Research and Application of Virtual Reality Technology for Undergraduate Online Teaching

Song Li, Xianmei Kong and Lina Wang*
School of Economics and Management, Shenyang Institute of Technology, Liaoning, China

*Corresponding author e-mail: 59160784@sylu.edu.cn

Abstract. Under the strong influence of the COVID-19, online teaching has been carried out in Colleges and universities all over the world. There are essential differences between online teaching and offline teaching. Although the teaching method of live online teaching is novel, a series of problems arise, such as students can't keep up with the steps of teachers, which is difficult to absorb teaching content and low teaching efficiency. Therefore, the objective of this paper is effectively solve the online teaching, poor understanding and analysis ability, low atmosphere and other problems. In this paper, VR technology e-learning which is new ideas, the design of new VR and online teaching integration way, the construction of online VR classroom and teacher control system, the use of modeling technology to create virtual classroom, cross space real-time teaching, improve the efficiency of online teaching in colleges and universities.

Keywords: Virtual Reality; Online Teaching; Undergraduate Education

1. Introduction of Background and Existing Problems for Undergraduate Online Teaching

1.1. Demand of Undergraduate Online Teaching
At present, most colleges and universities open the online course teaching mode. colleges and universities set up the online course system of general undergraduate elective courses or winter and summer vacation elective courses, and a small number of courses adopt the online teaching mode. In 2019, with the global outbreak of Novel Corona-virus Pneumonia, large-scale online courses will be needed in colleges and universities around the world to replace the traditional teaching mode. The demand for online courses has become an important teaching method and mode for colleges and universities, and the demand for online teaching is increasing. Even after the Novel Corona-virus Pneumonia, there will be an increasing demand for online training courses and online courses to assist traditional teaching due to spatial and geographical constraints. [1] Online teaching is the development demand of current university teaching and technological reform in the era of big data, and the exploration of online teaching model is a subject that needs rapid research and implementation.

1.2. The problems of Online Teaching
Due to the adoption of live online or video broadcast mode, online learning is essentially different
from traditional classroom. Although online teaching has its own advantages, there are also many problems needed be solved. First of all, there is no traditional classroom learning environment and atmosphere in online classroom, so it is difficult for students to concentrate on learning for a long time in the face of monotonous teaching mode, especially for long-term online video courses. Secondly, it is difficult for students to absorb the teaching difficulties. How to solve the in-depth explanation of knowledge points is one of the problems to be solved. Finally, for the limitation of online courses, lack of interaction and communication, for the control of the whole process, it is difficult for teachers to understand the current situation of each student, and it is necessary to timely feedback the status information of students to adjust the whole teaching process.

2. Then Foundation of Technology and Equipment for VR Online Teaching

2.1. VR Technology Principle
VR technology is also known as the spirit environment technology, and the simulation of intelligent sensor online, multimedia and computer technology. At the same time, it involves multi-disciplinary knowledge such as mechanics, optics, mathematics, etc. It can be transformed into multidimensional information with various forms of expression that can be felt and experienced \(^3\). VR is a comprehensive integration technology, involving three-level graphics, human-computer interaction technology, sensing technology, artificial intelligence and other fields. It uses computers to generate realistic three-dimensional visual, listening, olfactory and other senses, so that people as participants can experience and interact with the virtual world naturally through appropriate devices. When the user moves the position, the computer can immediately carry out complex operations and send back the accurate 3D world images to produce a sense of presence. The scenes and characters seen by VR are all fake, which is to put people's consciousness into a virtual world. This technology integrates the latest development achievements of computer graphics (CG)\(^3\), computer simulation technology, artificial intelligence, sensing technology, reality technology, online parallel processing technology and so on. It is a high-tech simulation system generated by computer technology. When people look at the world around them, because of the different positions of their eyes, the images they get are slightly different. This difference will make the experience feel the depth and make things look three-dimensional. VR technology also uses this visual difference to arrange different pictures for the eyes of the experimenters, so that they can feel the stereoscopic of the picture.

2.2. VR Main Equipment
The main equipment adopted for the new state experience of integrating AR technology is PC based immersion headgear (HMD). The representative of this device is Oculus Rift. Its advantages are good immersion experience and light weight. However, because of its wired equipment, its limited mobile range is a barrier, so it is not suitable for courses with large amount of activities. Secondly, mobile VR is also the selected VR classroom equipment. Now student users can reach the equipment holding rate of a mobile phone. Therefore, as long as the paper plate is simply folded into a box that can hold the mobile phone, this kind of equipment can enter the virtual classroom with low cost and easy to carry, so it can conduct online virtual class anytime and anywhere.

2.3. Design Ideas of VR Online Teaching
This teaching method is a very practical way, emphasizing the originality and interactivity of VR scene design. Students' thinking in class and the way of accepting their knowledge have changed. Classroom teaching is mainly used, VR virtual image and face-to-face teaching method is adopted to mobilize students' learning enthusiasm, activate classroom atmosphere, grasp students' thinking, and successfully complete teaching Learning task. Due to the long-term online teaching and the creativity and interactivity of VR classroom, teachers and students in other places can also face-to-face communication, increase the vitality of the classroom, and solve the problem of students' fatigue and
3. Design and Implementation of VR Online Teaching Platform

3.1. Design Ideas and Principles of Immersive Learning Environment Based on VR Technology
The focus of VR online teaching mode is the idea of how close the technical principle and teaching mode are. The principle of VR technology is to make people feel the three-dimensional of the picture. Its design principles mainly include head tracker using cursor to create aesthetic feeling[4]. Due to the needs of large-scale online teaching and online teaching after the epidemic, through the creativity and interactivity of VR classroom, teachers and students in remote places can communicate face to face and better assist teachers in distance teaching. Immersive learning mode needs to wear VR equipment to experience the learning environment and learning content. The application of VR teaching mode should mainly consider two aspects, one is how to create learning environment, the other is to solve the learning content. Learning environment is a classroom environment in which students achieve experiential classroom and create learning atmosphere through VR technology, while learning content is a learning mode that pays attention to the knowledge points of teaching itself, collects classroom teaching content and designs a reasonable VR scene cooperation learning mode for a certain problem.

3.2. Application of We-chat Public Platform and Small Routine
We-Chat public platform, is official account which is widely used by Chinese student. The project uses a subscription number, which is an account type of public platform. It will provide users with the use method of VR classroom and update information. On the platform, the team will send a group message every day, and this message will be displayed in the user's subscription number folder, so as not to be found when the user forgets. When sending messages to users, users will not receive instant message reminders to avoid disturbing users. In the user's address book, the subscription number will be placed in the subscription number folder.

Colleges and universities in the setting of the public platform to quickly create store small programs. It is necessary to simply fill in information about enterprises, profiles, usage patterns and pictures. Without complex development, a small program similar to name card is generated quickly, and it is supported in the official account's custom menu, picture message and template message. At the same time, we also develop our own small program, generate the corresponding two-dimensional code, and set the specific use process, which is applied to VR online teaching. Through the introduction of VR's principle, design principles and design ideas, users can better understand the design and development of its platform. And it will show them to understand the VR device style, we-chat public platform and we-chat applet interface introduction, usage, promotion information.

3.3. Precautions for Establishing VR Online Teaching Mode
VR technology is one of the tools to assist online teaching. The purpose of establishing VR online classroom mode is to effectively increase the sense of classroom experience and let students experience the teaching content. The first mock exam should consider the use time of VR animation. Long time VR immersion teaching will have some effect on eyesight, and a single mode will also make students lose interest. Schools should speed up the development of VR online mode, and pay attention to the equipment cost and practical[5]. Although the integration theory of VR technology and teaching mode needs to be improved and applied, the practical needs need to develop and research feasible VR technology teaching scheme as soon as possible.

4. Summary
VR online teaching mode is a specific means of expression of educational content, which is a higher degree of concretization than video, better experience, and more interactive design space. Compared with the traditional online course which has strong representational ability, VR online mode introduces
the sense of balance and direction, which optimizes the sense of space. The improvement of its representational ability is revolutionary.

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