Research on University Experiment Immersive Teaching Model Based on Virtual Reality

Ming-Hua ZHANG, Mao-Mao ZHANG, Yu-Qi CHEN and Ji LI

Fu Yang Normal University, Fuyang, Anhui, China

Keywords: University experimental; Immersive teaching; Virtual reality.

Abstract. Virtual reality has attracted more and more attention due to its advantages of immersive and interactive, these advantages provide a new and effective teaching method for educators. In order to effectively solve the problems existing in university experiments and promote university experimental teaching, virtual reality provides an effective way. This paper aims to apply virtual reality to the teaching of university experiments, and university experiment immersive teaching model is proposed based on virtual reality, which stimulates students' interest in active learning and improves learning effect. And it also lays a certain theoretical foundation for the application and popularization of virtual reality technology in future education.

Introduction

The study found that the experimental teaching of most of the local university undergraduate has more or less problems. Firstly, the experimental project setting is not perfect, the experimental project is lack of inquiry, and the experimental project is too simple, which limits the cultivation of students' practical ability. Secondly, the experimental platform is slow to build and backward. Only a small part of the school's funds is invested in the construction of experimental courses. Due to lack of funds, some expensive experiments cannot be carried out. Thirdly, the model of university experiment follows the high school teaching model, and uses the method of words and deeds to conduct university experimental teaching. Students simply passively follow the given experimental steps to complete the experiment, and students' innovative thinking and hands-on practice are limited. Fourthly, due to the low interest of students in the experimental course, the effect of experimental learning is not good. The experimental class can't stimulate students' interest. The time invested by the students is very small, which directly leads to the students' poor practical ability. In general, the existence of these problems is not conducive to the improvement of students' hands-on practical ability.

In recent years, virtual reality (VR, Virtual Reality) has achieved rapid development and has been used widely in many fields, which has Promoted the development of all walks of life in society. VR+ education has also gained more attention. The immersive and human-computer interaction operating environment in virtual reality provides a new solution to solve some existing problems in experimental teaching. This immersive and interactive teaching method can stimulate students' interest in active learning and improve learning outcomes.

The Overview of Virtual Reality

Virtual Reality Technology is a computer simulation operating system that can create, develop, and experience virtual environments [1, 2, 3]. Virtual reality technology has the following three
most significant features: firstly, Interactivity mainly means that users can interact with content in a virtual scene by wearing specific hardware devices. Secondly, Immersion mainly refers to the use of software and hardware devices to build a virtual space that allows users to feel "real" vision and hearing. Thirdly, Space Conceptuality; this feature of virtual reality allows people to create things that do not exist in reality in the virtual environment. In virtual reality technology, key technologies include the model building, sound localization, visual and spatial tracking, and so on. The use of these key technologies can make the virtual scenes more authentic [4].

With the gradual maturity of virtual reality technology, VR systems are mainly divided into the following categories, including desktop virtual reality systems, immersive virtual reality systems, distributed virtual reality systems, and remote sensing virtual reality systems. The immersive virtual reality system is studied in this paper. In order to solve some problems in university experimental teaching, the immersive virtual reality technology was used as a new educational technology and has been applied in the teaching of university experiments, which can improve the university experimental teaching effects and students' practical ability.

Application Status and Advantages of Virtual Reality Technology in Education

In 2012, Oculus Rift launched the VR package, and immersive VR has also been greatly developed and promoted, and in 2013 it began to be applied to the education sector in the United States [5]. In 2013, digital images of a large scale high-resolution VizWall were imported into the Oculus Rift VR helmet to create an immersive virtual reality learning environment and become a new educational method. In 2016, immersive VR has also received widespread attention in China, and some universities in China have conducted research on related topics in immersive VR. For example, Beijing Aerospace University has studied the application of distributed flight simulation. Zhejiang University has carried out research on virtual planning and virtual design in architecture. Some domestic companies and institutions have cooperated to launch VR education and training products in recent years.

There are several advantages for virtual technology in the field of education. One is security. In real experiments, some high-cost or high-risk experiments are difficult to operate [6]. Students can perform dangerous experiments in virtual scenarios to ensure student safety by virtual technology. The second is economic. The use of virtual technology to model the experiments of these disciplines is often very low cost and can be shared with more schools. Third, science and technology are developing rapidly, and some emerging disciplines are produced. Virtual technologies can be used to quickly develop experiments for emerging disciplines. Fourth, the virtual experiment teaching is interactive, which can stimulate students' interest and improve the learning effect.

Feasibility Analysis of Virtual Reality Application in College Experiment Teaching

University experimental immersive teaching is to apply the immersive virtual reality technology to the university experiment. Students can enter the constructed virtual experiment scene through wear virtual reality equipment, and perform experimental under the guidance of teachers. University experimental immersion teaching based on virtual reality technology is only one way to achieve our teaching purpose, which can stimulate students' interest in active learning and improve learning efficiency. With the continuous improvement of immersive virtual reality technology, some experiments will largely adopt immersive virtual reality as the main teaching method, allowing students to cultivate students' active learning interest and improve learning efficiency through immersive and interactive learning methods. To understand and master subject knowledge faster.

This paper will analyze the feasibility of applying virtual reality to university experiments from the following aspects. Firstly, the feasibility of the policy; the state encourages the development of the virtual technology industry. Secondly, the feasibility of technology; with the support of advanced technologies such as 5G technology, human-machine interface technology, and sensing technology, the comprehensive application of these technologies will create an immersive virtual
reality experiment that meets the requirements. Thirdly, the feasibility of demand; the safety of students can be guaranteed when various dangerous experiments are carried out in the immersive virtual reality experiment. In the virtual reality classroom, the interest of active learning of students can be stimulated and obtain efficient learning results. Fourthly, the feasibility of the economy; it will take little time and money to develop the university immersive virtual experiment courses. After completing the virtual experiment courses, more teachers and students can participate in the immersive virtual reality experiment through online resource sharing, which will realize the economic benefits of low input and high output.

Design of Teaching Model for Virtual Reality Application to University Experiment

Although virtual reality has many advantages, it does not apply to all experimental courses. Some experimental scenarios can be used. Some experimental scenarios do not need to be used. In some experimental scenarios, the virtual reality cost is too high to be used reasonably, and the expected learning effect cannot be achieved. Some experimental scenarios virtual reality technology cannot be realized at present. So when should I use virtual reality? Next, we mainly study the design of teaching models that apply virtual reality to university experiments, and give the general steps to be followed.

The teaching model designed in this paper. Firstly, develop specific experimental goals; then according to the experimental goal, the experimental process is divided into several links, and each link is evaluated from three aspects: safety, economy and learning effect, so as to choose a more appropriate way to carry out experimental teaching. Often dangerous experiments, it is recommended to teach in a virtual experimental scenario. Secondly, technology and resource needs; some experiments, using virtual reality technology, are too costly and often do not recommend virtual technology. Thirdly, the teaching effect is estimated; regardless of the teaching technique used, the main purpose is to improve the learning effect. Due to the immersive and interactive advantages of virtual technology, students can often stimulate their interest in learning and improve their learning. Finally, virtual experiments must be scientific; conception is a feature of virtual technology, but when using virtual technology to develop experiments, it must be scientific and not contrary to scientific principles.

Summary

The virtual reality technology is studied in this paper. And it is regarded as a new educational technology, the application status and advantages of virtual reality technology in the field of education is also studied. Finally, the university experimental immersive teaching model was discussed from the feasibility of the university experimental immersion teaching method and the design of the teaching model. This kind of exploratory teaching research aims to stimulate students' interest in active learning and maximize the effect of teaching, and lays a theoretical foundation for the application of virtual reality technology in future education.

Acknowledgements

This research was supported by Fuyang Municipal Government - Fu Yang Normal University Cooperation Project (No.XDHX201734, XDHX201734), Provincial Natural Science Research Project of Anhui Province (No. KJ2011ZD07), Research on Analysis of Big Data by Complex Network Method (No. 2018HXXM34), Reform and Practice of Multi-party Collaborative Education Mode in ICT New Engineering (No. 2017xgkxm41), Research on the Construction and Implementation Action of the Applied Talents Training System from the Perspective of Academic Competition Extension, Strengthening and Innovative Practice Ability Training (No.2015ZDJY10).
References

[1] Zhan, C., Yu, X., Wu, Y., et al. The Application of "Virtual Reality + Education" in College Practical Teaching [C].

[2] Gao, Dongfeng. The Influence of Virtual Reality Technology Development on College Experimental Teaching Reform and Coping Strategies [J]. China Higher Education Research, 2016 (10): 56-57

[3] Liu, Dejian, Liu, Xiaolin, Lu, Aifan and Huang, Ronghuai. The Potential, Progress and Challenge of Virtual Reality Technology Education Application [J]. Open Education Research, 2016 (8): 25-26

[4] Fung, F.M., Choo, W.Y., Ardisara, A., et al. Applying a Virtual Reality Platform in Environmental Chemistry Education to Conduct a Field Trip to an Overseas Site [J]. Journal of Chemical Education, 2019.

[5] Laura Freina and Michela Ott. A Literature Review on Immersive Virtual Reality in Education: State Of The Art and Perspectives [Conference]: eLearning and Software for Education (eLSE), At Bucharest (Romania). April 1, 2001.

[6] Yiqun Liu, Xuanxia Fan, Xiaojing Zhou, et al. Application of Virtual Reality Technology in Distance Higher Education. ICDEL 2019, May 24–27. DOI: https://doi.org/10.1145/3338147.3338174