Application Analysis of VR Virtual Technology in Environmental Art Design Teaching

Wenfang Li*

School of Software Engineering, JiangXi University of Software Professional Technology, Nanchang, China

*Corresponding author e-mail: liwenfang_jx@ncpu.edu.cn

Abstract. VR technology has been widely used in various industries, and has brought huge benefits. The field also needs VR to inject more new vitality. The purpose of this paper is to analyze the application of vr virtual technology in environmental art design teaching. This paper introduces the basic concepts of panoramic video projection, then briefly analyzes the implementation principles and layout methods of mainstream projection methods. Using the knowledge and analyzing the advantages of practical teaching cases, constructions scheme of desktop virtual reality course. And the use of software for VR display. For the current art design teaching proposed new teaching methods. This paper evaluates the teaching effect of the application. The experimental results show that in the investigation, when you think that the use to create environment design situation is conducive to improving students' enthusiasm for learning environment design, 37 students in the experimental class choose to promote, while 12 students choose to have no change, one of the students chose to be a hindrance.

Keywords: VR Virtual Technology, Environmental Art, Design Teaching, Application Analysis

1. Introduction

Virtual reality products are recognized as the next generation of phenomenal devices after computers, which can make students and teachers break through the limitations of classroom space to experience a variety of scenarios [1-2]. In the process of design, all kinds of hypothetical models will be solved[3]. Virtual reality technology can also stimulate students' thinking ability and creative ability, and can play a very good auxiliary effect for the diversity of design in principle [4-5]. Through the promotion of VR teaching, we can make different majors of art design obtain good teaching effect, and also can effectively relieve the pressure of teachers' teaching. Therefore, if VR technology is correctly combined with design teaching, it will have a profound impact on future design teaching [6-7].

According to the results of the "demand survey", Li BJ improved the portability and operability of the 3D VR system used for screen demonstration, and then took the virtual reality textbook produced by Li BJ to a high school and conducted teaching demonstration with the system [8]. Rossi S has carried on the teaching practice and carried on the appraisal to the primary school fourth grade student.
The results show that the introduction of virtual reality teaching material improves students' understanding level [9]. Bressani-Ribeiro T introduced the characteristics of virtual reality technology and its application in visual teaching of environmental design specialty [10].

This paper is an interdisciplinary study of environmental science and educational technology. Based on the actual example of land supervision office building, studies the virtual reality technology in the field of teaching. It tries to import the environmental model established by modeling software such as SketchUp and 3DS into the virtual reality platform Quest3D to set up the virtual environment, so as to create teaching situation and improve enthusiasm and initiative. At the same time, through the teaching example, this paper attempts to explore the skills in environmental design teaching, and tries to explore the new field of environmental design with examples, so as to improve the teaching effect of environmental design teaching.

2. Research on VR Virtual Technology in Environmental Art Design Teaching

2.1 VR Panoramic Technology

For the transformation from a point in three-dimensional space to a point in two-dimensional space, the point P' (x, y, z) on the spherical surface is obtained, and then the two-dimensional coordinates of the point P' are converted according to the three-dimensional coordinates of the point P'. Firstly, the index of patch to which point P' belongs is determined by the following formula:

$$F = \text{arg} \max_{i\in[0,7]} (\rightarrow), \ i \in [0,7] \quad (1)$$

The first step of panoramic video projection is to project the unit ball into two plane circles.

Let's reserve the gray spherical crown area of the hemisphere as $S_1$ and the height H. after projection, the gray area of the corresponding small circle in the horizontal circle is $S_2$, and its radius is r. If the spherical type of the crown is $s = 2\pi RH$; RH, the ratio of the spherical range of the top $S_1$ to the predicted small circle of the $S_2$ horizontal plane should be as follows:

$$\frac{S_1}{S_2} = \frac{2\pi RH}{\pi r^2} = \frac{2\pi R\times(R\times\sin\phi)}{\pi r^2} = \frac{2R^2\times(1-\sin\phi)}{r^2} \quad (2)$$

If r = 1, the relationship between the latitude of any point P in the sphere and the corresponding point P' (U, V) on the horizontal plane can be obtained.

$$\Phi = \arcsin(1 - (u^2 + v^2)) \quad (3)$$

Finally, the area stretch ratio of the two differential elements can be calculated as follows:

$$\text{SR}(u,v) = \frac{\delta S(\Theta, \Phi)}{\delta S(u, v)} = \frac{\cos(\phi)|d\Theta d\phi|}{|dudv|} = \cos(\phi)(u, v) \quad (4)$$

2.2 VR Generation of New Art Design Teaching Tools

Click render in the rendering options interface of keyshotvr to automatically generate keyshotvr files. Each frame of static image can be seen in the rendering process, and the rendering time is long. Keyshotvr files can be displayed on any web browser that supports HTML5. This kind of browser is very common, almost all kinds of teaching models are equipped. This file has the characteristics of high-quality display imaging and touch interaction. Skilled use of keyshotvr function can provide extremely high-quality interactive 3D display, and can be applied to a wide range of devices.

3. The Experimental Application of VR Virtual Technology in Environmental Art Design Teaching

Course content: Landscape Design

Class arrangement: 8 class hours
Participants: the third year students of environmental design major in college, namely class A and class B, 50 students in class A and 50 students in class B. Class A is the experimental class and class B is the control class.

Experimental methods and conditions: the comparative test method was used in this study. Class A adopts task driven method to realize virtual environment design teaching, and teachers use multimedia teaching. The teaching assistant software includes Autoexec CAD, sketchup and Quest3D software. Class B adopts the traditional teaching method of environmental design, but the teacher uses multimedia teaching. The teaching assistant software includes Autoexec CAD and sketchup. The teaching materials and auxiliary materials used in the two classes are the same. The students in the two classes have classes in the computer room, and the teachers are the same.

Experimental preparation: teaching examples, teaching task unification, computer installation of corresponding software.

In order to further understand the students' application of virtual reality technology in the teaching of environmental design and the effect after use, provide reliable basis for our further research. A questionnaire survey on the application of virtual reality technology in environmental design teaching was developed and distributed to the experimental class students. This time, 50 questionnaires were sent out and 50 copies were recovered, and the number of valid papers was 50.

4. Application Analysis of Vr Virtual Technology in Environmental Art Design Teaching

4.1 Application Evaluation of VR Virtual in Environmental Design Teaching

The data analysis of the questionnaire is as follows: in the survey, you think: when applying vr to teaching is better than the traditional multimedia teaching, 39 of the 50 students in the experimental class think the former is better, 10 students think the two are almost the same, and 1 student thinks that the latter is better than the former. In the survey, when you think that the use to create environment design situation is conducive to improving students' enthusiasm for learning environment design, 37 of the 50 chose to promote, 12 students chose to have no change, and 1 student chose to have the blocking effect, as shown in Figure 1.

![Figure 1. Using virtual reality technology to design learning environment](image)

In the survey, using virtual reality technology to design the learning environment, when your attention in class was compared with before, 45 of the 50 students in the experimental class chose to be more attentive, 4 chose not to change, and 1 chose to be easy to distract, as shown in Table 1.

| Facilitation     | Nothing has changed | Hindrance |
|------------------|---------------------|-----------|
| Increase enthusiasm | 37                  | 12        | 1         |
| Improve attention        | 45                  | 4         | 1         |

Table 1. Using virtual reality technology to design learning environment

In the survey, when you think that the design of learning environment with task driven learning mode or traditional teaching mode is better, 32 out of 50 students in the experimental class choose the
task driven teaching mode, 10 choose it doesn't matter, and 8 choose the teaching mode. From the above survey data, we can see that most of the students hold a positive attitude towards the application of virtual reality technology in the process of environmental design teaching. It plays a positive role in improving teaching, and improving students' enthusiasm and initiative.

In the survey of teaching mode, most think that the teaching effect of task driven learning environment design is better. When answering why, 22 students filled in: can stimulate students' interest in learning; 18 students fill in: can improve students' awareness of active participation; 7 students fill in: make students easier to master the teaching content; 3 students fill in: can cultivate students' innovation ability. It can be seen that most students hold a positive attitude towards learning virtual environment design with task driven teaching mode.

4.2 Evaluation and Analysis of VR Virtual Technology in Environmental Design Teaching

In the survey, when you think that the use of virtual reality technology to design learning environment is conducive to the cultivation of students' spatial scale, 46 out of 50 students in the experimental class chose to be in favor of it, 4 of them chose it unchanged, and 2 of them chose to hinder the cultivation of spatial scale, as shown in Figure 2.

![Figure 2. The use of vr is conducive to the design of learning environment](image)

In the survey, when you think that using virtual reality technology to design the learning environment is conducive to teaching communication between students and teachers, 40 out of 50 students in the experimental class chose to be in favor of it, while 10 chose it without any change. The choice of one person hindered the teaching communication between teachers and students, as shown in Table 2.

|培养空间尺度       | 46 | 4 | 2 |
|-------------------|----|---|---|
|教学沟通           | 40 | 10| 1 |

Table 2. The use of vr is conducive to the design of learning environment

The practice shows that after comparing, the students feel that the design of learning environment through the construction of virtual environment roaming system is helpful for students to carry out the overall conception, experience the space feeling of design, and speed up the design speed. What's more, this kind of environment design mode can fully reflect the design intention of teachers and let students participate in classroom teaching together, And become the main body of classroom teaching. Students can experience the effect of the environment, students generally think that this design mode is our future trend of environmental design. In learning new knowledge and applying knowledge to solve problems, students are free to explore the conversion of various file types, the selection of roaming camera and the realization of interaction. When encountering difficulties, students can discuss with each other or discuss with the instructor to solve the problems and difficulties in learning. This not only cultivates the students' cooperative learning ability, but also enhances the students' awareness and confidence in facing and overcoming difficulties.
5. Conclusions

VR technology can increase the sense of psychological immersion. For the teaching field, the multi-disciplinary knowledge integration are obvious. Based on VR technology, puts forward the theoretical guidance of virtual reality technology and desktop virtual reality experimental course. The VR technology combined with the shortcomings of environmental art design. This paper puts forward the complement means and constructs the teaching equipment perfectly. Through the use of this course in environmental art and design teaching, students' interest in class can be improved, and their sense of participation and learning enthusiasm can be stimulated. The interaction of virtual software can also give full play to students' subjective initiative, which has a great effect on improving students' space modeling thinking and creative ability. In addition, it also solves the needs of teaching equipment updating.

Acknowledgments

This research was financially supported by the Teaching Reform Research Project of Jiangxi's Universities under Grant no.JXJG-19-87-4.

References

[1] Zhang X, Jiang S, Patricia O D P, et al. How virtual reality affects perceived learning effectiveness: a task–technology fit perspective [J]. Behaviour & Information Technology, 2017, 36(4-6):548-556.

[2] Liou H H, Yang S J H, Chen S Y, et al. The influences of the 2D image-based augmented reality and virtual reality on student learning [J]. Educational Technology & Society, 2017, 20(3):110-121.

[3] Hui Z. Head-mounted display-based intuitive virtual reality training system for the mining industry [J]. International Journal of Mining Science and Technology, 2017, 27(04):134-139.

[4] Sabalic M, Schoener J D. Virtual Reality-Based Technologies in Dental Medicine: Knowledge, Attitudes and Practice Among Students and Practitioners [J]. Technology Knowledge & Learning, 2017, 22(2):1-9.

[5] Huang T K, Yang C H, Hsieh Y H, et al. Augmented reality (AR) and virtual reality (VR) applied in dentistry[J]. The Kaohsiung Journal of Medical ences, 2018, 34(4):243-248.

[6] Sai L, Yufei H. Study on the Architecture Design and interior Decoration based on VR Technology and Computer Simulation Platform [J]. Paper Asia, 2019, 35(2):54-57.

[7] Hou H C, Wu H. Technology for real estate education and practice: a VR technology perspective [J]. Property Management, 2020, 38(2):311-324.

[8] Li B J, Li F. Application progress of virtual reality rehabilitation technology in upper limb dysfunction after stroke [J]. Chinese Journal of Contemporary Neurology & Neurosurgery, 2017, 17(4):245-248.

[9] Rossi S, Pitidis A. Multiple Chemical Sensitivity: Review of the State of the Art in Epidemiology, Diagnosis, and Future Perspectives [J]. Journal of Occupational and Environmental Medicine, 2017, 60(2):1.

[10] Bressani-Ribeiro T, Almeida P G S, Volcke E I P, et al. Trickling filters following anaerobic sewage treatment: state of the art and perspectives[J]. Environmental Science: Water Research & Technology, 2018, 4(11):1721-1738.