

# Metaverse in Education

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**Abstract:** *The presence of technology in everyday life has also entered the field of education, including as a virtual environment. Metaverse is one of the technologies that can bring new learning and teaching processes. It is a virtual environment that allows multiple users to interact in a 3D space. This technology can bring new ways of learning and teaching, such as simulations, virtual visits to museums or historical sites, virtual exercises, and more. The use and development of applications for these technologies, as well as artificial intelligence, is the connection between ICT and educational techniques. The goal of this article is to define metaverse and describe the roles of virtual, augmented, and mixed reality. The use of artificial intelligence and applications in metaverse can also bring new opportunities for personalized learning that adapts to the needs and preferences of individual students. For example, based on the analysis of the data from previous interactions and results there can be created recommendations for students and their learning.*

**Keywords:** METAVERSE, TEACHING, VR, AR, MR, INTERNET, EDUCATION

## 1. Introduction

In today's world, there is an increased interest in using technology to improve educational goals. Metaverse is a virtual world environment that allows for the creation and interaction with virtual objects and characters. Due to its functionality, the Metaverse has great potential in the field of education. One example of using the Metaverse in schools could be a virtual learning environment where students can interact with various virtual objects such as cell structures, landscapes, or even planets. Such an environment can be an interesting and innovative way for students to learn new information. The Metaverse can also help in language teaching. Creating a virtual world in which students must communicate in a foreign language with other characters can be a very effective way to learn a language. Additionally, the Metaverse can be used in the field of training and education in the workplace. Employees can use the Metaverse to learn new procedures or train for various situations, which can lead to improved performance and reduced risk of errors. However, it is important to note that the Metaverse is a technology that is in its early stages of development and there are technological limitations that may affect its use in education. Furthermore, due to its dependence on technology, the use of the Metaverse should be carefully considered and healthy boundaries for students should also be considered.

## 2. Metaverse

The Metaverse is a combination of the prefix "meta" which means transcending, with the word "universe" which describes a parallel or virtual environment connected to the physical world. The Metaverse was first created in 1992 by Neal Stephenson in his sci-fi novel *Snow Crash*, which imagines a virtual reality based on avatars on the internet. Since then, the Metaverse has been defined and considered distinct from virtual environments, including collective spaces in virtual worlds, mirror worlds [1], embodied internet/spatial internet [2], a new type of internet application and social form that integrates a range of new technologies, a post-real universe including a persistent multi-user environment that connects physical reality with virtualization [3].

In academic literature, it is stated that "Metaverse means a world in which virtual and reality influence each other and develop socially, economically and culturally to create value" [4]. From these two definitions, it follows that Metaverse simply does not combine physical and virtual worlds; on the contrary, it is a continuity of the physical world in the virtual world to create an ecosystem that connects both worlds (physical and virtual). Knox [5] supports the idea that the Metaverse is an ecosystem and emphasizes its scope and emphasizes that the Metaverse "is not just an ordinary platform developed by one company, which indicates the usual limitations of monopolization (users of one network)". The idea that the Metaverse is an ecosystem is also mentioned.

## 3. VR, AR, MR = xR

The term "VR", "AR", and "MR" are abbreviations for virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies [6]. These technologies are also used in education, where they allow for the creation of realistic environments for simulations, training, interactive learning materials, and other forms of teaching. The use of these technologies in education allows the students and the employees to better understand and remember the subject matter, improves their practical skills, and provides an interactive and engaging form of learning.

The Metaverse is built using a wide range of new technologies, it's online, it's a social network, and it provides immersive experiences through AR, MR, and VR. This world is a replica of the real world with an economic system based on blockchain technology and blends the real and virtual worlds in its economic, social, and identity system, where every user can create content and modify their world without cultural and political constraints. So, we can see replicas of buildings, environments, spaces, and objects from the real world, although the Metaverse is not an exact copy, it presents its properties and functions. Based on VR technology, AR can increase the penetration between virtual and physical space. The AR system creates a virtual 3D model through interaction technologies between human and computer, optoelectronic display, real-time 3D animation, computer graphics and tracking registration technology. The virtual model is displayed in the real world to connect the user to a combined environment and gain new experiences [7]. Additionally, AR systems increase the ability to capture information beyond the scope of human perception in the real world. Human perception expands as these pieces of information are processed by the AR system, making them perceptible to humans. Some of the potentialities and limits of the Metaverse and xR technology applied to education are like those in e-learning, such as location: both the student and the teacher can be located anywhere in the world. The Metaverse and xR technology in education offer a more immersive and interactive learning experience. Students can engage with learning materials and environments in a more natural and intuitive way, using their whole body and multiple senses. This can lead to a deeper understanding of the subject matter and better retention of information.

Another potential advantage of the Metaverse and xR technology is the ability to simulate real-life situations and experiences, which can be particularly useful for training in fields such as medicine, engineering, and aviation. Students can practice skills and procedures in a safe and controlled environment without the risk of harm to themselves or others.

However, there are also limitations to the use of Metaverse and xR technology in education. One of the main challenges is the cost and accessibility of the technology. Creating and maintaining virtual environments and providing the necessary hardware and software for students to access them can be

expensive. There is also a risk of over-reliance on technology, which can lead to a loss of personal connection and communication between students and teachers. It is important to ensure that the use of Metaverse and xR technology is balanced with face-to-face interaction and other forms of learning.

Finally, there are concerns about privacy and security in the Metaverse, particularly regarding the collection and use of personal data. It is important to establish clear guidelines and regulations to ensure that students' privacy is protected, and their data is used responsibly.

#### **4. Results and discussion**

This article provides a brief description and evaluation of the metaverse and xR technologies. It shows that the fundamental characteristics of VR/AR/MR and the Metaverse, which are immersive and multi-sensory interactive experiences, can be introduced into education.

VR is a popular choice among college students as a supplement to teaching, despite related costs and side effects such as nausea. AR has shown the greatest potential for independent study. Larger and long-term studies are needed to determine the real effectiveness and consider the clinical relevance of these technologies. In addition, the potential for monetization through the use of the Metaverses in education should also be considered. For instance, schools can potentially monetize the use of virtual classrooms, where students can interact with each other and their teachers in a virtual environment. This could potentially be a source of revenue for schools and a way to fund the implementation of new educational technologies.

Furthermore, future research could explore the use of different platforms and projects for different subjects and catalogue various platforms and projects according to their effectiveness in transferring educational experiences. Another possibility is to develop a curriculum for these platforms/projects that would help educators become more familiar with the Metaverse.

In conclusion, while there is much potential for the use of VR/AR/MR and the metaverse in education, there is still much research needed to determine their true effectiveness and clinical relevance. However, with the ongoing advancements in technology and the increasing demand for innovative educational experiences, the future of education in the Metaverse looks promising.

#### **5. Conclusion**

Metaverses can provide schools with opportunities for monetization. In future works, authors could test different platforms/projects with different subjects and bring insights into which ones could be most useful, and catalogue various platforms/projects for comparison of age/subject with regards to effective transfer of educational experiences. Another possibility is to approach the curriculum of these platforms/projects or create a curriculum plan that will help educators become more familiar with the Metaverse.

Another possibility for research could be exploring the potential of the Metaverses for educating specific groups of students, such as children with autism spectrum disorder. Research could also examine what are the most suitable ways to integrate metaverses into educational programs, what is the impact of using metaverses on student motivation, and what are the best ways to evaluate educational outcomes in Metaverse environments.

#### **6. References**

1. I. Lee, et al., ICIC Ex. Lett. **13**, 10 (2022)
2. K. Chayka, The NY. **8** (2021)
3. B. Kye, Edu. Heal Prof. J. E **18**, 1 (2021)
4. S. Mystakidis, Comp. **10**, 10 (2021)
5. J. Knox, Sci. Edu. Post **4**, 2 (2022)
6. L. Taylor, et al. Ana. Anz. **239**, 1 (2022)
7. K. Shiqian, et al. CIRP **83**, 2 (2019)