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The application research on virtual reality technology in teaching in China

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Abstract
Virtual reality technology (referred to as VR technology) as a new generation of information technology has brought new opportunities for the development of education industry. It allows students to interact with course content in a virtual environment and solve the problems of interactivity, situation and immersion in traditional classroom. At present, many researchers have achieved fruitful results in the teaching of VR technology. These studies have not only greatly promoted the wide application of VR technology in teaching, but also further improved people's recognition of VR teaching. In order to further promote the application research of VR technology in teaching, this paper reviewed the application of VR technology in teaching, analyzed the advantages and challenges of VR technology in teaching applications. The reasons why it could not be popularized in teaching and how to improve it were summarized in order to prepare for further research in the future.

Keywords: virtual reality technology, virtual environment, virtual teaching

1. Introduction
VR is the abbreviation of virtual reality, which refers to the virtual environment that gives people the immersive reality feeling. It has the characteristics of immersion, interaction and conception (Huang, Y. Y., 2018) [1]. As soon as this kind of technology appeared, it has just received widespread attention. It is widely believed that this new technology will not only provide students with a rich and varied personalized learning environment, but also bring great assistance and promotion to students' learning. It can also implement the educational concept of "teaching with pleasure" and "teaching according to their aptitude", and stimulate students' intrinsic motivation. Therefore, it represents the direction of virtual teaching in the future. In order to promote the scientific and rational use of VR technology in teaching, a series of related academic research has appeared at home and abroad. These academic studies have undoubtedly greatly promoted the widespread use of VR technology in teaching practice. In order to further enrich the application research of VR technology in teaching, this paper reviewed the advantages of VR technology applied in teaching and the challenges it faced, so as to pave the way for further research.

2. Advantages of VR Technology in Teaching
2.1 In Terms of Knowledge and Skills
2.1.1 Presentation of Spatial Relationships and Internal Structures of Objects
Ding Nan, Wang Yamin and others believed that virtual reality technology could promote students' understanding of the internal structure and spatial relationship of objects in various disciplines (Ding, N. & Wang, Y. M., 2017) [2]. Zhu Geyu believed that VR technology could largely make up for the lack of traditional classroom flattening (text, picture) and one-way teaching forms, and help students understand the teaching content (Zhu, G. Y., 2014) [3].

2.1.2 Simulation of a Specific Scene
Li Guipin believed that VR technology could simulate and reproduce the process of changing natural phenomena or things that could not be observed in real life, provide students with vivid and realistic and intuitive learning materials to help students solve the difficult problems in learning, turn abstract teaching problems into concrete images and improve the acceptability of knowledge (Li, G. P., 2006) [4]. Liang Yutao believed that the use of virtual reality systems in experimental teaching could make up for the shortage of experimental equipment, experimental sites, teaching funds, etc. Students could do all kinds of experiments without leaving home, gain the same experience as real experiments, enrich their perceptual understanding, and deepen their understanding of the contents of teaching (Liang, Y. T., 2006) [5]. Li Guipin and Wu Jiang believed that VR technology could change the current situation that students lose the use of some instruments and reagents due to relatively backward economic and cultural conditions, poor experimental facilities, and limitations of experimental equipment and site facilities, and greatly improve the learning quality and efficiency(Li, G. P., 2006) [4]. Liang Yutao believed that using VR technology to conduct virtual experiments could avoid all kinds of the dangers caused by real experiments or operations as well as experiments that were dangerous or harmful to human health. Students could directly participate in experiments without fear of this concern (Liang, Y. T., 2006) [5]. Li Guipin and Wu Jiang believed that in the experimental teaching, it was very difficult to do an experiment under the experimental teaching environment, or it took a lot of money to carry out the experiment, or some dangerous, relatively responsive, long-term reaction. Using VR technology, these phenomena or processes could be simulated dynamically and realistically without fear of equipment damage or injury students (Li, G. P., 2006) [4].

2.1.3 Simulation of Skill Operations

Through teaching experiments, Zhao Xiaokun believed that VR technology could effectively improve students' attention and the proficiency of students' technical movements, and could effectively and quickly feedback, which was conducive to quickly grasping the difficult points of technical movements and improving students' interest in learning(Zhao, X. K., 2015) [6]. Han Li and Liu Qi, through experimental comparison, believed that the real-time interactive teaching through the virtual scene system had a significant effect on improving students' technical level and teaching quality(Han, L. & Liu, Q., 2015) [7]. Zhu Geyu believed that virtual reality could simulate realistic scenes. Students could play roles in the virtual environment and perform the same operations as the real world, including training of various vocational skills, and these operation training could be repeated and safe and reliable(Zhu, G. Y., 2014) [3].

2.2 In Terms of Personalized Learning

Huang Yiyu believed VR technology provided students with personalized learning conditions. Students could try to complete different tasks in the virtual environment or complete tasks in different ways according to their personality expression, so as to achieve more proactive planning, organization and monitoring of course activities(Huang, Y. Y., 2018) [1].

2.3 In Terms of Learning Motivation

2.3.1 Learning Interests of Students

He Kun and Wang Ying thought that using VR technology to produce courseware and apply it to teaching, the results showed that the teaching effect was significantly better than that of traditional courseware, and it could stimulate students' interest in learning(He, K., 2007; Wang, Y., 2011) [8-9].

2.3.2 Teaching of Sense of Presence

Ding Nan, Wang Yamin and others believed that traditional classroom teaching made it easier for students with lower motivation to distract themselves from their attention because of some classroom environment factors. And VR technology provided students with the opportunity to interact with the learning environment and could instantly give immersive interactive feedback, which made students have a strong sense of presence and greatly enhanced their participation in learning(Ding, N. & Wang, Y. M., 2017) [2].

2.3.3 Breaking the Limitations of Time and Space

Liang Yutao believed that VR technology could completely break the limitation of space, from cosmic celestial bodies to small atomic particles. Students could enter the interior of these objects for observation. They could also break through the limitations of time. Some changing processes that take decades or even hundreds of years to observe could be presented to students in a short period of time through virtual reality technology(Liang, Y. T., 2006) [5]. Li Guipin believed that it could completely break the limitations of time and space, provided students with a realistic and interactive, graphic learning environment, and provided situations and experiences found in real life or reproduce specific environments, so that they could become participants, gain the same experience as real learning and experimentation, and break through the key points and difficulties of teaching(Li, G. P., 2006) [4].

2.4 In Distance Education and Online Collaborative Learning

Liang Yutao thought that VR technology could create a humanized learning environment by virtual historical figures, great men, teachers, students and other characters, so that distance education students could learn in a natural and intimate atmosphere(Liang, Y. T., 2006) [5]. Zhu Geyu also believed that VR technology created interactive learning environment by virtue of various characters, and greatly improved the learning efficiency of distance education students by making courseware systems for distance learning(Zhu, G. Y., 2014) [3]. Gao Jianhua and Deng Yaming also believed that the constructed virtual characters could reflect the real student individual into the virtual environment. This role could help students grasp and understand curriculum knowledge in the virtual environment according to the presetting learning tasks that need to be completed by the computer(Gao, J. H. & Deng, Y. M., 2011) [10].

3. Challenges of VR Technology in Practical Teaching

3.1 At the Product Technology Level

Ding Nan and Wang Yamin believed that there was a poor experience in the use of head-mounted display devices. The viewing area of the display device was relatively narrow. The weight and volume of the device were too large, and the freedom of movement of the user was limited by hardware, which led to insufficient interactive experience and other defects(Ding, N. & Wang, Y. M., 2017) [2].

Jiang Duorong believed that VR technology was currently costly and not suitable for large-scale popularization. To some extent, the high cost investment has restricted the technology to civilians(Jiang, D. R., 2015) [11].

Wei Wei and Ma Ge believed that the performance of graphics rendering hardware needed to be further improved. Although the level of hardware has developed rapidly and the ability of graphics processing has been greatly optimized, it still could not meet the requirements of virtual reality technology for hardware, especially for image rendering(Wei, W. & Ma, G., 2012) [12].

Zhu Geyu believed that the software was still affected by the limitations of hardware. The writing cost was still high, and it was difficult to popularize among the teachers who need it most. The VR programming program which was more convenient for teachers to use still needed to be developed(Zhu, G. Y., 2014) [3].

3.2 At the Teaching Application Level

Lun Farley believed that the biggest challenge was that the teaching methods of teachers had not yet changed, and traditional teaching was still adopted in virtual environments, which made virtual reality technology difficult to function (Lun, F., 2015) [13]. The production of virtual reality content must have many years of teaching experience and professional teachers to participate in, which was impossible for enterprises to do. Jiang Duorong also believed that the application of VR technology in practical teaching will put forward higher

requirements for front-line teachers' professional level and new technology application ability, and the difficulty of teaching and preparing lessons will be further enhanced(Jiang, D. R., 2015) [11].

Liu Dejian and Gao Yuan both proposed that the multiple information transmission methods used by virtual reality were likely to cause the student's cognitive overload, and there was no effective evaluation of the relevant monitoring data of students' learning process. It was not clear whether students were using virtual reality technology for learning or entertainment (Liu, D. J. & Gao, Y, 2016) [14]. Zhu Geyu believed that although VR technology has authenticity, sometimes too real will easily lead to thinking stereotype (Zhu, G. Y., 2014) [3].

4. Improvement Measures

4.1 In Terms of VR Technology Itself

Huang Yiyu believed that enterprises needed to further improve the maturity of the technology, and assist in the creation of intelligent and practical virtual reality teaching environment through augmented reality, enhanced virtual environment, mixed reality and other technical means. And enterprises needed to reduce the difficulty of using technology and provide a better experience of equipment use. To develop the function of collecting and evaluating technical data, which was convenient for educators to evaluate the effect of students' learning, and to improve the safety factor for data privacy, especially for students' personal information(Huang, Y. Y., 2018) [1].

4.2 In the Teaching of Teachers

Huang Yiyu believed that educators must first consider what content should be taught by VR technology and how to conduct teaching in the face of specific teaching situations, so that the teaching design could be more in line with the students' cognitive process. According to the actual teaching, carry out long-term effect testing, monitoring and evaluation, master rules of data, and improve the learning environment and teaching design based on VR technology according to the evaluation results(Huang, Y. Y., 2018) [1].

5. Comment on Current Studies

At present, the research on the application of VR technology in teaching is rich. The research direction of academia is roughly the application of VR technology in teaching, the advantages of VR technology applied in teaching, the huge challenges and improvement measures of VR technology, etc.

At present, different researchers have their own views on how the combination of VR technology and teaching will bring about to teaching. The purpose of introducing VR technology is to solve the problems existing in teaching and to help students overcome the difficulties in their study, such as three-dimensional geometry problems, poor spatial imagination and so on. In order to free students from the constraints of traditional teaching, it is no longer limited to textbooks, but to perceive the process of development of knowledge from a more three-dimensional and intuitive perspective, to embody abstract problems, to plane the three-dimensional space, to change passive learning into active learning, and to achieve great benefits of teaching. Therefore, the unique advantages of VR technology are integrated into teaching.

When talking about the important guiding significance of VR technology to teaching, we must also clearly recognize the problems. First, VR technology is only an auxiliary means of teaching, not the ultimate goal of teaching. When the teaching content is relatively unfamiliar and students encounter difficulties in understanding and mastering the knowledge, they need to use the intuitive teaching aids. When using VR technology, teachers must grasp the scales to prevent students from relying too much on the actual experience, and put the cart before the horse. At the same time, teachers should give full play to our leading role, pay attention to inspiring and guiding students. Therefore, based on the cultivation of students' core literacy, the reasonable use of VR technology makes the teaching classroom of VR technology truly becomes a platform for teachers and students to actively participate, interact and develop together. Second, in the VR world, for teachers, it is necessary to correctly and rationally guide students transform from the virtual world to the real world, so that they can develop good cognition, correctly understand VR technology, prevent indulging in the VR world and not extricate themselves. Finally, the attitudes of the education authorities, governments, and enterprises directly affect the application of VR technology in teaching. We must strive for the active cooperation of the three to form a trinity education network. Therefore, future research should strengthen the specific research of VR teaching improvement measures and the research of VR itself, aiming to improve the teaching measures, enable VR technology to enter the classroom better, and play the role and function of VR technology in teaching better, so as to make VR teaching more popular and popular.

The use of VR technology has fundamentally changed the way humans think. With the further maturity and development of related technologies, the improvement of the performance of corresponding hardware devices and the development of software systems, the application of VR in the field of teaching has been expanded. And with its successful application in the fields of biology and physics, VR is used in the field of teaching and research, which will bring subversive changes to teaching.

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