

# Experimental research on virtual simulation teaching of exhibition design based on immersive experience

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**Abstract.** Presently, in the design practice teaching courses at Chinese universities, students generally lack construction experience. Although some universities have training rooms, it is challenging to keep pace with the development of the industry due to high construction costs, long procurement cycles, and other reasons. There are potential safety hazards in some teaching practices. "Metauniverse" provides an immersive experience, and teachers and students can independently practice the design and construction without limitation of time and space. The "Metauniverse" exhibition designs a virtual simulation teaching laboratory through research, excavates students' needs, combines AR, VR, and other virtual reality technologies with somatosensory equipment, and provides channels to understand materials, experience construction, observe and learn, and correct errors in time, to improve the level of exhibition design education.

**Keywords:** Metaverse, design practice, virtual reality, Exhibition Design.

## 1. Introduction

The research on the "meta-universe" outside China mainly focuses on the meta-universe's social form, education, and operation mode. However, the thinking on improving exhibition design education under the concept of "meta-universe" is insufficient, and the experimental research on immersive exhibition design teaching is still vacant. By visiting the universities in China that have set up virtual simulation teaching laboratories and exhibition design majors, with the help of virtual reality and other technologies and body sensing equipment, an immersive virtual space for exhibition design teaching is established to meet students' practical learning, university teachers' interactive teaching, improve teaching needs, and carry out teaching practice and display sharing at any time.

## 2. Concept and development of immersive experience

### 2.1. Historical origin of immersive experience

American psychologist Mihara Chiksen Mihalai put forward the immersive experience in 1975. It refers to the mental state or experience when people concentrate on an activity. In the history of human development, there has always been a shadow of immersive experience. Now, immersive experience has started to cross the border and integrate various business formats, and the depth of narrative, interaction, and five senses integration has been constantly improved. In particular, the concept of a "meta-universe" has been put forward, and with the development of AR and VR technology, immersive experience has entered a new height of development.

The term "meta-universe" was first proposed by Neil Stephenson, an American writer, in his novel *Avalanche* in 1992. In 2018, Steven Spielberg directed the film "The Number One Player," which is considered the evolutionary future of the "meta-universe." In the future, people can explore, create, collaborate, socialize, learn, and have other experiences in this space dimension.

### 2.2. Application background of immersive experience

In the context of the "meta-universe," immersive experience is spreading to various fields. In the game field, there is a sports game, "Supernatural." Players wear VR and somatosensory devices as if they are in the scene and follow the music rhythm to enjoy sports. In drama and film, Pico, a Chinese

VR brand, joined hands with many global film industries to launch the "3D blockbuster revival plan", which gives users an immersive experience in the film plot. In the field of exhibition, there is a creative exhibition of caring for children launched by Bethune Public Welfare Foundation, which vividly presents and shares the healthy life in the eyes of children with the help of 3D digital technology innovated by Vision Innovation Cloud Exhibition. There is a 5D art restaurant in the catering field named Tianxi · Taohuayuan. The holographic projection restaurant combines holographic projection skills with various scenes of the natural restaurant so diners can feel the dining experience in the natural environment.

### **2.3. Technology status of immersive experience**

At present, 5G (the fifth generation mobile communication technology)+VR (virtual reality technology)+AR (augmented reality technology)+AI (artificial intelligence technology)+somatosensory devices and other technology combinations are the technical basis of the "meta-universe" immersive experience. Technically, today's VR/AR devices, such as Pico Neo3, have reached 4K level  $3664 \times 1920$  display effect is 773PPI for both eyes, 120 frames, and the current VR/AR device is much smaller. It has also evolved into a wireless all-in-one machine. The body sensing devices Axonsuit and Tesla suite can simulate different pressures and temperatures and feel the weight and texture of objects. From the experience level, the picture quality is clear, the body feeling is simulated and honest, and the user has no obvious vertigo after use, meeting the basic requirements of meta-universe immersion.

## **3. Overview of virtual simulation teaching**

### **3.1. Concept of virtual simulation teaching**

Virtual simulation teaching refers to various virtual experimental environments simulated by virtual reality technology in the computer system. The participants are as if they are in a natural environment and complete various scheduled experimental projects.

### **3.2. Advantages of virtual simulation teaching**

With the progress of technology and the verification of time, the advantages of virtual simulation teaching gradually emerge, embodied in the following three points: First, it is not limited by time and space to carry out teaching practice at any time. Virtual simulation teaching is located in a virtual space, which can be accessed without coordination, and the courses learned can be reviewed at any time. Second, enrich teaching practice activities and ensure the safety of the whole process. In virtual simulation teaching, students can carry out simulation experiments, training, and construction in the virtual space, and the whole process is very safe. The feeling and experience of practice are no less than the actual situation, which can ensure safety and bring more substantial learning effects. Third, improve the teaching environment and facilities. Virtual venues and equipment are rich and not easy to be damaged and consumed. They can be updated and improved with the development of the industry, provide a variety of teaching environments and equipment, and ease the pressure on the preparation of facilities.

### **3.3. Comparative application of virtual simulation teaching cases**

Virtual simulation teaching laboratories have been set up in some universities in China, such as the "Virtual Curatorial Laboratory of the Art Museum" built by the Central Academy of Fine Arts, the "Hubei Textile Printing and Dyeing Virtual Simulation Experimental Teaching Center" established by Wuhan Textile University, and the "Virtual Simulation Experimental Teaching of Art and Cultural Research in Ancient Houses in Three Street Alleys and Seven Alleys in Fuzhou" established by Fujian Sunshine College Horizontal comparison is made in five aspects: technical basis, teaching process, practice process, and teaching feedback. Furthermore, the results of the comparative

analysis will be transformed into the construction of a virtual simulation teaching laboratory for exhibition design.

Through comparison, in terms of R&D positioning, we can solve the actual teaching problems according to the needs of the service crowd; In terms of technical basis: net platform programming system, 3D technology restores scenes and objects, establishes resource library, creates AI terminal, and conducts human-computer interaction; In terms of the teaching process: students learn and practice under the guidance of the system, and finally generate a learning practice report. However, college teachers lack leadership in the classroom, and their direct influence on the teaching effect is reduced. In the practice process, students' subjectivity in practice has been given full play. Students' thinking is the axis from the early copy research to the later design practice. In practical experience: the practice is mainly completed in the face of the computer display screen, which is separated from the virtual classroom environment. The practical experience and operability need to be strengthened; In terms of teaching feedback: visual learning reports are generated, but the evaluation method is implemented in a systematic manner according to the set standards, which needs to be strengthened in terms of the diversity of evaluation contents and evaluation subjects.

## **4. Organization and content of immersive virtual simulation teaching for exhibition design**

### **4.1. New exhibition teaching organization**

The simulation teaches experimental classroom designed for exhibition uses virtual simulation technology and somatosensory equipment to build an experiential virtual simulation "meta-universe" teaching space. University teachers and students wear virtual reality equipment, launch the exhibition design simulation teaching laboratory platform software, and pop up two login methods for university users and social users. Taking campus login as an example, fill in the information such as university name, student number/job number login password, and the system will conduct identity verification. If the verification is successful, you can log in to the virtual classroom. The system will use specific scanning equipment to generate virtual digital human images based on the images of teachers and students themselves.

Before the beginning of the course, the teacher needs to select the classroom scene, including the indoor scene and the outdoor scene. The outdoor scene needs to be set with geographical location, terrain, environment, etc., while the indoor scene needs to be set with ground pavement, wall material, ceiling height, lighting location, etc., or you can choose to use the classroom scene template to set with one key. The height of the material in the classroom scene template is restored to the actual scene. Then, set up students' classroom authority and other related matters. The university teacher, as the class organizer, can set the number of students in the class and the access password. The system will verify the student's identity when the students enter and carry out sign-in statistics. College teachers have the highest authority in the classroom, and students cannot change the settings in the teacher's classroom.

At the beginning of the course, the teacher guides the class, clarifies the booth type, height limit, and other course design requirements, and guides students to carry out exhibition design activities. At the beginning of the design, university teachers guided students to think, inspired students, and assisted students in designing exhibition booths. As the main body of the classroom, students' initiative has been brought into full play. Teachers guide students to practice and learn, which is more flexible, intriguing, and targeted than systematic guidance, to achieve the organic combination of teaching and learning.

At the end of the course, university teachers will organize a simulated exhibition in the meta-universe, where students' exhibition design works are used for exhibition. Facing the university and society, they will provide a multi-subject evaluation method for students' works, with more diversified evaluation standards and contents.

#### **4.2. Understand the building materials of the simulation exhibition**

In the simulation teaching experimental classroom of exhibition design, the material model is built through the comprehensive exhibition design provided by the material library. The user can call out the operation interface by putting his hands together and opening it again. There are user information, classroom settings, friends, exit login, and other function bars. In the material library operation interface, click the icon of the material library with your finger, press and hold the selected material and drag it out of the interface to generate a three-dimensional model in front of the user.

The material library classifies the construction materials, such as standardized parts, coatings, electronic equipment, etc. Click the general category to pop up the subcategories, such as the standardized parts divided into exhibition racks, furniture, lamps, etc. The classification will have graphical marks for easy searching and identification, and a summary description of such materials is attached. On specific materials, the length, width, height Material, etc. Students will learn the information about each material step by step. After selecting materials and generating models, students will zoom in and out of the materials designed to build exhibition spaces and rotate and adjust them. Through observation from all angles, experience the spatial scale, feel the details of materials, constantly optimize and improve the functions, and immerse the descriptive knowledge in books in the virtual simulation teaching process.

#### **4.3. Experience the on-site exhibition construction process**

In the simulation teaching experimental classroom of exhibition design, students have a virtual exhibition building space where they can carry out design and creation activities. The content in this virtual space can be saved for backup, or a new space can be created. Users of this creative space can visit each other. When designing their own exhibition, students should first plan the intention map on the ground, determine the theme, select the scope, determine the location of the barrier-free passage, lay out the space of the exhibition area, divide the functional area, conceive the pedestrian flow line and other preliminary work, select exhibition frame materials from the material library, such as octagonal prism structure exhibition frame, etc., and use simulation materials to construct according to the preliminary planning.

First, the structural exhibition frame is built, then the floor is paved, and then the ceiling shape is built. The ceiling shape can be modified or assembled by selecting finished models from the material library. The completed ceiling shape is suspended and fixed on the line frame with steel wires. Then, the assembly and placement of booth exhibition tools and exhibits are started according to the layout determined in the earlier stage, and then the lamps are selected to be installed on the line frame or slide according to the lighting needs of the exhibits and functional areas, Finally, add decoration to the booth, such as installation art, large screen, light box, LED light strip, mascot, etc., including the selection of sound and music, to improve the audio-visual effect of the booth. Students can create and practice independently in the simulation teaching an experimental classroom of exhibition design, experience the exhibition construction process, deeply design the space and display the details, and feel the fun of design in a new way.

#### **4.4. Immerse in the opening scene of the exhibition**

After the exhibition design course, teachers organize students to present their design works in the "Metauniverse" exhibition hall, which is a public exhibition platform. The university teachers set up the scene of the exhibition in the "Metauniverse" exhibition hall. The students export their works from their own studios and arrange them in the venue according to the selected booths. Before the exhibition of virtual works for professional courses, an invitation will be issued to the "Metauniverse" community. The exhibition will be held for universities and society for a period of time. During this period, university teachers, students, and people from all walks of life will have the opportunity to come to the exhibition. Students will introduce their design ideas, inspiration sources, design positioning, functional characteristics, etc., to the audience in front of their booths and interact with the visitors, Or choose to walk around in the exhibition scene to observe and learn from other student's

booths. After the holding period, the exhibition is still open to the "Metauniverse" community in the cloud exhibition hall, and you can watch the exhibition again at any time. Students can also immerse themselves in other exhibitions held in the Cloud Exhibition Hall and learn about space layout, plane planning, information presentation, interactive experience, modeling design features, etc., in other exhibitions.

#### 4.5. Timely solve actual design defects

In the process of students' personal experience of the exhibition building, due to the simulation of gravity, object material, and object structure, students will encounter some practical problems during the building process, such as incorrect selection of load-bearing materials leading to collapse, unstable structure leading to scattered stands, and planning errors leading to narrow aisles. Students can also invite teachers to help them when encountering difficulties. College teachers can also provide on-site guidance during the construction of students' works, verify the design of students' works, verify their safety, avoid the danger of construction, save materials; and at the same time, the guidance content is more specific to deepen students' understanding. After the completion of the works, in the professional course virtual works exhibition, it will also receive the multi-subject evaluation from the university teachers, students, and people from all walks of life, and provide valuable suggestions for the improvement of the subsequent students' design works in a timely manner.

### 5. Conclusion

At present, in the teaching of design practice courses such as exhibition design, there are problems such as students' little contact with materials, no construction experience, few observation and learning channels, and difficulty in finding actual design defects. "Metauniverse" makes teaching break through the limitation of time and space and brings new development direction to design practice courses. Through the construction of an immersive exhibition design virtual simulation teaching laboratory, it provides an open teaching platform that is not limited by space, funds, and security. College teachers and students experience a new teaching mode through virtual roles, immersing in experience, interactive teaching, and students gain knowledge, interactive practice, display and share through continuous practice in the "Yuanyuzhou" space so as to create a sense of gain in the process and satisfy the sense of achievement in the results.

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