Application of Virtual Reality Technology in University Education

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Abstract—Through the analysis of information and data, we use multimedia, simulation, sensing and artificial intelligence in teaching in colleges and universities, and use many abstract and difficult experiments and theoretical knowledge to create simulated scenarios, natural simulations, and lifelike experiences with virtual technology. Technology and methods. It can generate real-time artificial virtual environment with three-dimensional information that people can interact with naturally. When learners enter it, they can have an immersive and completely real feeling. Through a variety of sensing devices, people can inspect or manipulate objects in the virtual environment, and manipulate and communicate with the environment in real time as in the real world. Virtual reality technology has been fully utilized and popularized in the education of colleges and universities.

1. Introduction
Virtual reality technology refers to an interdisciplinary development based on multimedia technology, computer graphics, simulation technology, sensing technology, artificial intelligence, etc. Virtual reality technology makes full use of high-performance computer hardware, software resources and various advanced sensors integrated technology. In fact, it not only refers to the use of sensor-assisted facilities, but also includes everything related to it with learners entering it, which can produce an immersive and completely real feeling. [1] At the same time, learners can use human natural skills to investigate or manipulate objects in the virtual environment based on their own feelings through a variety of sensing devices, and conduct real-time manipulation and mutual communication with the environment as in the real world. The application of virtual reality technology in the field of education and teaching has unique advantages.

With the rapid development of information education, the application of high-tech has become the direction of the education field to help learners develop self-learning ability and knowledge renewal ability. Virtual reality technology is one of the most popular research fields at home and abroad. The use of virtual reality technology in teaching can fully mobilize the learners' thinking and sensory organs. For some difficult-to-access teaching content and scenes that are difficult to restore, virtual reality technology can also be used to observe and reproduce the scene in multiple directions.

2. Overview of Virtual Reality Technology
Virtual Reality refers to the use of three-dimensional graphics generation technology, multi-sensor interaction technology, multimedia technology, artificial intelligence technology, human-machine...
interface technology and high-resolution display technology and other high-tech to generate a three-dimensional realistic virtual environment [2]. Provide users with the simulation of vision, hearing, touch and other senses, so that users can observe things in three-dimensional space in a timely and unlimited manner as if they are on the scene. At the same time, multi-dimensional information interaction can be carried out between humans and the virtual environment. From the virtual environment integrated qualitatively and quantitatively, users can obtain a perceptual and rational understanding of objective things in the objective world, thereby deepening concepts and constructing new ideas and ideas.

Virtual reality includes four key characteristics: multi-sensory, immersive, interactive, and conceptual. They emphasize the dominant position occupied by humans in virtual reality environments. The so-called "multi-sensory" refers to visual perception, auditory perception, tactile perception, force perception, movement perception, and even taste perception, smell perception and so on. The so-called "immersion" refers to the degree of realism that users experience in a virtual environment. The best effect is that it is difficult for users to distinguish between true and false during the experience. The so-called "interactivity" refers to the user's degree of maneuverability of objects in the simulated environment and the natural degree of feedback from the environment (including real-time). The so-called "conceptuality" refers to the combination of various information and their own behaviors in the process of using the virtual reality system, so as to develop imagination, association, reasoning and logical judgment, so as to acquire more knowledge and achieve a deeper level of knowledge. Practice exercise [3]. Reality and virtual technology have four characteristics: perception, immersion, interaction, and conception, as shown in Figure 1:

![Figure 1. Features of virtual reality](image)

3. Research status of virtual reality technology in the field of education at home and abroad
VR was proposed in the 1960s, but only in the past 10 years with the rapid development of computer technology, has it been popularized and applied in more and more fields. The United States is the country with the earliest VR research, the widest research scope, the highest level of research, and the largest contribution of related research to national development. At present, the basic research in this field in the United States mainly focuses on four aspects: perception, user interface, background software and hardware. Japan is also one of the leading countries in the current research and development of practical VR, and it is mainly dedicated to the research of establishing a large-scale VR knowledge base.

3.1. The current research status of virtual reality technology in the field of foreign education
Currently in developed countries, VR has been widely used in education. As early as 1985, the U.S. National Library of Medicine began digital research on human anatomy images, and used virtual humans to carry out computer-assisted teaching in subjects such as virtual anatomy, virtual radiology, and virtual endoscopy; In 1992, Mark Ingriberg and Robin Bedditi collaborated to create a virtual physics laboratory. The goal is to make it a highly operable experimental environment so that students can carry out the basics. Physics research; the University of Hannover in Germany has established a
The Department of Electronics of the University of Spain has developed a virtual working platform for electronic instruments; the University of Pavador in Italy has established a remote virtual education laboratory; the National University of Singapore has developed a remote oscilloscope experiment and pressure vessel experiment; In 1995, a virtual experiment of "virtual frog dissection" appeared on the Internet. "Experimenters" communicated with each other and expressed their opinions on the Internet. They could even conduct dissections by themselves on the screen, using virtual scalpels to separate layer by layer. frog. Observing its muscle and bone tissue is almost the same as a real anatomical experiment [4]. The viewer can also adjust the observation angle and zoom the image arbitrarily.

3.2. The development of virtual reality technology in the domestic education field

In China, the development and research of virtual reality technology is still a long way from developed countries, but it has attracted great attention from relevant government departments and the scientific community. According to the questionnaire survey of some domestic colleges and universities, the number of virtual reality technology projects is shown in Figure 2:

![Figure 2: Comparison of the number of VR projects](image)

With the rapid development of computer system engineering, computer graphics and other technologies, virtual reality technology has attracted the interest and attention of people from all walks of life in our country. The National Natural Science Foundation and the National High-Tech Research and Development Program have included VR in their research projects. Some key domestic colleges and universities have actively carried out research in this field. Famous universities such as Zhejiang University, Peking University and Shanghai Jiaotong University have successively established virtual campuses. Tsinghua University uses virtual instruments to build an automobile engine detection system; the Engineering Testing Laboratory of the School of Mechanical Engineering of Huazhong University of Science and Technology publicly displays its virtual laboratory results on the Internet for distance education; but domestic research on virtual reality technology mainly focuses on virtual instrument implementation, Local simulation, experimental demonstration, etc.

4. Experiential learning in the environment of virtual reality technology

Research shows that learning in the process of personal experience is the most effective. Virtual reality technology can provide learners with realistic experience and technical support similar to personal experience. Learners can experience different time and space in this kind of simulation process, and can come into contact with various simulated objects and various parts of the virtual environment, so as to produce a realistic experience and better experience learning.

Reality virtual technology has been successfully applied in experience perception, simulation experiment, simulating history and culture, interactive learning, etc., as shown in Figure 3:
4.1. Experience perception in a virtual environment

Virtual reality technology provides learners with abundant learning resources and opportunities to choose learning materials and learning methods. The use of virtual reality technology allows learners to learn a variety of things that are actually time, deformable, distance, abstract and difficult to observe and verify by other methods. For example, when learning about the formation and development of various natural phenomena, most natural phenomena are time-sensitive, or fleeting, or very long, and it is difficult for learners to observe. However, we can use virtual reality technology to allow learners to realistically observe the changes that have occurred in the natural world for decades, hundreds, thousands, or even tens of thousands of years in a short period of time. In another example, the various concepts and definitions in subjects such as physics, chemistry, and mathematics, as well as the atomic and molecular structures and chemical reactions of substances, are all very abstract. In traditional teaching, they can only rely on the oral narration of teachers to teach; while using virtual real-world technology, teachers can accompany learners to experience the virtual environment together in the classroom, observe some key issues, and allow learners to "enter into it" to experience, so as to obtain first-hand concepts and knowledge. This learning method makes those abstract hard-to-understand learning content presented in a vivid and vivid form, which greatly improves the learner's understanding and mastery ability.

4.2. Carry out simulation experiments in the virtual laboratory

Experiment is an indispensable process in teaching activities, and many subjects are based on experiments. A virtual laboratory is a virtual environment in which experiments can be carried out simulated or fabricated by virtual reality technology. In this environment, learners seem to be performing field operations at close range in a real laboratory. Learners can use the virtual laboratory to carry out simulation experiments. For example, some drugs in chemical experiments are highly toxic, and some chemical reactions are violent or take a long time. Putting these experiments in a virtual laboratory can simulate the experimental phenomenon or process well without worrying about causing harm. For another example, researchers at the University of Houston and NASA (National Aeronautics and Space Administration) Johnson Space Center built a system called "virtual physics laboratory", which can be used to intuitively study physical phenomena such as gravity and inertia [5]. Learners who use this system can do various experiments including the law of universal gravitation, and can control and observe various phenomena caused by changing the magnitude and direction of gravity and the effect on acceleration.

4.3. Feel the history and culture in the virtual scene

Experiential learning can also be carried out in the virtual scene. For example, the virtual Forbidden City built by Intel Corporation uses virtual reality technology to show the full view of the Forbidden
City. As long as we use the mouse and keyboard, we can tour the historical Forbidden City. Taking a tour in this vivid virtual Forbidden City can not only gain knowledge, but also save tiring journeys and expensive expenses. Here, learners can experience personally and learn knowledge beyond textbooks. For another example, educators at the University of California, Los Angeles used the most advanced computer technology to reconstruct the digital ancient Rome with very accurate virtual reality technology. We enter this completely virtual world, and the various humanistic landscapes of ancient Rome are vividly visible, as if we are in a strange and foreign environment. This kind of virtual scene can help learners better understand the specific historical situation and historical culture, which is undoubtedly unique.

4.4. Interactive learning in a virtual environment
The most critical link in the experiential learning process is the communication between learners. The interaction of experiential learning in the Internet age is becoming increasingly virtual. In the process of experiential learning, there are a large number of network tools that can be used by learners [6]. They can interact with learners and teachers in real-time in the three-dimensional chat room and in the BBS system, and they can also use the mail system to interact with learners or collectively in non-real-time to obtain asynchronous answers from teachers or peers. The interaction in virtual experience learning is not limited by time and space, and learners all participate in the communication as virtual identities. In the process of virtual interaction, learners are free and equal, and the relationship formed is also virtual. In this situation, they can speak freely and it is easier to express their true opinions in experiential learning.

5. Conclusion
Whether it is the experience perception, interactive learning in the virtual environment, the simulation experiment in the virtual laboratory, or the historical and cultural experience in the virtual scene, the learners can get a realistic experience and produce better learning results.

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