Teaching Research of Integrating Virtual Reality Technology into Environmental Design Professional Courses

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Abstract. The role of virtual reality technology in environmental design professional courses has become increasingly prominent. The integration of augmented reality technology and gamified learning has become a new trend in environmental design. This article introduces the concept and characteristics of virtual reality technology, points out its application in the environmental design profession, and focuses on these applications to analyze the specific application and changes of virtual reality technology in the environmental design profession teaching, in order to be able to provide information on the environmental design profession. Modernized teaching brings new thinking. This article takes the VR virtual reality technology teaching interactive model as the research object, and analyzes the model with the multimedia teaching platform. In the course of the experiment, combined with the empirical analysis of the development status of VR virtual reality technology, the VR interaction model was analyzed, combined with the learning characteristics of the environmental design major, and it was concluded that the panoramic display software related to the environmental art design major can be combined with other software in actual teaching. Teaching activities. The research results show that the virtual reality technology in the experiment is 2.31 higher than the non-priority teaching factor, and the average variance is higher than 0.97. The teaching uses VR technology reasonably, combines the characteristics of the environmental design discipline, and strengthens the perspective of the integrated design material standard case. Experiential exploration of color materials, etc., improve students' enthusiasm and enthusiasm for learning, and can also bring innovation in teaching models to environmental design.

Keywords: Virtual Reality, Environment Design, Teaching Research, Information Teaching

1. Introduction
Virtual reality technology has the characteristics of strong comprehensiveness, a wide variety of parts, technology intensive, and large expenditures. Therefore, it has derived the problems of long training cycle of virtual reality teaching staff, poor training quality, and susceptibility to equipment and location restrictions [1-2]. With the development of computer technology, simulation technology,
virtual reality technology, and interactive technology, the field of aviation product manufacturing and maintenance training is undergoing major changes. Mechanical assembly, mechanical simulation, and design verification combined with virtual reality and augmented reality technology have become the new direction of simulation technology development [3-4].

Speight L designed and developed a micro lathe assembly simulation platform based on IdeaVR, and realized interactive functions such as virtual dynamic demonstration, disassembly and assembly that imitated real scenes through helmet-mounted virtual reality equipment [5]. The virtual assembly system of aerospace products designed by Puschmann P based on UE4 adopts the joint display scheme of L-shaped projection system and CAVE system, which can realize multi-person collaborative virtual assembly operation and report demonstration function [6]. Fan G proposed a virtual simulation technology based on time Petri net modeling, using Unity3D as a development platform, and established a nested Petri net model group based on time beat constraints [7]. Li L developed a system data exchange engine based on the C# function library, which can clearly describe the logical sequence of each device's movement and greatly improve the development efficiency [8]. The entire technology urgently needs to find new growth points to further overcome bottlenecks and bottlenecks and make full use of it, so as to continue to maintain the current development speed [9-10].

This article first analyzes the current situation of VR technology application teaching in environmental art design majors, and addresses the existing problems of insufficient depth and lack of universality in teaching applications, and then combines the cognitive laws of education and teaching, students' psychological needs, etc., to cultivate students' design innovation thinking as the goal, try new applications of teaching methods and methods, in order to promote the improvement of the teaching quality of environmental art design, and promote the application and development of virtual reality technology in the field of education and teaching in the future. The use of virtual reality automatic interactive system based on VR interactive technology in the teaching of environmental design professional courses is an innovation of environmental design teaching technology. It can cultivate students' design thinking habits, effectively improve teaching quality and enhance teaching effects, and is the same series of basic skills operating system development laid the foundation. Therefore, the system has far-reaching significance and can be widely used.

2. Virtual Reality Technology and Teaching

2.1 Free Model of VR Interactive System

The system uses a six-degree-of-freedom control pen as the main interactive input method. The user selects an object through the virtual ray emitted from the position of the control pen. When the virtual ray is in contact with the object, press the corresponding interactive key and move the control pen to grab the part or zoom.

(1) Six degrees of freedom grasping

In unity, the rotation of an object is described by a unit quaternion, and the expression is $\tilde{q} = (w,x,y,z)$, the operation between the quaternion and the vector needs to extend the vector to the quaternion space and express it in the form in formula (1). Before updating the position and angle of the object, the system calculates and caches the interactive initial information of the object: ray length $d$, the initial coordinate point of the object and the ray collision point $P_P$, Offset vector $\tilde{v}_0$, and $\tilde{q}_s^{-1}$, the product of the initial rotation angle of the object.

$$[O,P_P] = P_s + \tilde{q}_s([0,(0,0,1)]d)$$  (1)

$$d = \|P_s-P_P\|$$  (2)

$$\tilde{q}_a = \tilde{q}_s^{-1} \times \tilde{q}_0$$  (3)
Among them $P_p$ is the coordinate of the ray collision point, which is obtained by (1) $P_r$, $P_0$ are the initial coordinates of the control pen and the object at this time; $\tilde{q}_0, \tilde{q}_s$ are the initial rotation angles of the object and the control pen respectively; in formula (2) and formula (3), $\tilde{q}_0^{-1}, \tilde{q}_s^{-1}$ are the inverse of the quaternions of the angle of the object and the control pen at this time, which are used to compensate for the offset caused by the first calculation of the loop; $[0,(0,0,1)]$ indicates the positive direction of the local coordinate system of the control pen. After the initial information is recorded, the updated rotation angle and position of the object are calculated by formula (4) and formula (5):

$$\begin{align*}
\{0, p_{pi}\} &= \{0, p_{pi}\} + \tilde{q}_s([0,(0,0,1)]d)
\end{align*}$$  (4)

$$\tilde{q}_i = \tilde{q}_{si} \times \tilde{q}_a$$  (5)

During the above process $P_p^i$ is the ray collision point coordinate of the first cycle $P_{si}, \tilde{q}_{si}$ are the position and angle of the control pen for the first cycle.

(2) Object zooms
When the ray is in contact with the object, hold down the zoom key, and calculate the displacement of the Z axis of the local coordinate system of the control pen in real time to obtain the zoom ratio of the object, and dynamically assign it to the selected object.

(3) Select all
The implementation method is the same as grabbing, which is used to grab all interactive objects in the scene.

2.2 Virtual Reality Technology in Environmental Design Teaching
(1) Changes in teaching mode
Construct virtual teaching solutions for environmental design majors based on VR technology, and introduce VR technology into practical teaching classrooms of environmental design majors in colleges and universities. Use virtual interactivity to change the mode of teachers speaking on stage and students listening in their seats, allowing teachers and students to participate in learning together. No longer blindly emphasize the completion of homework, but use virtual technology to change the traditional teaching mode, and use visualization technology to make the original complex and abstract concepts more intuitive, thereby improving teaching efficiency. The basic teaching process first introduces the case, and the teacher uses VR technology to guide students to conduct immersive learning on the topic; then the project guides to clarify the design requirements; then the virtual design platform is used for creative ideas until the design and development, and the final result is produced; and carry out exchanges and sharing to form the final result. Through the continuous teaching of the above mode, it can cover all the procedures and processes of the environmental design major in social practice, so that the content of classroom teaching is consistent with social practice, and it is easier for students to adapt to the rhythm of society. The resulting works also laid a solid foundation for subsequent learning.

(2) Changes in teaching methods
The virtual reality technology practice teaching solution for environmental design majors can effectively solve the monotony of the current traditional teaching methods and fail to grasp the hearts of students. Let students use the virtual design platform to quickly show the effects of their design schemes, and at the same time, they can have an immersive experience in the virtual experience space, which improves students' learning interest. In the application of the teaching process, with the help of AR technology, teachers can use this system to integrate the concept of living space design, three major components, lighting and color in design principles, furniture and furnishings, design styles, etc.; materials and construction techniques, and residential housing the space design of the public buildings; the rationality of the space layout of public buildings and other related knowledge systems are
reflected, thereby reducing the pressure of teacher preparation. Through the immersive experience, students can have a better understanding of the works they have designed; cultivate students' ability to explain their own designs.

(3) Change of studio construction model
So far, students can only create an accurate feeling using computer 3D renderings. The virtual reality experience space developed based on VR technology allows users to combine virtual and reality interactions to enter the virtual space in the real scene, see every detail of the display and experience the actual feeling; it can also be achieved through virtual reality supporting software the interaction between virtual reality and the real world realizes the perfect combination of VR and IoT technology. In this way, when choosing a design plan, customers can experience a more realistic level, and they are more likely to prefer your design to choose your design plan. The virtual reality technology practice teaching solution for environmental design major changes the construction mode of university studios. Traditional design static studios are mostly displayed in the form of sample rooms, which are costly and have a single content. Students lack the experience of space, color, and materials. Use the design virtual experience space to make students' design plans and decoration effects get what they want.

(4) Change of project site practice methods
Traditional project practice activities are greatly restricted by external conditions, some of the training operations are dangerous, inconvenient to repeat, and safety cannot be guaranteed. Most of them emphasize the completion of homework, which dampens the enthusiasm and enthusiasm of students in learning. Designing a virtual experience space allows students to experience actual projects in the entire virtual environment. Through the analysis of the core competencies of the environmental design major, the analysis is carried out around the necessary competencies of students. A series of digital training courses based on industry software and virtual simulation technology based on VR have been developed. Students will gradually master the skills required for environmental design jobs by completing tasks that combine virtual and reality.

3. Experiment

3.1 Research Methods
(1) Document method
This article summarizes the related theories of VR virtual reality technology and environment design through the method of searching literature data and searching relevant domestic and foreign data according to the research purpose.

(2) Empirical analysis method
In the course of the experiment, combined with the empirical analysis of the development status of VR virtual reality technology, the VR interaction model is analyzed, combined with the learning characteristics of the environmental design major, and it is concluded that the panoramic display software related to the environmental art design major can be combined with other software in actual teaching. Teaching activities. Such as combining CAD, sketch master, 3DMAX, etc. Make up for the shortcomings created by the existing VR scenes and realize model conversion.

3.2 Experimental Design
(1) Research object
This article takes the VR virtual reality technology teaching interaction model as the research object, and analyzes the model with the multimedia teaching platform.

(2) Experimental steps
This article first analyzes the current situation of VR technology application teaching in environmental art design majors, and addresses the existing problems of insufficient depth and lack of universality in teaching applications, and then combines the cognitive laws of education and teaching, students' psychological needs, etc., to cultivate students' design innovation thinking as the goal, to try
new applications of teaching methods and methods to promote the improvement of the teaching quality of environmental art design and promote the application and development of virtual reality technology in the field of education and teaching in the future.

4. Teaching Analysis of Integrating Virtual Reality Technology into Environmental Design Professional Courses

4.1 Status Quo of VR Virtual Reality Technology in Teaching

Environmental design virtual space experience VR as a new technology is at the forefront of professional trends. How environmental design takes the lead in applying new technologies to program design and display, which not only meets the development needs of professional trends, but also serves as an innovator in the application of virtual technology in environmental design, be ahead of other peers to enhance the overall strength, and will also gain a long-term brand advantage. In the current traditional instillation teaching method, students learn passively, the knowledge received is scattered, the teacher's teaching style is too subjective, the application of teaching resources is time-consuming, case presentations are outdated, lack of exercise in learning thinking, and limited by space and time, it is difficult to create a systematic learning environment is not conducive to the integration of theory and practice.

![Figure 1. Combine GIS information to clear the surrounding situation](image)

As shown in Figure 1, environmental design projects experience VR technology application cases in the environmental design industry are also relatively common. Feel the future of the location after construction, and combine GIS information to know the surrounding situation and the outside environment more clearly the landscape has been designed and the surrounding environment combined with the overall planning design effect. In addition, many environmental companies are also using VR technology for in-depth applications in environmental-related fields.
Figure 2. The development stage of VR virtual reality technology

As shown in Figure 2, domestic schools that truly apply virtual reality technology to regular campus courses are still rare, and they are still in the stage of collaborative research between key university laboratories and related technology companies. However, the application and promotion of virtual reality technology in campus courses is undoubtedly the trend of educational technology development and the direction of teaching method reform. It is to explore the effective combination of virtual reality technology and conventional courses, and play the role of curriculum education that combines virtual reality and reality. Obtaining effective teaching effects and promoting teaching reform are the issues that education researchers are concerned about and researched at this stage.

4.2 Characteristic Analysis of VR Virtual Reality Technology in Teaching

Table 1. Descriptive statistical results of paired sample test of pre- and post-test scores

| Group        | Quiz type | Sample size | Mean  | Standard deviation | Standard error |
|--------------|-----------|-------------|-------|--------------------|----------------|
| Priority group | Pre-test  | 10          | 5.76  | 2.31               | 0.76           |
|              | Post-test | 10          | 9.33  | 2.03               | 0.65           |
| Non-gaming group | Pre-test | 10          | 7.63  | 2.12               | 0.72           |
|              | Post-test | 10          | 9.65  | 1.96               | 0.65           |

As shown in Table 1, VR technology has been widely used in environmental design education in recent years, with various forms and rich content. Its core is a virtual three-dimensional interactive experience space composed of computer hardware and software according to rigorous design thinking skills operation specifications. It enables users to produce the feelings of seeing, hearing, and touching, immersed in the virtual reality scene for training and assessment.

As shown in Figure 3, the students in the observation group are better than the control group in terms of environmental design theory knowledge mastery and skill operation (P<0.05). Especially in the skill operation assessment, the students in the observation group are more confident in dealing with various sudden changes. Issue the situation and handle it correctly. The results of the questionnaire survey showed that the students in the observation group were more satisfied with the effect of their own teaching model, and their performance in developing environmental design thinking ability and stimulating learning interest was significantly higher than that in the control group (P<0.01).
5. Conclusions
Teachers introduce VR technology in the teaching of environmental art design professional courses, combine this technology with the teaching content, create a good learning environment, stimulate students' interest in learning, increase the interest of the classroom and the effect of knowledge transfer, which will greatly improve environmental art design course teaching quality. Based on the future development of Internet technology and the application of teaching practice, VR technology will face new development opportunities, which will provide updated inspiration for the actual teaching of environmental art design.

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