Application Research of Virtual Reality Technology in Higher Education

Li Lei, Qi Jingjia, Xi Wangyuan and Jiang Wei

Application Research of Virtual Reality Technology in Higher Education

Lilei, Jingjia Qi, Wangyuan Xi, Jiangwei

Harbin Finance University

Harbin, China

lilei_ll2009@163.com, qjj72@126.com, 13980894@qq.com, jw9@qq.com

Abstract—**Virtual Reality Technology is be loved by gamer, especially young people, because of its vivid simulation effect and real experience. Meanwhile, the classroom in university is occupied by many dynamic games in smart phones. Are students don't like the class, or because the teachers' class is so bad? Actually, it is the game too attractive to move their eyes that teachers can't compare with. Can this vivid VR technology be used in our education? Can we pull students' attention back to our classroom by using this kind of new cognitive tools? This is what this paper wants to discuss.**

Keywords—virtual reality technology, financial field, higher education, application research.

I. INTRODUCTION

In 1965, Ivan Sutherland first proposed the basic idea of Virtual Reality System in a paper titled "The Ultimate Display". From then on, human beings began to explore the research of Virtual Reality System. In 1966, Lincoln Laboratory of MIT in the United States began the development of helmet-mounted displays officially. The first fully functional system emerged, in 1970. In the 1980s, Jaron Lnaier put forward the term "Virtual Reality" (VR) officially. At the same time, the NASA and the US Department of Defense organized a series research on Virtual Reality technology, and achieved remarkable results. In the 1990s, the rapid development of computer hardware technology matches the continuous improvement of computer software system. It makes real-time animation which based on large data and images possible. The design of human-computer interaction system has innovated continuously. Meanwhile, input and output equipment which is novel and practical constantly enter the market. All these make a good technical foundation for the development of Virtual Reality System.

A. The Meaning of Virtual Reality Technology

Virtual Reality Technology is a new computer simulation systems, based on computer technology, which fuses with traditional display, servo, simulation, database technology and modern sensor technology, interaction, human-computer interface, three-dimensional graphics technology, generating a realistic three-dimensional world, which makes users browse and interact with the objects and scenes in virtual world from their own perspective.

B. Research on Application of Virtual Reality Technology

Since the 21st century, Virtual Reality Technology has been supported by both hardware and software very well, due to the rapid development of computing technology. Therefore, the application area of Virtual Reality Technology is more extensive, and also makes the technology become more mature. Although Virtual Reality Technology has only been produced for more than fifty years, its development speed is quite astonishing. It has been widely used in people's daily life, for instance, military, modeling and simulation, visualization of scientific computing, education and training, medicine, art and entertainment, etc.

The research and application of Virtual Reality Technology start earlier in abroad than in China. Technology, theory and application researches have reached a certain height, especially in the military, medical and educational fields, in which the application has begun to mature. NASA and the U.S. Department of Defense are important departments in the research and application of virtual reality technology. It is mainly used for space simulation and virtual operation exercises, as well as manipulating space robots in outer space to perform tasks that humans cannot do. In addition, the Royal Air Force uses Virtual Reality Simulator to simulate the training of British parachutists to achieve the whole process of parachuting. The most famous institution which applied VR technology to medical surgery is the University of North Carolina in the United States who uses simulation technology to simulate the key links of surgery. VR technology has made great contributions to human medicine.

Domestic research on Virtual Reality Technology started in the early 1990s which is late than abroad a lot. Because VR is a research field with large investment scale and high difficulty in technology, it is difficult to get the return in short term. However, due to its tremendous impact on scientific and technological research and application, especially in military, medical, educational and other fields, involving human well-being, our government and relevant departments attach great importance to it. In the Tenth Five-Year Plan, the Eleventh Five-Year Plan, the Twelfth Five-Year Plan, the National 863 Plan, the National Natural Science Foundation and the National Defense Science and Technology Commission, the research has been listed as the key funding areas. And the national "973" plan places VR technology as the top priority. After nearly 30 years of efforts, China's VR technology has made some achievements. For example, in military industry, industrial simulation, medical treatment, emergency rescue, education and training, real estate and home, VR technology highlights its unpredictable technical advantages. Beijing Palace Museum launched the "Forbidden City beyond Time and Space" - Virtual Palace Museum Project in 2008. Using VR technology, the buildings and cultural relics in the Palace Museum are made into three-dimensional images through image acquisition, digital processing and compression technology, integrating high-definition, ultra-wide screen and surround stereo digital audio, so that people can view and appreciate the buildings and cultural relics of the Palace Museum at will from various angles. Moreover, Virtual Reality Technology has been widely used in digital libraries,

large-scale performance lighting and scene customization. In addition, a large number of enterprises and institutions have invested in technology development, not only actively carry out applied research, but also make full use of their websites to provide learning and communication platform for the vast number of domestic fans and college students.

II. CURRENT APPLICATION OF VIRTUAL REALITY TECHNOLOGY IN HIGHER EDUCATION

The application of Virtual Reality Technology in education has played an important role in promoting the education level and the sharing of educational resources. By using Virtual Reality Technology, students can visit the seabed, travel in space, visit historical castles, and even go deep into the atom to observe the trajectory of electrons and experience Einstein's relativistic world, acquire knowledge vividly, stimulate thinking, and greatly shorten the distance from theory in book to practical application. In addition, Virtual Reality Technology can also be applied in high-difficulty work training and dangerous environment. The simulation of dangerous environment can not only give the trainer real operation experience, but also avoid unnecessary injury.

Overseas: For example, cyber Math, a research project in the field of mathematics education, is a shared virtual environment based on avatars. It is suitable for teachers and students to teach and explore when they are separated on the spot or in space. Dr. David Warner of Loma Linda University Medical Center and his team successfully used computer graphics and virtual reality devices to explore neurological problems and pioneered virtual reality pediatric therapies.

The application of Virtual Reality Technology in Higher Education in China mainly concentrates on the following three aspects: the application of VR in the field of scientific research; in virtual simulation campus; virtual teaching and experiment.

C. The Application of Virtual Reality Technology in Scientific Research

Universities in China have carried out research on Virtual Reality Technology in many fields, which has a great promoting function in scientific and technological research. Some key institutions of higher learning in China are also actively involved in this research field. At present, many systems have been implemented and are being developed. Some key universities in China are also actively involved in this research field. At present, many systems have been implemented and are being developed. Table I shows the research progress of key universities about VR in China.

Table I-1
RESEARCH PROGRESS OF KEY UNIVERSITIES ABOUT VR IN CHINA

Research Subject	Big Event	Remarks
National University of Defense Technology	In 1994, the first image-based virtual information space generation platform was successfully developed in China.	One of the earliest research institutes of image-based virtual reality in China.
	In 1999, a collaborative virtual reality system, virtual space conference system, was successfully developed.	
Zhejiang University	The project of "Basic Theory, Algorithms and Implementation of Virtual Reality" in 2003 studies the establishment of virtual environment, natural human-computer interaction, enhanced VR, distributed VR and the application of VR in product innovation.	Approved National Key Basic Research Development Project, 973 Project.
Beihang University	In 2007, the State Key Laboratory for New Technologies was approved.	In cooperation with the Armored Forces Engineering Institute of the PLA, the overall design objective is to provide a multi-weapon cooperative or confrontational tactical drilling system for military simulation training and exercises in China.
Tsinghua University	Research VR, presence and face objects in images, including face detection, registration and labeling methods.	It is hoped that computers can process and understand human visual images like human vision.
Wuhan University	In 1989, the State Planning Commission officially approved the establishment of the National Key Laboratory of Surveying, Mapping and Remote Sensing Information Engineering, which is the only National Key Laboratory of Surveying and mapping discipline in China.	It presided over the formulation of the Ministry of Housing and Urban-Rural Construction Standard of the People's Republic of China, Technical Specification for Three-dimensional Modeling of Cities, which was officially released, and developed a number of three-dimensional simulation systems.
Harbin Institute of Technology	With "Face Recognition Theory, Technology, System and Application" won the second prize of the National Science and Technology Progress Award in 2005.	They will develop a further study on the head posture, hand movements, speech and intonation synchronization in human speech.

University of Science and Technology Beijing	Pure Interactive Vehicle Simulated Driving Training System, which was patented by the State in 2004.	The three-dimensional graphics developed by the system are very realistic, and there is little difference between the virtual environment and the real driving environment.

D. The Application of Virtual Reality Technology in Virtual Simulation Campus

Virtual campus is the earliest application of Virtual Reality Technology and network education. At present, the actual function of virtual campus is mainly to realize browsing function. With the deepening use of network in education, three-dimensional visualization virtual campus based on teaching, administration and campus life functions is coming out. Real, interactive and situational Virtual Reality Technology will inevitably lead to a revolution in the way of education.

E. Virtual Teaching and Experiments

In practical application, virtual teaching and experimental application of science and engineering are early, especially in the fields of architecture, machinery, physics, chemistry, computer and other disciplines, has substantial breakthroughs. Using the virtual experiment system, students can do all kinds of difficult experiments, gain the same experience as real experiments, enrich perceptual knowledge, deepen the understanding of teaching content, avoid all kinds of dangers brought by real experiments or operations, and break the limitation of space and time. This is the most extensive application of Virtual Reality Technology in education and teaching under the current technological conditions.

For example, the virtual experiment in the virtual experiment factory (http://veep.chinacloudapp.cn) built by the team of Professor Li Fengxia of Beijing Institute of Technology realizes the virtual disassembly of desktop computer through the three-dimensional modeling and disassembly animation design of a microcomputer. Let students intuitively understand the composition of micro-computer hardware system and the position of its main components in the system, understand the external and internal connections, understand the concepts of host and external equipment, motherboard and host, memory and memory, and enable students to deeply understand the hardware-related content, instruction execution, program control and other concepts.

III. EXPANSION OF VIRTUAL REALITY TECHNOLOGY APPLICATION IN HIGHER EDUCATION

A. Theoretical Basis

The concept of modern higher education advocates student-centered, while the new cognitive tools represented by VR help learners to achieve a profound understanding of knowledge, so that students become the main body of information processing, active learners of knowledge, and teachers become helpers, promoters and guiders of students' active learning. From the three perspectives of participation, generation and controllability, the new cognitive tools should show positive, creative and active learning ideas. Virtual reality technology meets the basic needs of modern higher education for new cognitive tools. The learning environment created by virtual reality technology is free and autonomous, and the learning process is explored by learners. The learning content needs to be created by using various tools and information resources.

B. Practical Application Value

First, it has an intuitive teaching form. Using virtual reality technology to create a learning environment that cannot be easily created under normal teaching conditions, learners can observe and learn in a more intuitive way, breaking the limitations of time and space in traditional teaching. Virtual reality technology creates a good virtual learning environment, makes knowledge learning intuitive and vivid, and realizes visualized teaching under "real situation".

Second, strengthen the entertainment of learning. Game teaching theory holds that games can arouse learners' motivation, guide learners to actively solve difficult problems, and try to think from different perspectives by playing different roles and identities in games. Virtual reality technology is the best learning tool to achieve this goal at present. The learning environment constructed by virtual reality technology often contains game elements, so as to enjoy the pleasure of learning.

Third, taste the real environment. Virtual reality technology can give people a real feeling. In the process of learning, learners can explore freely and learn independently, providing learners with a sense of real environment experience and various tools and information resources.

Fourth, save educational resources and make up for the shortage of teaching conditions. The virtual learning environment constructed by virtual reality technology can be used repeatedly in the same field, which will not lead to the loss of education resources and save social energy. At the same time, it makes up for the inadequacy of teaching conditions in some economic backward areas.

In addition, virtual reality technology can highlight its huge technological advantages in training students' thinking and exploring abilities, teaching students in accordance with their aptitude and so on.

C. Financial Field Application

Most of the existing applications are concentrated in engineering courses, but less in liberal arts courses.

First of all, virtual reality technology also has some applications in financial courses. Students enter the virtual financial environment in the role of Central Bank, President of Commercial Bank, Bank Clerks, enterprises, consumers, Third Party Institutions, CA Certification Center, etc. by group, deeply understand the process of currency circulation in the financial system. Students use the virtual experiment system to get the same role experience as the real world, avoiding the problem that the sensitive data, confidentiality and high cost of in financial system.
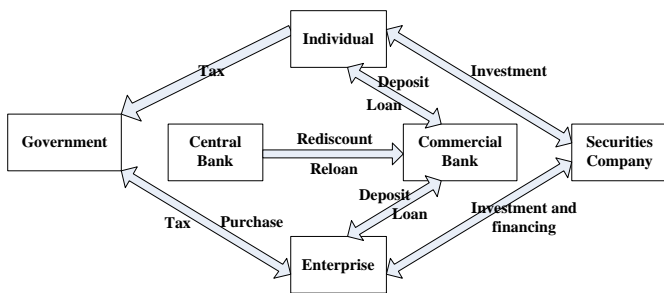
Like above chart shows that, one group has six roles who have his own duty. Every student has to cooperate with other to complete one task. Virtual reality technology can make this process more vividly and students get more involved in class.

Secondly, virtual reality technology is also very useful in simulating stock exchange. Because of the financial sensitivity of the securities industry, students can not personally practice the process of stock speculation, nor can they know the operating mechanism behind the stock market. Virtual reality technology can make this come true.

Lastly, application of virtual reality technology in law-related courses, teachers can divide the class into several groups. Students play the roles of judges, prosecutors, lawyers and so on. After choosing the case, students should prepare for the court according to their litigation role. They should analyze the case, write litigation documents, collect information and prepare evidence. In the process of simulated trial, they assume ourselves as the real parties, participants, judges, prosecutors, and strive for the best results of the case judgment. Virtual reality technology can promote the authenticity of case trial in this process.

And physical courses in university, like skiing, diving, mountaineering, equestrian, parachute jumping etc. can also use virtual reality technology to make students experiment different sports.

In addition, under the level of existing virtual reality technology, further exploit the available space, such as in the teaching and experiment process of various courses in universities, which deep-seated content can also get more teaching output through the upgrading of technology. And through virtual reality technology help university to solve the problem of high cost, security and other issues in practice process.

IV. SUMMARY

In the ecological environment of higher education, a large number of scientific research forces have been gathered and have most of the young people in society who are easy to accept new things. Universities should be the leader in the application of new cognitive tools. Therefore, the application of new cognitive tools in the field of education should start with universities and be widely applied. The application of virtual reality technology in the field of Liberal Arts in universities will broaden the scope of application, and open up a larger market where virtual reality technology takes root. Therefore, in-depth exploration in this field will bring considerable social benefits to society, as well as new ideas for teaching reform in universities. Through the use of new cognitive tools, universities have made progress in teaching methods, updated teaching content, more flexible and convenient assessment methods, ultimately helping universities to improve the existing teaching efficiency and provide more senior talents to adapt to social development.

REFERENCES

[1] Csikszentmihalyi M, Csikszentmihalyi M. Flow: the psychology of optimal experience[J]. Design Issues, 1991,8(1):75-77.
[2] Zhu Shaoping. Research on Influencing Factors of community user acceptance behavior of cloud logistics information platform based on immersion theory [D]. Anhui University, 2017.
[3] Brilliant, Zhao Hongmin. Application of Immersion Theory in Online Learning [J]. Software Guide, 2013, 12 (09): 185-187.
[4] Zhang Yu. Design and development of research-based learning based on virtual reality technology [D]. Central China Normal University, 2009.
[5] Austin, Texas. 2017 NMC Technology Outlook for Chinese Higher Education: A Horizon Project Regional Report, The New Media Consortium, 2017.
[6] Ministry of Education of the People's Republic of China, [Online]. Available: http://www.moe.gov.cn/s78/A08/.
[7] Li Fengxia. University Computer - Beijing Institute of Tec hnology [EB/OL]. https://www.icourse163.org/course/BIT-47 004#/inf