

Research on the Construction of Teaching Environment Model from the Perspective of Metaverse

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Abstract: By utilizing metaverse technology in teaching and integrating virtual and real MR teaching systems, digital twin intelligent experimental platforms, XR training systems, immersive VR teaching systems, and other technical equipment, a situational experiential teaching environment can be constructed, which can achieve a breakthrough in traditional online teaching. Teaching environment is also related to all the time, space, and personnel involved in teaching. There are both objective conditions and subjective components. Therefore, the classification of teaching environments is also diverse. Based on the concept of traditional teaching environment, this paper analyzes the changes brought by new technologies such as the metaverse to the teaching environment, explores the construction of teaching environment models under the background of metaverse technology, proposes teaching environment "Tree Ring" models and teaching environment "Tree Stump" models, and summarizes and forms a new understanding of the development laws of educational technology.

Keywords: Teaching Environment; Metaverse; Situational Experience; Teaching Environment Model

1. Introduction

The use of virtual reality fusion MR teaching system, digital twin intelligent experimental platform, XR training system, immersive VR teaching system and other technical equipment in teaching can break through the bottleneck of traditional online teaching and training. At present, teaching models based on metaverse technology have gradually emerged using the latest digital technologies, such as 5G, cloud computing, artificial intelligence, virtual reality, blockchain, digital currency, the

Internet of Things, and human-computer interaction. The so-called Metaverse is a virtual world constructed by humans using digital technology, which is mapped or transcended by the real world and can interact with the real world[1-2]. It is a digital living space with a new social system. The metaverse is essentially a process of virtualization and digitization of the real world, requiring significant modifications to user experience and physical world content. The 'metaverse' itself is not a new technology, but a comprehensive presentation that integrates a large number of existing technologies. The metaverse contains eight elements: identity, friends, immersion, low latency, diversity, anytime, anywhere, economic system, and civilization. The development of the metaverse is gradual, supported by shared infrastructure, standards, and protocols, and ultimately formed through the continuous integration and evolution of numerous tools and platforms[3]. The current common forms, such as achieving a good teaching experience through immersive paths and wearing VR devices, allow people to enter an immersive exclusive scene where everything is ready for me. Alternatively, by using overlay path AR technology to overlay and extend existing conditions, such as adding skin and skin to ordinary robots, injecting soul emotions, and making them simulation robots. In a broad sense, the teaching environment includes all material and spiritual conditions that affect teaching activities, which means that the teaching environment is composed of both physical and psychological environments. The physical environment mainly refers to teaching facilities such as venues, classes, learning tools, and learning platforms, while the psychological environment mainly refers to social, psychological, and cultural environment. From a narrow perspective, the teaching environment generally refers to all the conditions that affect teaching, including the

class and class atmosphere, teacher-student relationships, tables and chairs, etc. In summary, the teaching environment is the condition for achieving teaching[4-6].

The environment has a great impact on human growth. Social cognitive theory points out that individuals, behaviors, and the environment interact with each other. Bandura's interactive determinism model also believes that behavior, individuals, and environment are actually interconnected and interact with each other. This impact will vary depending on different activities, individuals, and environmental conditions[7-9]. In certain specific situations, a certain factor may play a dominant role. Teaching, as an activity of transmitting specific information between people, needs to be carried out effectively in a certain environment. The key to conducting research on the construction of teaching environment from the perspective of the metaverse is to apply digital technologies related to the metaverse to learning and teaching activities. The premise is that educational institutions or schools should design and construct new teaching environments that promote learning. Due to differences in research purposes, interests, and perspectives, the classification of teaching environments varies. Although different definitions exist, they all roughly reflect the context of research on the teaching environment. With the development and popularization of modern digital technologies such as the metaverse, how to use new technologies to create a favorable teaching environment has gradually become an important contemporary topic. Although terms such as online learning, mobile learning, ubiquitous learning, and metaverse learning are constantly being updated, the metaverse learning environment still belongs to the digital environment. From existing research, it can be seen that the understanding of the teaching environment varies. Different perspectives reflect the essence and connotation of the teaching environment from different perspectives. From this, it can be seen that the teaching environment involves the school environment, family environment, and social environment, as well as the material environment, psychological environment, and cultural environment. It is also related to all the time, space, and personnel involved in teaching. There are both objective conditions

and subjective components. Therefore, the classification of teaching environments is also diverse. By utilizing metaverse technology in teaching and integrating virtual and real MR teaching systems, digital twin intelligent experimental platforms, XR training systems, immersive VR teaching systems, and other technical equipment, a situational experiential teaching environment can be constructed, which can achieve a breakthrough in traditional online teaching[10].

2. Construction of Teaching Environment Model

A certain factor must have two basic conditions to become a learning environment: one is related to teaching and can affect the occurrence and development of teaching. Teaching facilities such as various learning terminals, digital libraries, learning systems (platforms), schools, workplaces, homes, communities, etc. are all equipped for teaching purposes and directly serve teaching work. These factors have become essential components of the ubiquitous teaching environment; The other is to be able to have an impact on people through teaching. Not all factors that serve teaching can have the expected impact. Although certain factors have a clear teaching purpose when used, due to various reasons, these expected effects do not have an impact on people. Therefore, these factors cannot constitute the teaching environment. Building a teaching environment for the metaverse model means planning new elements for the surrounding environment, fully leveraging the characteristics and advantages of metaverse technology, while also removing harmful elements.

2.1 "Tree Ring" Model

The learning environment can be elaborated on through spatial elements, technological elements, and service elements. In addition, it is necessary to start from the ontology of the teaching environment and identify the top-level framework of the teaching environment. In addition to the physical and social psychological environments, the teaching environment also includes a "digital space" constructed by information technology. Although it is a non physical

existence, it can be perceived and controlled by humans. This digital space constructed by computer network technology and multimedia technology is called a digital environment. The physical environment (PE), digital environment (DE), and social psychological environment (SE) all have a certain impact on learners. At the same time, the teaching environment is learner centered, including information technology, learning resources, and learning services. Summarizing the concept of teaching environment, we can obtain a "Tree Ring" model of teaching environment, as shown in Figure 1.

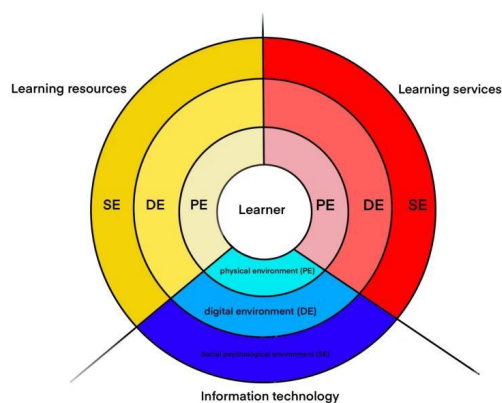


Figure 1. "Tree Ring" Model

2.2 "Tree Stump" Model

The construction of a teaching environment is people-centered, including information technology, learning resources, and learning services. Information technology provides appropriate information technology and means, such as computers, electronic teaching products, internet platforms, mobile devices, wireless communication technology, perception technology, virtual reality technology, interactive technology, multimedia technology, etc; Provide appropriate teaching time, teaching space, and teaching materials for learning resources, including learning content, learning materials, learning materials, learning activities, learning partners, teaching faculty, and teaching interactions; Learning services provide suitable teaching methods and supporting services, including one-on-one teaching, small class teaching, large class teaching, teaching management, logistics services, catering, daily life, and other adaptive and personalized services.

Whether it is information technology, learning resources, or learning services, they are all learner centered, with the aim of transforming learners' knowledge structure and ultimately achieving internalized teaching objectives.

At the same time, the teaching environment is an environment that integrates multiple levels and dimensions of physics, digital space, and social psychology. The physical level includes physical spaces such as educational institutions, workplaces, communities, and homes, including venues and equipment; The social psychological level involves educators, learners, parents, friends, work partners, and their level of acceptance in society; At the technical level, it includes various types of devices such as large, small, mobile, fixed, digital, analog, etc; The flow of information connects them together, and various heterogeneous learning devices can interoperate. Various spaces are bridged through mobile computing technology to achieve "transparency" to users, creating a good "learning atmosphere" for different types of people.

The three levels of physics, digital space, and social psychology are interrelated, developing layer by layer, and promoting each other. With the progress and development of information technology, the acceptance of social psychology continues to increase, gradually realizing the updating and upgrading of physical environment, digital environment, and social psychological environment. Starting from the underlying physical environment, it promotes the updating of digital environment and social psychological environment, and the development process shows a spiral upward trend. When information technology reaches a certain level, the teaching environment can be upgraded and replaced. The four development stages of the teaching environment are the paper-based era, the electronic era, the networked era, and the ubiquitous (metaverse) era, among which metaverse technology belongs to the new stage of the ubiquitous era.

Corresponding to the previous teaching environment "Tree Ring" model, combined with learning resources (teaching time,

teaching space, teaching materials, etc.), learning services (teaching methods and supporting services, etc.), information technology (electronic teaching products, internet platforms, multimedia technologies, etc.), a three-dimensional teaching environment "Tree Stump" model can be summarized and summarized, as shown in Figure 2.

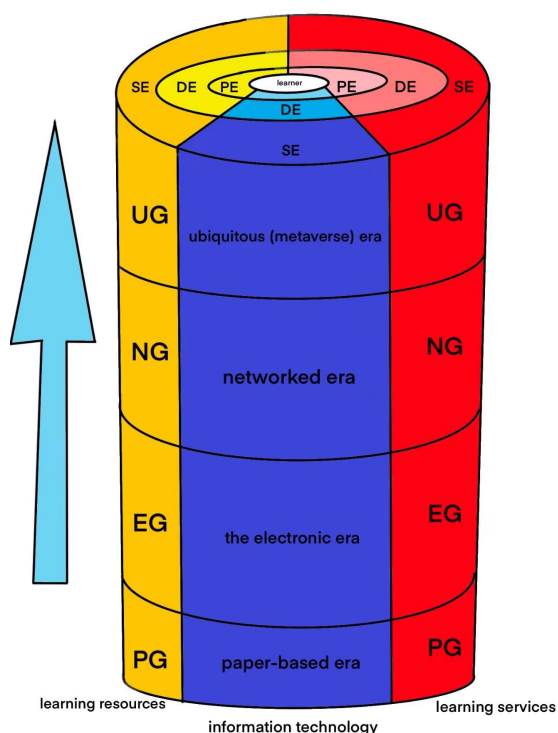


Figure 2. "Tree Stump" Model

The current position of people is at the top level, the ubiquitous era, which focuses on learners and forms learning resources, services, and information technology. From the perspective of teaching environment, it surrounds the periphery of learners and is divided into three layers from the inside out, namely physical environment (PE), digital environment (DE), and social psychological environment (SE).

3. Technical Implementation of Metaverse Mode Teaching Environment

The teaching environment must be able to be perceived and utilized by teaching staff, and have an impact on their knowledge, emotions, etc. This influence sometimes directly affects teaching staff, but more often it affects people indirectly. The implementation of the metaverse mode teaching environment mainly depends on

the stage of technological development and the degree of technological implementation. At present, there are three main modes of ubiquitous computing implementation: information device mode, intelligent interaction space mode, and wearable computing mode, which to some extent presents the initial stage of metaverse technology. The information device model emphasizes the interconnection and interoperability between things with computing power, while the intelligent space emphasizes the changes in interaction methods and interfaces, as well as the mutual mapping, interaction, and transformation between digital space and real space. The current wearable mode can build personalized learning environments around learners. The national macro level provides information infrastructure construction, teaching institutions provide interactive space for intelligent learning systems, and learners construct personalized learning environments around them through wearable modes. Therefore, teaching environments can be classified from three levels: macro ubiquitous learning networks, meso learning technology systems, and micro personal learning environments.

3.1 Ubiquitous Learning Network

The ubiquitous network follows the principle of putting people first, integrating multiple access and bearer methods to achieve seamless access. It is a dynamic and intelligent network. Create a strong sense of unity in society, where even the elderly and disabled can transcend generation gaps and geographical limitations, and easily utilize information technology to participate in social activities. From the perspective of users, fully consider technologies and services closely related to their needs; At the same time, the integration of production and consumption activities is achieved through the internet, building a society full of individuality and vitality, and continuously innovating social systems and services. Not only does it focus on the construction of information infrastructure, but also on the comprehensive penetration of information technology, focusing on major issues of human and economic society, shifting from "building an

information environment" to "improving the utilization of the information environment". The ubiquitous nature of the network has become an inevitable trend in the future information and communication society. Smart cities and digital cities with the goal of providing ubiquitous applications will fully arrive, building ubiquitous intelligent network platforms for ubiquitous information services.

3.2 Learning Technology System

Technology is the whole of material means or tools, skills, processes or activities, and knowledge, which interact and are interconnected to form the structure of technology and complete its functions. Learning technology refers to the application of technological means in teaching to promote teaching, learning, and evaluation. Specific forms include computer-based learning, multimedia material learning, and network and communication system support learning. The learning technology system refers to an external learning system that applies mainstream technologies of the era. The learning technology system needs a large platform to integrate the current digital learning system. The learning technology system should be a comprehensive learning management system with learning content management and learning activity management.

3.3 Personal Learning Environment

The Personal Learning Environment (PLE) is a loose collection of tools, services, people, and resources. It is a new way to leverage the power of the internet and is a personal electronic learning system that can help learners easily access learning resources, enabling seamless communication and communication between students and teachers in different virtual learning environments. The current research focuses on the personalization of virtual spaces, and physical space is one of the three major spaces in teaching environments. Ignoring the perspectives of physical space and personal psychological space is not comprehensive. A generalized information space is a multidimensional vector space composed of a set of

information vectors that can fully cover the information that needs to be expressed. In other words, a generalized information space is the information space within the entire physical space, including the information that human society can recognize and has already utilized, as well as the parts that cannot be recognized or have not yet been recognized. In this level of information space, information exists without relying on human will, and its vastness and complexity are immeasurable. The narrow sense of information space mainly refers to the part of information space that can be recognized by human society. For humans themselves, only the information that can and can be recognized is meaningful and closely related to humans. The personal information space is the information domain within the scope of an individual's cognitive ability. It always communicates and exchanges information with various elements in the environment it can touch, and is a dynamic and infinitely expandable space. An abstract personal communication layer has been constructed in each person's information space, which is an intelligent management system. All user information is stored and managed by it, making information dissemination activities more rich and intelligent. So, the personal learning environment is a subset of the personal information space, only transmitting teaching related information, which starts from the narrow sense of the learning environment. From a broad perspective, the learning environment is the entire living environment for learners.

4. Summary

Overall, the teaching environment includes three levels: ubiquitous learning networks, learning technology systems, and personal learning environments. By utilizing metaverse technology in teaching and integrating virtual and real MR teaching systems, digital twin intelligent experimental platforms, XR training systems, immersive VR teaching systems, and other technical equipment, a situational experiential teaching environment can be constructed, which can achieve a breakthrough in traditional online teaching. Based on the concept of traditional teaching

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