Application of Virtual Reality Technology in Interior Design Teaching

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***Abstract*—Virtual reality simulates the three-dimensional space virtual environment formed by the computer multimedia information processing system, and makes the user feel immersed in the gold through the relevant sensing devices, so as to achieve a good interaction between the user and the environment and let them feel immersed in it environment effect. This paper focuses on the research on interior design teaching, based on VR virtual reality technology, the three virtual reality technology and interior design teaching are closely combined. In the interior design teaching application designed in this paper, students can use virtual reality technology to enter the simulated three-dimensional scene, and they can experience the final effect of their own plan. In this way, students can not only evaluate and analyze the rationality of the plan, In order to optimize the teaching plan and obtain better application results, we can also keep in mind the reasonable and unreasonable aspects of the plan through personal experience, and accumulate experience for designing better works in the future. The final results of the research show that with the increase of the frame design area, the restoration degree of the virtual teaching frame model will decrease slightly, but it remains above 90% restoration degree. When the design area is 56m2, the restoration degree of the frame model is 98.4. %, in order to ensure the authenticity of the restoration degree of the virtual teaching framework model, the design area of the framework should be properly controlled.**

Keywords*—*Virtual reality, interior design, frame design, space environment

I. Introduction

With the continuous development of virtual reality technology, and using virtual reality technology means, the interaction points are set in the VR interior design model according to the interaction behavior of students, and the selection of interaction points and feedback information in the teaching mode in the VR interaction experiment are used to optimize the indoor environment. Quality improvement method, to explore the feasibility and advantages of VR intervention in interior design teaching [1]. Virtual reality can help to achieve good enlightenment teaching. Compared with traditional teaching methods such as projection and multimedia projecting pictures, virtual reality has achieved a greater degree of development and growth. Therefore, the use of VR virtual reality technology combined with the application of interior design teaching has certain educational practical significance.

In recent years, many researchers have studied the application of VR virtual reality technology in interior design teaching, and achieved good results. For example, Kalantari S believes that in virtual teaching, students can fully devote themselves to the simulated scene, and put themselves in the position of practice, which helps to strengthen memory and improve hands-on ability [2]. Yusuf G believes that virtual reality technology enables interior design teaching to get rid of the shackles of the current traditional and single-form multimedia teaching, and to innovate newer and more suitable teaching and learning methods of interior design [3]. At present, domestic and foreign scholars have carried out a lot of research on the application of three interior design teaching. These previous theoretical and experimental results provide a theoretical basis for the research in this paper.

Based on the theoretical basis of VR virtual reality technology, combined with the application in interior design teaching, this paper conducts research and analysis, and through a series of experiments to prove that VR virtual reality technology has certain feasibility in interior design teaching, through the teaching characteristics preference data analysis And virtual teaching framework model reduction degree analysis. Teaching method is an important element in the teaching process of teachers, and it is a powerful guarantee to achieve teaching purposes and complete teaching tasks. After virtual reality technology is applied to interior design teaching, it will definitely make the teaching method more scientific and the teaching process more efficient.

II. Related Theoretical Overview

A. The Main Teaching Methods of Virtual Reality Technology in Interior Design Teaching

The introduction of virtual reality technology in interior design teaching can enhance the creativity and practicality of teaching activities, and the teaching methods also tend to be flexible. According to the needs of the actual teaching system, choosing an effective teaching method not only helps teachers to apply teaching work more smoothly, but also helps students memorize and consolidate old and new knowledge.

(1) Teaching computer simulation

Teaching simulation is an advanced stage of computer-aided design teaching. With the development of communication network, computer multimedia and other related technologies, computer virtual teaching mainly focuses on simulating indoor construction, which is convenient for teachers to explain the construction process and design scheme related to interior decoration, and guide students to accurately understand the teaching points [4-5]. During school, it is impossible for students to engage in various practical interior design activities and not be familiar enough with interior design materials, let alone go to construction sites for professional work. Incomprehensible

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situations in real classroom teaching can also be handled through virtual simulation, allowing students to experience these learning points more realistically. Computer simulation teaching has the advantages of strong repeatability, rich information resources, good teaching effect and good adaptation effect, and can be widely used in teaching work. It is the fastest growing new teaching method at this stage.

(2) Teaching demonstration template

In the actual teaching process, teachers can visualize the teaching points through the model constructed in the virtual space. For example, interior design involves a variety of decorative materials [6]. The placement of the teacher is also different, and it is impossible to resonate with the students only by the teacher's dictation or description. Therefore, in the virtual space, by building models, analyzing materials and explaining, understand and master the basic laws of material application, so as to better understand the theoretical knowledge of design. The VR teaching demonstration template is the basis for students to experience the scene and choose the renovation method. Through the public participation in the interior renovation design survey, online participation, offline participation, filling in questionnaires and selection of interaction points are completed. The teacher is responsible for the establishment of the virtual reality system, the design of the evaluation survey, the processing of the public feedback information, and the application and update of the optimization and reconstruction design method. The student participation section includes wearing equipment, participating in self-selected feeling surveys and completing VR interactive experiments. Through the students' decision-making participation and feedback into the plan, a diversified transformation design plan can be realized.

B. The Concept of VR Virtual Reality Technology

(1) Definition of virtual reality technology

Virtual reality technology is a technology that allows users to cooperate with various inspection equipment to directly interact with the environment in a 3D simulated computer-generated space [7-8]. Here, the internal structure corresponds to the structural design layout that has been done for the subject knowledge. The multimedia network connection format helps to actively display teaching content consistent with students' knowledge, allowing students to complete the construction of knowledge structure independently. In addition to the traditional way of connecting professional drawings and renderings, with the development of society and technological progress, a variety of new concepts, new technologies and new methods for the regeneration of residential interior space have emerged. A 360-degree panoramic picture of the indoor space can be immersed in the scene, and the sense of space and distance will be more layered. The purpose of use is to let residents fully understand the content of interior renovation, let students participate in renovation design work, and improve the quality level of virtual teaching.

(2) Artificial synthetic environment

With the support of virtual reality technology, building a simulation environment can provide users with a highly realistic and powerful virtual environment, that is, a synthetic environment. Artificially created virtual environments are perceived in various ways, such as physical images, sounds, or force responses. When the user needs, they can perform corresponding actions, such as: walking back and forth, turning their heads, changing gestures, etc. Affect the virtual environment. The latter will make corresponding changes, react to people, and make people acquire new emotions [9]. In this virtual space, a new feeling should be given to the user, and the overall concept is more real.

For example, you go to a simulated public room and you see a lot of people and objects, and you see people moving. As you approach these people or things, you will see the scale of these people or things grow, and even see the material of these objects and the faces of the people, while hearing them speak, it makes you feel like you are there [10-11]. Why does the term "virtual reality" contain so many opposing "virtual" and "real" elements? In fact, when the word "virtual" is used, it means that part of the space environment it creates belongs to non-real existence and can only be created by computer imagination; the word "reality" means that although this space environment is artificial, To the person entering the environment, it feels like the real world. The senses here include sight, hearing and touch.

(3) Basic elements of virtual reality

The basic idea of virtual reality technology is to use modern science and technology to artificially create a virtual space, in this space, people can perform interactive activities such as watching, listening, and moving as in the real environment [12]. For a virtual reality system in a realistic sense, it should have three basic elements: one is to provide users with a 3D virtual space; the third is that users can interact with the virtual environment space by means of special control equipment.

III. EXPERIMENT

A. Experimental Method

Optimization goals tailored for indoor scene retargeting. The goal is to optimize Φ by rearranging the objects in V so that spatial awareness in indoor scenes can be preserved as much as possible：

$$E_{w,si} = \varphi\left(\frac{\rho_i}{\rho_{\min}} - 1\right) + \varphi\left(1 - \frac{\rho_i}{\rho_{\max}}\right) \quad (1)$$

$$\varphi(x) = \frac{1}{x + \sqrt{x^2 + \varepsilon^2}} \quad (2)$$

where ρmin and ρmax are the corresponding minimum and maximum scaling factors in the length and width directions, respectively. To prevent the scaling factor from going beyond our specified range, we define a penalty function φ, where ε is a very small constant and the value of φ(x) increases drastically when $x \leq 0$.

B. Experimental Requirements

Based on VR virtual reality technology, this experiment conducts research on the application of interior design teaching. Through the analysis of teaching feature preference data and the reduction degree analysis of virtual teaching framework model, the experiment is based on the analysis of teaching feature preference data, and a statistical survey is

conducted on 200 students. , carry out preference analysis on the four characteristics of interaction, imagination, immersion and virtuality of virtual reality teaching, and judge the feasibility of interior design teaching by the correlation between the area of the virtual teaching framework model design and the degree of reduction.

IV. Analysis and Discussion

A. Data Analysis of Teaching Feature Preference

Through the analysis and analysis of teaching feature preference data, the experiment conducted a statistical survey on 200 students, and carried out preference analysis on the four characteristics of interaction, imagination, immersion and virtuality of virtual reality teaching. The experimental data are shown in Table I.

TABLE I. Teaching feature preference data analysis table

Teaching Characteristics	Number of People	Proportion (%)
Interactivity	89	44.5
Imaginative	67	33.5
Immersion	23	11.5
Virtuality	21	10.5

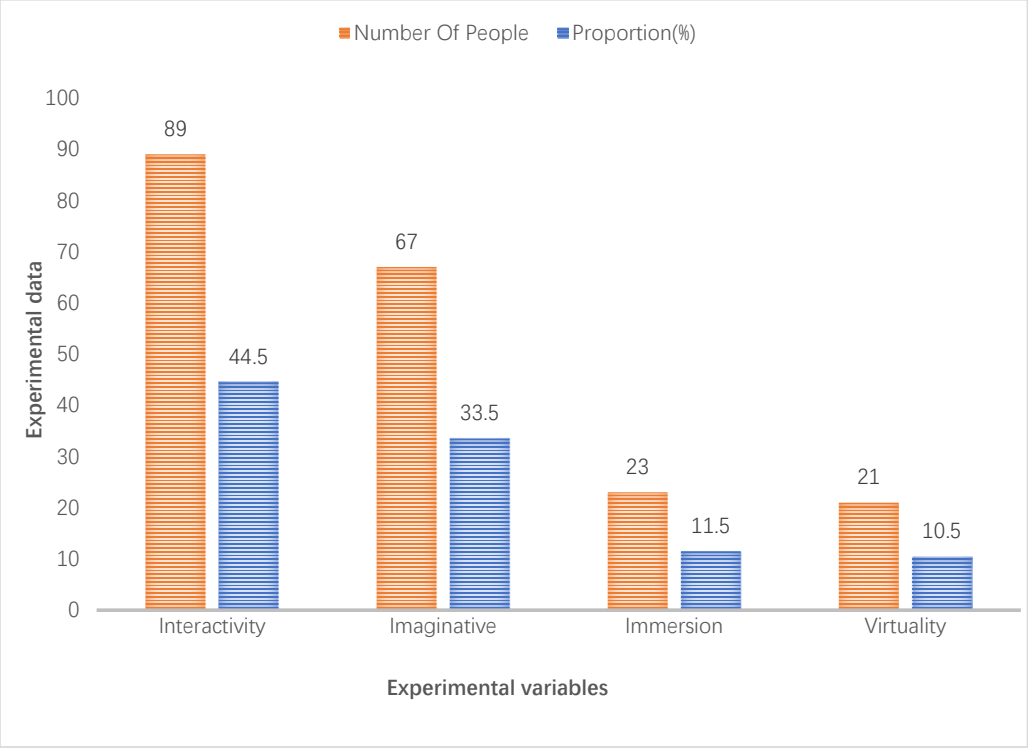

Fig. 1. Data analysis diagram of teaching feature preference

As can be seen from Figure 1, it can be seen from the above results that among the 200 students' preference choices for the four characteristics of interactivity, imagination, immersion and virtuality, the number of students who chose interactivity was at most 89, accounting for 44.5%. , followed by imagination with 67 people, accounting for 33.5%, followed by immersion with 23 people, accounting for 11.5%, and finally virtual with 21 people, accounting for 10.5%. Design teaching has the greatest impact, and the application of interactivity in interior design teaching should be strengthened.

B. Analysis of Reduction Degree of Virtual Teaching Framework Model

Through the analysis of teaching feature preference data, interactivity has the greatest impact on the teaching of virtual reality technology interior design. The experiment continues to analyze the reduction degree of the virtual teaching framework model. The experimental data is shown in the figure below.

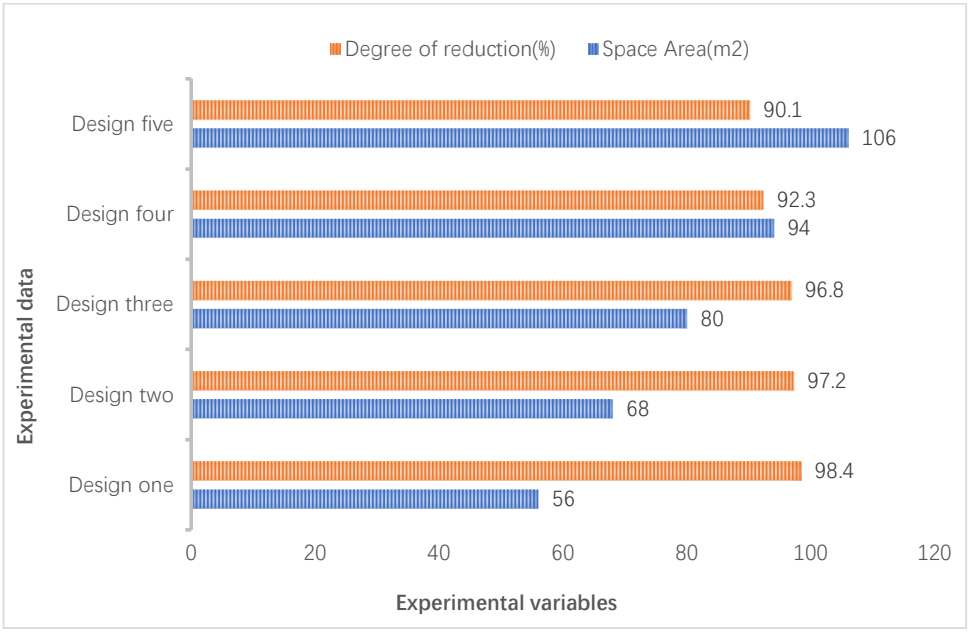

Fig. 2. Analysis of reduction degree of virtual teaching framework model

As shown in Figure 2, with the increase of the frame design area, the restoration degree of the virtual teaching frame model will decrease slightly, but it remains above 90% restoration degree. When the design area is 56m2, the restoration degree of the frame model is 98.4 %, when the design area is 68m2, the frame model restoration degree is 97.2%, and when the design area is 80m2, the frame model restoration degree is 96.8%. It can be seen that in order to ensure the authenticity of the virtual teaching frame model restoration degree, it should be Appropriately control the frame design area.

V. Conclusions

This paper firstly studies the application of interior design teaching based on VR virtual reality technology, and through a series of experiments to prove that VR virtual reality technology has certain feasibility in interior design teaching, through teaching characteristics preference data analysis and virtual teaching It can be seen from the experimental data of frame model reduction degree analysis that interactivity has the greatest impact on interior design teaching of virtual reality technology, and the application of interactivity in interior design teaching should be strengthened, and with the increase of frame design area, the virtual teaching frame model The reduction degree will decrease slightly, but it will remain above 90% reduction degree. In order to ensure a certain authenticity of the reduction degree of the virtual teaching framework model, the frame design area should be properly controlled. Virtual reality technology is aimed at the performance of teaching content. It can convey materials that stimulate students' sensory systems to students in an intuitive, vivid and richer way. Through students' immersive experience and human-computer interaction controlled by their subjective wishes, they can feel it. The transformation of the "external environment", the good virtual performance of virtual reality technology can realistically create a real indoor space, create a realistic learning environment for learners, and present teaching content more intuitively.

References

[1] Sharafeldin S, Suidan A. Reflection on Practical Implementation of Virtual Reality in Interior Design Teaching Studio. 6 th annual international conference on Architecture. 2019, 16(8), 201-215.

[2] Kalantari S, JR J Neo. Virtual Environments for Design Research: Lessons Learned From Use of Fully Immersive Virtual Reality in Interior Design Research. Journal of Interior Design, 2020, 16(11):45-53.

[3] Yusuf G. Software fir virtual reality in interior design. Journal of Xingtai Polytechnic College, 2021, 88(6):599-605.

[4] Nie G, Ren G. The Application of Virtual Reality Technology in Teaching of Industrial Design Outline of the Project for the Human-Computer Interactive Simulation of the Upper Limb Operations. Applied Mechanics & Materials, 2019, 037(005):134-136..

[5] Sharaf S, Assoc E , Prof, et al. Reflection on practical implementation of virtual reality in interior Design Teaching studio. International Athenar Conference-2019". 2019.74(1):15-30.

[6] Patera M, Draper S W. Colour & Interior Design: Using Virtual Reality Technology to Study the Effects of Scale. International Conference on Designs on E-learning. 2021:(6):6-15.

[7] Pober E, Cook M. Thinking in Virtual Spaces: Impacts of Virtual Reality on the Undergraduate Interior Design Process. International Journal of Virtual and Augmented Reality, 2019, 3(2):23-40.

[8] Neves L, Pombo F. Portuguese interior design history through virtual reality. An emergent technology as a facilitator to learn and promote cultural studies. 2019, 2(1):17-21.

[9] Shasha, Cai. Application and Research of Immersive Virtual Reality Technology in the Interior Decoration of Folk Houses in Guanzhong. 4th International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2020), 11(1)9-11.

[10] Kim I A, Hout D V, Lee H S. Signal detection-based satisfaction measure of the holistic product usage experience with and without the 'double-faced applicability' test. Food Quality and Preference, 2018, 1(68):40-49.

[11] Wook T S M T, Nor S F M, Mohamed H, et al. Multi-Dimensional Interface Design of E-Commerce for Virtual Museum System. 2020, (9):19-52.

[12] Filippov A, Filippova O. Long-Range Thermal 3D Perception in Low Contrast Environments. 2021, 1(4):17-20