Proceeding Paper

Study on the Application of Virtual Reality Technology in Cross-Border Higher Education [†]

Yanfang Hou

School of Humanities and Social Sciences, Xi'an Jiaotong University, Xi'an 710000, China; hyfxjtu@outlook.com

[†] Presented at the 2023 Summit of the International Society for the Study of Information (IS4SI 2023), Beijing, China, 14–16 August 2023.

Abstract: This paper summarizes the problems existing in cross-border higher education through the analysis of the development status and characteristics of virtual reality technology and cross-border higher education, and puts forward the important significance and enlightenment of the application of virtual reality technology in cross-border higher education in the new era for solving the practical problems of cross-border education. It also points out that the new mode and situation of online and offline joint development created by the integration of virtual reality technology and cross-border higher education will have an important impact on accelerating the opening up of Chinese education and improving the quality and efficiency of cross-border higher education.

Keywords: virtual reality technology; cross-border higher education; applied research; development status

1. Introduction

With the spread of the global epidemic, the acceleration of century-long changes, and the world entering a period of turbulent change, cross-border education is facing serious challenges, and the normal educational exchanges between countries in the past have been seriously affected and have had to be suspended or conducted online. Although certain results have been achieved with the support of current information technology in current online teaching, meetings, projects, and activities, compensating for the fact that offline activities cannot be carried out normally due to the physical space barrier, there is still a certain gap between online educational activities and offline activities in terms of teaching effects, which cannot meet the needs and expectations of participants. Therefore, the formulation of appropriate educational development strategies based on the development needs of target groups and in combination with the objectives of cross-border educational activities, with the purpose of optimizing the implementation effect of cross-border education activities, is worth further study. This paper attempts to analyze the characteristics of cross-border higher education, in combination with the current development status and characteristics of virtual reality technology, and puts forward the important value and significance of the integrated development of virtual reality technology and cross-border higher education, so as to provide a useful reference for promoting the application of virtual reality technology in cross-border education.

2. The Development of Virtual Reality Technology

Virtual Reality (VR) technology is a modern information processing technology with computer technology at its core that is based on the scientific idea of mechanically simulating the cognitive behavior of human perception and consciousness. In the field of virtual reality, a specific virtual environment can be created with the integration of realistic sight, sound, and touch. Users can interact with objects in the virtual environment in a natural way with the help of the necessary equipment so as to generate real feelings and experiences as if visiting the scene in person. As a technology aimed at enhancing the

human–computer interaction function, virtual reality technology integrates the advantages of computer graphics, human–computer interface technology, artificial intelligence technology, visualization technology, and other advanced technologies. It can immerse learners in a virtual environment, stimulate learning motivation, enhance the learning experience, overcome spatial barriers, and achieve situational learning.

At present, there are three basic characteristics in light of virtual reality technology. G. Burde proposed the "Virtual Reality Technology Triangle", namely the three "I's", in his paper "Virtual Reality Systems and Application", published at the Electro93 International Conference. They are immersion, interaction, and imagination. Among them, the feature of immersion is reflected in the user through computer technology to simulate various scenes so that participants have a sense of being in the scene. This technology generally requires a visual perception helmet, tactile gloves, and other equipment to feel the corresponding content, with the help of multi-directional stimulation to make users feel as if they are in the real scene. Interaction refers to the perception of various virtual environments created by users through interactive media such as computers, and the system will provide corresponding feedback to the information collector. This technology requires users to realize the perception and operation of a virtual environment through a keyboard, mouse, and various sensors and to interact with a multi-dimensional information environment. Imagination means that users immerse themselves in multiple information spaces, rely on self-awareness and cognitive ability, obtain information in an all-around way, exercise subjective initiative, seek solutions, and form new concepts so as to maximize human creativity and imagination.

3. The Development Status of Cross-Border Higher Education

In the Guidelines for the Protection of Cross-Border Higher Education jointly issued by the Organization for Economic Cooperation and Development (OECD) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in October 2005, cross-border higher education is defined as higher education conducted through teachers, students, projects, institutions or providers, and course materials across national borders under national jurisdiction. Cross-border higher education may include higher education provided by both the public and private sectors, as well as by for-profit or non-profit institutions. It covers a wide range of modes, ranging from face-to-face delivery (in various forms, such as students going abroad to study or the establishment of overseas campuses) to distance learning (using a range of technologies, including online learning).

As an important form of higher education internationalization, cross-border higher education has gradually become a new driving force of vitality in the field of global higher education. Cross-border higher education has the characteristics of transnationality, mobility, and complexity. At present, the rapid development of science and technology and the revolution of the media have opened up a new path for cross-border educational activities. Computer technology has greatly fulfilled the potential to find information. Interactive equipment and multimedia provide students with an inexhaustible treasure trove of information.

4. The Application of Virtual Reality Technology in Cross-Border Higher Education

At present, virtual reality technology has been applied to classroom teaching abroad, and the research and application in this field in China are also increasing. As a new means of teaching, virtual reality technology will undoubtedly have a profound impact on the existing educational concepts and teaching methods. Especially in the current complex international and domestic situation with unprecedented changes in a century, virtual reality technology will provide an effective way to solve the relevant complex situations and problems of cross-border education. Due to the inconsistency and non-uniformity of spatial and geographical locations and times of countries, online and long-distance cross-border education activities affected by the epidemic can work out by making full use of virtual reality technology to completely break the space barrier and time restrictions. In

the process of carrying out cross-border education activities, owing to the fact that there can be no physical face-to-face communication between students and teachers, students cannot go to the campus and cannot perform experiments on the spot, nor can they carry out scientific research or borrow books on campus, to name just a few activities. With the help of virtual reality technology, a good solution to the above problems can be achieved, specifically through the following ways.

4.1. Virtual Campus

With the help of simulation technology and 3D photography technology, the virtual campus can have real campus scenes such as classrooms, laboratories, libraries, dormitories, cafeterias, etc. Students can perform multi-role conversion and complete corresponding exploration activities in a certain field together with other students. For example, the virtual chemistry laboratory can break the constraints of time and space in traditional teaching, and students can perform various experiments without leaving home, gain real experience, enrich perceptual knowledge, and deepen their understanding of teaching content, which can save money and improve teaching quality. At the same time, virtual reality technology can avoid various dangers in real experiments or operations. In the virtual experimental environment, students can boldly carry out all kinds of dangerous or harmful experiments. At the same time, in order to improve proficiency, such experiments can be carried out repeatedly. The virtual library integrates the desks, bookshelves, newspapers, and books in the physical library with the help of software and hardware under the action of holographic technology and three-dimensional modeling technology, and the books and newspapers can be scanned with the help of high-definition scanners. Learners can freely browse the resources of the school library by moving the mouse around the virtual library to perform an immersive search activity [1].

4.2. Virtual Teaching

Virtual teaching can display content that is difficult for students to understand with the help of virtual reality technology in the process of classroom teaching. And it can also provide students with a vivid and realistic learning environment so that they become participants in the virtual environment. Through role-playing and other ways of learning, it can fully mobilize the enthusiasm of students, break through the key and difficult points of teaching, and cultivate students' skills. At the same time, it enables students to discover scientific laws through corresponding experiential activities so as to better grasp the key points of knowledge, enhance learning awareness, and thus improve the effect of classroom teaching.

4.3. Scientific Research

With the help of virtual reality technology, students can also effectively carry out a variety of scientific research studies and understand and explore the unknown world through virtual means. Researchers can summarize the rules and draw corresponding conclusions through analysis, observation, etc. Virtual reality technology can enable us to improve our teaching environment and scientific research methods at a lower cost. In the case of being unable to carry out cross-border education, students can have direct contact with the most advanced contemporary scientific and technological achievements at home, in so far as a good experimental place is provided for students to develop their creativity.

5. The Enlightenment of Virtual Reality Technology in the Application of Cross-Border Education

5.1. Changes in the Way of Cognition

In the ever-changing world of science, new tools often lead to significant discoveries that dramatically alter our understanding [2]. History is full of examples of dramatic changes in the way humans view and understand problems. For example, a telescope is just a tool, but it offers a whole new way of looking at things. Galileo used a telescope to observe

the celestial bodies, so he discovered a vast expanse of space that had never been discovered before. This caused a revolution in the history of science. The essence of virtual reality is to realize the virtual understanding of human beings by directly simulating the information environment, feeling, and experiencing, and directly operating the transformation of feeling and experiencing. It can be predicted that virtual reality not only opens up a very broad perspective on the possible ways of human cognition but also contributes to the fundamental clarification of the general process and mechanism of human cognitive activities as information retrieval activities [3].

5.2. Changes in the Way of Thinking

Virtual reality technology is not just a human–machine interface or a simulation tool; in fact, virtual reality reflects a new way of thinking and observing problems. Before that, humans and machines were always in conflicting situations; one was the subject (active), and the other was the object (passive). In this case, people can only observe the external performance of the machine, but lack a direct and effective understanding of its internal operation and means of control. Virtual reality technology makes people part of the system and provides a new way into the system to observe, intervene, and control the operating state and results of the system. According to the theory of objective reality in philosophy, what the subject sees is related to the way the subject observes [4]. Virtual reality technology makes objects, cognitive conditions, and subjects genuinely form an organic whole. As our way of observation changes, our ways of understanding and processing will also change accordingly, and the phenomena we observe will inevitably be very different from the past, which will be the beginning of the germination of innovation.

5.3. Changes in Educational Philosophy

Education should be equal for all, and every university should be an "open" university, giving participants free and equitable opportunities to learn in different spaces and times. However, this is still not ideal for now. However, with the continuous development and popularization of virtual reality technology, this situation can be changed over time. Virtual reality technology diversifies the teaching content and teaching mode, which contributes to the development of lifelong education and distance education.

6. Conclusions

Although the educational environment and mode provided by virtual reality technology can be even closer to real life than the traditional cross-border higher education mode, the development of virtual technology will not weaken the current traditional cross-border higher education activity mode, but will continue to integrate the traditional mode with a new mode emerging gradually. This is, namely, a new pattern of cross-border higher education activity that integrates online and offline development so as to promote the high-quality development of cross-border higher education as a whole with a new experience.

References

1. Fan, Y.H. Research on the Application of Virtual Reality Technology in Education. *Hei Longjiang Sci.* **2021**, *12*, 98–99.
2. Heim, M. *From Interface to Cyberspace: Metaphysics of Virtual Reality*; Jin, W.L.; Liu, G., Translators; Shanghai Science and Technology Education Press: Shanghai, China, 2000.

3. Wu, K. *Theoretical Basis of Complex Information Systems*; Xi'an Jiaotong University Press: Xi'an, China, 2010.
4. Luo, J.C. *From Material Reality to Relational Reality*; China Social Sciences Press: Beijing, China, 1996.