

# The Development and Opportunity of Educational Mode in the Metaverse Age

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**Abstract.** The Metaverse is an end-users-oriented integration of various layers of Information Technology (IT), where Human–Computer Interaction (HCI) would be the core technology. With the rapid development of IT, the Metaverse would allow users to connect, work, conduct business, and access educational resources, all in a technology-mediated environment in new interaction ways. The Metaverse can play a major role in the future of online learning and enable a rich active learning environment, where learners have the opportunity to obtain first-hand experiences that might not be accessible in the physical world. While currently there is a severe shortage in Metaverse-Learning studies, such research strands are expected to soon emerge. The main objective of this paper is to investigate challenges and opportunities for human-centric Metaverse technology in the learning sector, hence accelerating research in this field. A phenomenological research method was used, including semi-structured in-depth interviews, essays written by participants, a focus group discussion with 19 experts in the areas of HCI, intelligent interactive technologies, and online learning. Five challenges were identified for the Metaverse-Learning context: immersive design, privacy and security, universal access, physical and psychological health concerns, and governance. While the research provided suggestions to overcome those challenges, three Meta-Learning opportunities were identified: hands-on training and learning, game-based learning, and collaboration in creating knowledge. The findings of this research contribute to understanding the complexity of the online learning in the Metaverse from the Human–Computer Interaction point of view. These findings can be used to further research the Metaverse as a virtual communication environment and potential business and learning platform.

**Keywords:** Human-Computer Interaction; Metaverse; Phenomenological Research; Online Communities; Online Learning.

## 1. Introduction

With the COVID-19 pandemic declared in 2020, humanity was forced to live in a society being non-face-to-face with each other. In particular, a range of activities in the physical world has transited into the virtual world. Telecommuting, online meetings, distance learning, online shopping, etc., have become a natural part of human life. As a result, the human need to expand the boundaries of the physical world has been accelerated, triggering the yearning for a more advanced virtual world. Owing to the breakthrough of VR (virtual reality), AR (augmented reality), AI (artificial intelligence), blockchain, etc., the metaverse, a 3D digital space with collapsed virtual and real boundaries, has provoked increasing attention. It has been recognized as the next generation of the Internet (Hwang and Chien, 2022), which is about to dramatically change how we interact with the world. Owing to the breakthrough of VR (virtual reality), AR (augmented reality), AI (artificial intelligence), blockchain, etc., the metaverse, a 3D digital space with collapsed virtual and real boundaries, has provoked increasing attention. It has been recognized as the next generation of the Internet (Hwang and Chien, 2022), which is about to dramatically change how we interact with the world. The presence of the metaverse usually couples with multiple new technologies. It has been recognized as the next generation of the Internet, which is about to dramatically change how we interact with the world.

The establishment of metaverse school provides new possibilities for the development of metaverse education in the future, such as virtual-real synchronization and high simulation, innovation and open-source development, and continuous and dynamic development. The creation of the meta-universe school can not only solve the problems such as the lack of immersion in teaching

and learning, the loneliness of learning and the lack of social scope and experience caused by the separation of time and space of online learning, but also build a learning time and space parallel to the physical learning space, the integration of virtual and real environment and the development of higher order thinking. Teachers, students, parents, and others can create their own personalized learning Spaces in the meta-universe to unlock unique, personalized, and ubiquitous immersive learning experiences.

However, the previous literature rarely discussed the metaverse from the perspective of education but focused much on the metaverse-related technologies in education separately. As an emerging item, the majority of educational researchers might be unaware of what the metaverse is, its components, and its application in the educational field. as an emerging item, the majority of educational researchers might be unaware of what the metaverse is, its components, and its application in the educational field. The main contributions of this paper include the following points:

- The origin, definition, and typical features of the metaverse are discussed with the perspectives taken from state-of-the-art studies.
- Potential applications, challenges, and future research topics of the metaverse in education are presented.

## 2. The Origin and Development of the Metaverse

"Metaverse" is the Chinese definition of metaverse, consisting of the two root words Meta and Verse. Meta is derived from the Greek word for "Beyond" and is also translated as "After" from a pragmatic perspective. Verse is derived from the Universe, meaning the universe or the world. The term Metaverse implies a recognized new kingdom formed through reality. The term "metacomes" was first coined by science fiction writer Neal Stephenson in his novel *Avalanche* [1], and subsequent science fiction films such as *Ready Player One*, *Westworld*, and *The Matrix* have more realistically described the basic idea of a metacomes. After the term "Metaverse" was clearly mentioned in the prospectus of Robleus listing, the explanation of the basic connotation of the metaverse began to show diversified development, especially Facebook founder Zuckerberg used video images to present the unique social picture of the metaverse.

## 3. The Main Features of the Metaverse

The salient features of the meta-universe are deep immersion experience, embodied social network, group free creation, social civilization ecology, and the integration of virtual and real life.

### 3.1 Deep Immersion Experience

"Perception is reality" is the essence of deep immersion experience in the meta-universe. With the blessing of technologies such as augmented reality, Lifelogging, mirrored world and virtual reality, the inhabitants of the meta-universe can not only obtain the same real experience as the real world, but also the life record of the whole life cycle further enhances the immersive experience. The meta-universe is not a virtual reality game, 3D virtual space or virtual social space, but a high-fidelity space that is parallel to and independent of the natural world, based on technologies such as digital twins, augmented reality, the Internet of Things and brain-computer interfaces.

### 3.2 Embodied Social Networks

Perceptive sociability, co-presence effect and emotional experience are the prominent advantages of meta-universe embodied social networks. The meta-universe will bring panoramic social perception experience to people, create the presence effect of virtual and real scenes, especially to provide people with real social emotional experience. The meta-universe conceived by Zuckerberg highlights the social communication forms of people's entertainment, games, work or life in the meta-universe, and vividly presents the perceptual experience of people's virtual avatars traveling in the

meta-universe and socializing with others. David Basouki of Loblas explained the virtual-real fusion function of meta-cosmic social network from the two dimensions of Identity and Friends, and meta-cosmic residents can use their unique meta-cosmic identities to conduct all-round social communication, such as friends, lovers and relatives. The cross-domain socialization provided by the meta-universe also brings people a surreal social experience, and each individual can have a unique social experience with different roles in different meta-universes.

### **3.3 Social Ecological Civilization**

The metaverse is a new social ecological civilization that transcends the physical world. The social ecological civilization of the meta-universe is decentralized, sustainable and systemically sound, with complete economic system, realistic legal system and perfect meta-universe infrastructure. The meta-universe must exist in a decentralized social form, which is not only determined by the participation characteristics of the meta-universe residents, the meta-universe development process and the meta-universe distributed network, but also the basic institutional guarantee for the rapid development of the meta-universe, group innovation and the development of the digital economy. The decentralized meta-universe is an important basis for ensuring the cross-regional transactions of digital assets of the residents of the meta-universe, and is the key to eliminating the constraints of institutions, conditions, and talents in the real space. Decentralization does not mean chaos, disorder and violence, and under the protection of the meta-universe trust system and public order rules built on the block chain, it can form a good social ecology, fight against Internet giants and curb commercial monopolies.

## **4. The Need for Metaverse-Based Online Learning**

Online learning is increasingly becoming part of the learning experience, especially in higher education. The extraordinary period accelerated online learning trends, leading to the largest online movement in the history of education. However, the effectiveness of the current online learning environment is an open question. For instance, while Open Online Courses (MOOCs) have emerged as a popular innovative platform offering open access world-class educational resources, their completion rates are substantially less than for traditional education courses. On average, less than 10% of learners who sign up to an online learning environment, such as MOOCs, typically complete a course, with low retention reported to be a cause of low learner engagement due mainly to the current limitations of the 2D online learning platforms. Limited ways of interaction among participants in 2D online platforms lead to learners' inactivity and low motivation. These limitations could be addressed with the Metaverse 3D environments.

## **5. Meta-Education Opportunities**

### **5.1 Hands-On Training and Learning**

All people confirmed the possible positive impact of the Metaverse on e-learning, in terms of providing access to hands-on training using scenarios that could not be applied in the physical classrooms. "Such as flight simulation training, surgical experiment, planet discovery, or simply chemistry experiment", as mentioned by an educator interviewee. It was expressed that the Metaverse can go beyond the capabilities of the hybrid education, combining the physical classroom and e-learning platforms. Most interviewees cited that the Metaverse can deal with challenges of the current e-learning applications, such as learners' disengagement, by mirroring the learning face-to-face experience. "In the Metaverse, learners would interact seamlessly with each other, with the educators, and the environment, while simulating the social and emotional communication, facial expressions, and body language of the physical world", as cited by online learning expert interviewee. Metaverse can enable cost-effective and risk-free practice areas for trainees and students. Remote examination of patients in case of pandemic, fire protection exercises, are good examples. "In Metaverse, professionals and learners, regardless of their physical actual location, can learn tasks without

physical dangers, and can be trained on reactions to various dangerous situations, and practice unexpected situations”.

The Metaverse could reshape a new era of e-learning, which they called Meta-Education. Compared to currently known online teaching tools such as Zoom, the ultimate Meta-Education can better simulate a physical classroom experience, allowing teachers to comprehend students’ reactions and emotions, and hence adapt content based on individual reactions. The focus group recommended that Meta-learning should be accompanied by a paradigm shift in syllabus and content.

## 5.2 Game-Based Learning

The capability of Meta-Education to allow hybrid formal and informal active learning experiences in online 3D virtual campuses and classrooms, where wider deployment of game-based learning methods is employed. It was suggested that the entire online syllabus can be gamified and implemented as multiuser online games in virtual worlds. “Such game-based methods can foster learners’ inclusion, initiative, and experimentation”, as elaborated by an interviewee. Thanks to the ability to capture 360-degree panoramic photos and volumetric spherical video, Meta-Learning can be especially useful in laboratory and surgery simulations, internal human body organs observation, STEM education, and field trips to a tropical forest or an underwater wreckage, as well as gamification of the syllabus.

## 5.3 Collaboration in Creating Knowledge

Some of the people highlighted the fact that Meta-Learning can open up new possibilities for collaborative learning, enabling teamwork of learners from different institutions world-wide, unbounded by geographical restrictions. Learners with diverse and collective skills can share experience and collaborate to solve challenging problems, by cooperatively learning and creating knowledge together. Such universal collaboration might need a built-in translation feature in a Meta-Learning platform, as suggested by an interface design interviewee.

The metaverse is expected to make active learner-centric strategies more widely available, such as simulation and game-based learning. In the metaverse, learners will be able to experiment with equipment and practice complex procedural and behavioral skills without the severity of consequences or errors in the physical world. It is estimated that the meta-universe can facilitate learners' interaction with real and virtual Spaces, supported by multiple layers of technologies such as the Internet of Things, artificial intelligence, and machine learning. That being said, the information systems literature has not yet explored the use of the meta-universe in education. Therefore, it is necessary to investigate the human-computer interaction preferences of future Metaverse based online learning environments.

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