020). By combining such scenes and theoretical knowledge learned at school through interactive simulations in the metaverse environment, learning efficiency, interest and motivation can increase and learning can gain a new meaning. In addition, learning with three dimensional simulations can contribute to reducing the cognitive load that

occurs during the lesson (Henderson, 2011). With the development of such scenarios, while the basic theoretical knowledge learned at school gains meaning again, teachers can be offered the opportunity to overcome practice gaps and learners to learn by experience. Metaverse also provides access to primary sources from anywhere in the real world. In metaverse based education, information can be accessed from anywhere, not just from textbooks and classrooms.

The technology department of a UK school has taken on the task of creating their own VR-based teaching and learning scenarios in different disciplines (history, science and geography) to overcome the learning problems that have arisen during the pandemic. Thus, they allowed learners to experience these course contents in more detail than ever before (The National, 2021). A school in Florida in the USA has announced that they will establish a virtual school in the metaverse environment from August 2022 for the needs of distance education after the Covid-19 pandemic. A school day is planned as four hours of live lessons, four hours of independent study and additional courses to be held in the metaverse classroom (Euronews, 2022). Duan et al. (2021) created a university campus prototype in the metaverse. Suh and Ahn (2022) researched how relevant the metaverse environment is to the lives of primary school students. Their findings revealed that 97.9% of the students had experience with the metaverse and 95.5% of them thought that it was closely related to their daily lives. Lee et al. (2022) developed an aircraft maintenance simulation system incorporating VR and metaverse methods into the classroom to compensate for the lack of existing remote hands-on training models. The findings of their experimental studies comparing their systems with the video training method showed that the group using the developed system scored higher than the video training group in both the knowledge acquisition test and the retention test. Lee and Hwang (2022) researched the multidimensional aspects of pre-service English language teachers' readiness to design technology-enhanced VR learning environments and examined how these environments could be connected to a metaverse platform for sustainable education.

In metaverse and the multi-user interaction world it provides, it may be possible for learners to develop their sense of presence, to be active participants, to be in the environment with high attention and interest, to convey various emotions easily, and to have high interaction with their environment and others. Storing and sharing content, customizing the virtual classroom, and simulating presence with avatars can provide an immersive and realistic learning experience (Jovanović & Milosavljević, 2022). In some scientific studies, it has been

shown that VR based learning increases academic achievement scores and learner participation (Akman & Çakır, 2020; Al Amri et al., 2020; Kim, 2021; Liu et al., 2020; Yıldırım et al., 2020). For this reason, it will be important for teachers to move the learning process to a VR based environment in terms of supporting learner participation and academic success.

Considering the emergency remote teaching process with the COVID-19 pandemic, various video conferencing applications have been widely used in simultaneous online teaching. These are video-based applications such as Microsoft Teams, Google Meet, Zoom and Adobe Connect (Saidi et al., 2021). With these applications, people in different places can communicate simultaneously in a virtual environment. However, there are also lacks such as "learner distraction, limited interaction, passive participation, low emotional expression" in these virtual environments (Mystakidis, 2022). At this point, in the immersive virtual reality environment provided by the metaverse universe, learners are expected to experience the simulation of existence with virtual identities, to develop their sense of presence (Georgiou et al., 2021; Hite et al., 2019), to increase their interaction with the content, environment and other learners, and to have a realistic learning experience (Jovanovic & Milosavljević, 2022). AR applications can improve the performance of learners and these applications also increase the motivation and participation levels of learners (Bazarov et al., 2017; Dakeev et al., 2021; Schoenfeld, 2016). Applications such as Spatial.io, Mozilla Hubs, Horizon Workrooms, which allow collaborative virtual meetings, can be used for teaching purposes (Lyu et al., 2022). In this direction, immersive virtual reality environments can be used to move teaching to the metaverse universe.

In Spatial (<https://spatial.io/>), learners can meet in a virtual place simultaneously, create their own avatars, turn on their cameras and participate with their microphones. The teacher can instantly share the screen in the Spatial environment, embed web pages and conduct the lesson by integrating different documents into the environment during the lesson. Teachers can create sub rooms in a Spatial environment, similar to the breakout rooms that exist in video conferencing tools. In this way, they can do different collaborative small group studies with sub rooms. The owner of the environment can control the attendees' settings such as audio and microphone. The Spatial can be used independently of the device. Mozilla Hubs (<https://hubs.mozilla.com/>) also offers a customizable environment like the Spatial app. It is open source and compatible with most VR headsets. Horizon Workrooms

(<https://www.oculus.com/workrooms>) is a simple and effective environment created by Facebook for Oculus Quest 2 where people can communicate and collaborate in a virtual environment. Users can participate with their virtual identities. It also has features like whiteboard and file sharing.

The virtual, collaborative and task-oriented nature of the Metaverse environment can help children learn by playing games and having fun. The "gamification" of learning in the metaverse environment is one of its instructional advantages. Digital environments such as Minecraft, which encourages collaboration among anonymous users, and Second Life, which offers its users an alternative virtual life, have attracted hundreds of millions of players around the world. These games, in which the basic ideas of the metaverse environment are presented, take gamification in the metaverse to an important point. Various studies have shown that learning experiences are most effective when they are fun (Butt et al., 2018; Yıldırım & Şen, 2019). Games also represent areas of experiential learning where learners have rich, embodied, collaborative interactions, and they think with complex tools and resources in complex problem-solving techniques (Jovanović & Milosavljević, 2022). In fact, it is more than strategic opportunity or marketing that makes game-based learning environments effective in the metaverse.

Both VR and AR environments allow learners to experience course activities virtually in structured learning environments. Immersive virtual environments offer interaction opportunities based on the use of realistic images and effects that imitate situations that students cannot or can hardly experience in daily life (Hite et al., 2019). Therefore, immersive VR simulations can be considered as powerful pedagogical tools to support students' learning of abstract scientific concepts (McGrath et al., 2010). In this way, opportunities to practice with real-life simulations supported by theoretical knowledge can arise in teaching processes.

The limit of creativity in a course in the metaverse environment depends on the creativity of the teacher, because in this universe learning environments can be used simultaneously by connecting to each other. Interactive content can be developed with different learning tools, taking into account the course plan, the objectives and achievements of the course, and learner characteristics. So interactive content can be used in the classroom created in the metaverse environment. It is important to update learning contexts according to current scientific developments (Gökmen et al., 2016) and adapt global changes to curricula and lesson contents; however, there are some difficulties at this point (Parlak, 2017). It can be

said that the metaverse can help us to overcome the lack of updating the knowledge, as well as contribute to the progress of the learners in the relevant field and to cope with the challenges of a constantly competitive world outside the classroom environment.

In metaverse based education, there is also a need for evaluation studies to collect data to support learning. Especially in virtual teaching environments, measurement and evaluation is a very important issue for teachers (Ertuğ, 2020). In current education systems, problems regarding measurement and evaluation still exist. (Özalkan, 2021; Taşkın & Kılıç Çakmak, 2017). For example, written exams may be inadequate in both demonstrating and evaluating the practical skills required for certain professions. Because some studies state that learning by doing is superior to rote learning (Güneş, 2020; Kardaş & Uca, 2016). The fact that a learner can demonstrate real, hands-on experience by virtually connecting an electrical fuse, repairing a malfunctioning machine, or even performing a surgery, instead of reviewing existing theoretical knowledge for a written exam, will contribute positively to the training of professionals in the relevant field. In addition, it may be possible with the metaverse to experience these processes without risky consequences in the real world (Kye et al., 2021).

These advantages may also contribute to the educators to make more objective evaluations. Metaverse has a certain potential as a new field of social communication. This potential is very important to ensure social communication, which is difficult to provide among learners, especially in e-learning environments. In Metaverse, more than one person can be present in an environment at the same time and can work collaboratively. It is very important for the learning process that the learners, who are physically in separate places, come together in the perception of reality of the metaverse universe in the teaching process, interact with each other and socialize. In this direction, it can be said that the metaverse environment has a high potential to strengthen social communication. Therefore, in the metaverse environment, many issues from identity to cultural diversity, from ethics to linguistic barriers need to be handled carefully. In order to support learners to produce original projects, teachers should design their lessons by considering activities such as problem solving or collaborative learning. Basically, the training program focuses on improving the learning outcomes of learners. The educational process activated by VR and AR supports the learner to gain certain knowledge by experiencing it (Damar, 2021). On the other hand, virtual execution of the process may cause some security problems. The fact that the metaverse environment is virtual and offers anonymity can lead to the occurrence of illegal crimes and identity uncertainty. Therefore, it may cause real-world

adaptation problems for learners (Kye et al., 2021). At this point, since the endless communication potential will raise concerns about privacy, some precautions should be taken in terms of ethics and security.

## Conclusion

Metaverse offers many educational advantages such as learning by doing, user interactive learning, scenario-based learning with real life scenarios, learning by experiment, studying independently of time and place. Metaverse-based learning is suitable for constructivist strategies such as situational learning, cognitive apprenticeship, and social negotiation (for example, highly computational learning tasks such as heuristic problem solving, personal choice, and tracking cognitive strategies) (Ertmer & Newby, 1993). Many learning theories based on cognitivism, such as information processing theory or social cognitive theory, and Siemens' (2004) connectivism theory may also be suitable for the metaverse. Learning theories provide guidelines for students about motivation, learning process and learning outcomes (Radianti et al., 2020). Therefore, it is very important for researchers to consider existing learning theories while developing educational metaverse applications.

It would be helpful for teachers to carefully analyze how learners understand the metaverse environment. Understanding what learners want to do there, why they like it, and what value they place on their avatars in VR can be one of the important tasks of educators in the metaverse environment. It is necessary to examine the activity patterns of the learners, their level of entering the metaverse, and the positive and negative effects of the learners on their learning activities. The development of educational metaverse platforms that prevent misuse of student data can also be beneficial. Therefore, instructional designers and instructors who want to use the metaverse environment for education need to properly understand the technical characteristics and design classes of each metaverse environment in order to be able to solve problems or carry out projects collaboratively and creatively. There will also be a need to conduct evaluation studies to collect data to support teaching and learning processes.

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