Application of Computer Virtual Reality Technology in Practical Teaching of Construction Engineering Survey

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Abstract. Construction engineering survey is a professional course with strong practicality. In the process of practice teaching, teachers can not always take students to the production site for on-site teaching. In recent years, with the continuous progress of science and technology, computer virtual reality technology has been involved in many fields, which allows users to become a member of the virtual environment to sense and operate various objects in the virtual world and to have real-time interaction, so as to obtain immersive experience and feeling. Therefore, this course especially needs the help of computer virtual reality technology. This paper discusses the application significance of computer virtual reality technology in the practical teaching of the course and further discusses its application in the practical teaching of "Construction engineering survey" on this basis.

Keywords: Computer VR Technology, Construction Engineering Survey, Practice Teaching, Application

1. Introduction
Just like cloud computing, big data and 3D printing, the definition of VR is also very popular nowadays, with a charming sense of technology and future. This kind of three-dimensional virtual world simulated by computer technology and hardware equipment has the characteristics of virtual reality and multiple perception, which can make users get immersive experience and unlimited interactive possibilities, and make it a new expression carrier. With the maturity of virtual reality technology, it can be applied in more and more fields, and it is constantly going deep into our lives. No industry can resist the temptation of virtual reality, even teaching practical courses in the industry. The application of computer virtual reality technology to the practical teaching of building engineering survey is of great significance to improve the quality of practical teaching and obtain better teaching effect.

2. Virtual reality technology
Virtual reality is a kind of advanced human-computer interaction technology, which uses all kinds of modern information technology to effectively simulate the behavior of various perception systems in the natural environment. The application of virtual reality technology to teaching can provide students
with realistic and vivid three-dimensional perceptual learning resources, visualize the learning process, and change students from passive knowledge receivers to participants in the virtual environment. This learning method plays a positive role in arousing students' learning enthusiasm, cultivating students' learning skills and breaking through teaching difficulties. At present, there are many softwares for virtual reality production and virtual reality system development, among which skyline is the preferred software for real 3D digital scene production in China. As a mature 3D network digital earth platform software, skyline can create 3D scene with real photos, realize real-time browsing, planning and analysis in 3D scene and other applications. Almost all virtual simulation, simulation display and analysis of spatial objects can be realized through skyline. Skyline is mainly composed of terrabuilder, terragate and terraexplorer pro. Among them, terrabuilder realizes the generation of one-dimensional terrain data set, terragate realizes the release of three-dimensional terrain and spatial data, terraexplorer Pro realizes the construction and browsing function of three-dimensional scene, the three effectively organize different geospatial data, and constructs a complete virtual GIS platform combined with specific business themes [1].

3. Teaching status of construction engineering survey
At present, the teaching mode of construction engineering measurement practice is teacher explanation, video demonstration and student simulation operation practice. The specific process is as follows: first, the teacher explains and demonstrates, the teacher explains the measurement work and instrument operation according to the knowledge structure and his own experience; the second is the student operation, after listening to the theoretical explanation and observing the teacher operation demonstration, students practice in group on the existing training site of the school; video playback is usually used for the teaching of the construction survey chapter of "construction engineering survey". This part of the content is not vivid, people who have seen such works but have no practical operation can understand it, but it’s difficult for students to imagine how the work is going. The main defect of this mode is that for a large number of measurement work, students only learn how to measure, but do not know why to do so. The main causes of this phenomenon are as follows:

![Figure 1. Reasons for students' failure in learning](image)

3.1. Teachers lack practical experience in general
Many teachers in Vocational Colleges enter the school directly after graduation to complete the role transformation from "student" to "teacher".

Even if teachers have the relevant practice in the school, they still lack working experience in the construction engineering practice, so they have little understanding of the real production mode of the site and the operation methods of related work items.
3.2. The school can provide limited practical training conditions
Nowadays, universities are basically comprehensive universities, which have many comprehensive training centers. However, there are just a few corresponding practical training equipment provided by a course in a specific specialty. In addition, the construction engineering survey also needs a large and special training site[2,3]. At present, most schools can only meet the requirements of some training projects. For the course of "survey of Construction Engineering", only some basic experimental training sites can be provided, and the corresponding training conditions cannot be provided for many survey projects in construction engineering.

3.3. It is difficult to realize the practical teaching based on the construction site
For students majoring in construction engineering, it can help students understand the classroom theoretical knowledge more intuitively, accumulate practical work experience, and obtain a lot of knowledge that can not be learned in the classroom to visit the construction site, which is very popular with students[4]. However, this kind of learning method is only arranged in a certain period of the semester, but the time is relatively short, it can not achieve continuous learning, and affected by the production and construction stage of the construction unit, it can not basically achieve the requirements of learning what you want to see what construction site. In addition, it is also a problem about how to ensure the safety of students in the construction site.

4. Advantages of virtual simulation technology in practical teaching of construction engineering survey
As shown in Figure 2 below.

![Figure 2. Advantages of virtual simulation technology in practical teaching of construction engineering survey](image)

4.1. Students have equal access to learning
The application of virtual simulation technology is more three-dimensional than the traditional teaching content in form. In the process of learning by using virtual imitation technology, every student can feel that he is standing in front of the teacher directly, and there will be no problem that someone can't hear or see, which can ensure the learning effect and fairness of every student.

4.2. Break the limitation of space and time
The application of virtual simulation technology in the teaching of "construction engineering survey" can provide students with a good virtual practice site, and solve the problem that students can not
easily go to the construction site[6]. Combined with computer network technology, each student can click to learn anytime and anywhere according to their own situation, without fixed classroom, fixed class time, and not affected by the weather environment.

4.3. Not affected by construction progress
The learning process of students is gradual, especially the process of building survey, and relevant follow-up practice courses should be arranged. However, the learning progress of students is not necessarily the same as the construction sequence of the construction site, which greatly affects the practical effect of students. Virtual simulation technology can achieve the same desire of the two processes, make the construction progress consistent with the learning progress of students, and provide the corresponding simulation practice environment for students at any time.

5. Development of virtual teaching system of construction engineering survey
In order to explore the application of virtual reality technology in architectural teaching mode, this paper attempts to develop a virtual teaching system of architectural engineering survey based on B / S structure on Skyline 6.0 virtual reality platform of Tianjin historical building[7]. It realizes the 3D visualization of internal and external modeling function, information query, measurement, sunshine analysis, statistical analysis, etc. The implementation process of the system is as follows:

5.1. Create and publish 3D terrain scenarios
The remote sensing image and the digital elevation model DEM fused and superimposed by the Te"aBuilder to generate a realistic image with geographical reference 3D terrain scene. For multi-user real-time sharing of 3D terrain data, 3D terrain data set is published by Te"aBuilder[8].

5.2. Create 3D ground object models
Land model, such as land road, green landscape and architecture, is one of the indispensable elements of three-dimensional scene[9]. Using 3D software 3D studio MAX to create 3D geometric model, using image processing software Photoshop the process of texture processing modeling of ground objects includes processing texture guide CAD base map to build model map map and data export model to be exported to Microsoft model file.

5.3. Create 3D scenes
Three-dimensional scene is the foundation and research object of virtual system. Using the TerraExplorer pro to integrate the above three-dimensional terrain data, ground object model, vector data text, picture tagging, multimedia information and other related elements to create and publish three-dimensional engineering FLY, to generate a realistic virtual reality three-dimensional scene.

5.4. Functional development of spatial analysis
Using the secondary development API components provided by Vistual Studio 2010, SQL Server2008 database and TerraExplorer pro to realize the [2] of three-dimensional scene roaming, navigation, query, location, measurement and other spatial analysis functions. For example, the navigation function is shown in figure 1, the two-dimensional map in the lower left corner is linked with the three-dimensional view in real time, and the query function is shown in figure 2. Click on the model query target building implementation code as follows[10].

SGWorld.AttachEvent (" onLButtonDown "onLButtonDown ;// binding left mouse button click event
   var ret =SGWorld.Window.PixelToWorld (x ,y,1); if (ret.Type =:1)/judgment model type
   var plFeature =SGWorld 'Creator.GetObject (ret.ObjectI));
   buildingname =plFeature.Treeltem.Name; openDialogbuildingname =plFeature.Treeltem.Name / pop-up model information dialog box
   SGWorld.DetachEvent (" onLButtonDown' onLButtonDown ");
6. **Application of virtual simulation technology in practical teaching of construction engineering survey**

In order to realize the application of virtual simulation technology in the practical teaching of architectural engineering survey, a virtual simulation system of Architectural Survey is developed on the basis of desktop virtual simulation system. According to the content of construction survey, the virtual simulation system of construction survey will be divided into four subsystems: positioning laying system, foundation engineering construction survey system, wall construction survey system and deformation observation system. Each subsystem can continue to set different modules according to the characteristics of practical projects. For example, the deformation observation system can continue to set up three modules: building settlement observation, building inclination observation and building crack observation. We take the positioning laying system as an example to introduce the development concept of the system. The positioning and laying system uses three-dimensional interactive technology, streaming media technology, Internet technology and BIM based three-dimensional modeling technology to simulate a construction site on the computer screen. Students interact with the virtual building site through computer keyboard and mouse, and use the platform to complete the positioning and laying of buildings. The main technical difficulties of the system are as follows:

6.1. **Three dimensional modeling of construction site**

The three-dimensional model of construction site is established by using BIM three-dimensional modeling technology. At present, the development of BIM three-dimensional modeling technology has been relatively mature. For example, the school where the author works has opened relevant courses, and the students have the basic knowledge of the technology. Before using the platform, the students can complete the three-dimensional model of the construction site on the premise that the teacher provides the engineering case background.
6.2. 3D model input of construction site
The system platform will have the input function of 3D model to realize the interaction with other software. With the help of this function, students can input the prepared 3D model to realize the simulation of virtual construction site.

6.3. Interaction between students and virtual construction site
In order to complete the positioning and laying work on the virtual construction site, the three-dimensional interaction technology is used to realize the interaction between students and the virtual construction site. 3D interactive technology can intuitively and realistically simulate the real scene of the construction site to provide students a chance to interact with the virtual scene by clicking the mouse and keyboard to complete the actual project.

7. Conclusion
In the process of learning, we find that learning building engineering measurement in class is very different from on-site operation. Young students who have not yet practical working experience may feel abstract to learn these, and they must know this through practice. Besides, it is difficult for schools to provide corresponding practical environment. Virtual reality technology can make up for this deficiency, which can make the learning and the field practice maintain a high consistency, to bring a better teaching effect. In a word, the computer virtual reality technology will be applied in the practical teaching of this course.

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