

Research on Virtual Simulation Experiment Teaching in Colleges and Universities

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Abstract: This paper investigates the virtual simulation experiment teaching in Universities abroad, analyses the significance of virtual simulation experiment teaching and the current situation of virtual simulation experiment teaching in foreign countries, summarizes the various operating mechanisms and promoting effects of virtual simulation experiment teaching, points out the existing problems and difficulties, and looks forward to the follow-up research work.

Keywords: Virtual simulation; Experimental teaching; Foreign countries; Current situation; Key issues

1. Introduction

Under the guidance of the national information development strategy, the application of information technology in the field of education and teaching and in the process of management is gradually deepening, which effectively promotes the profound changes of education mode, teaching methods and learning methods. The construction of virtual simulation experiment teaching center conforms to the development trend and practical needs of educational informatization, and will have a positive and important impact on the improvement of higher education quality and the deepening of experimental teaching reform.

2. Virtual Simulation Experiment Teaching is an Important Part of Information Construction in Higher Education

Virtual simulation experiment teaching integrates virtual reality, multimedia, human-computer interaction, database and network communication technologies. By constructing a realistic experimental operating environment and experimental objects, students can carry out efficient, safe and economical experiments in an open, autonomous and interactive virtual environment, thus achieving teaching effects that real experiments do not have or are difficult to achieve, especially for the students. For those large-scale or comprehensive experimental projects involving high-risk or extreme environments, unreachable or irreversible operations, as well as those requiring high cost and high consumption, virtual simulation experiment teaching has obvious advantages, and has a far-reaching subversive impact on traditional experimental teaching ideas, systems, models, contents, methods and means. It can be said that virtual simulation experiment teaching is

an important part of higher education informationization construction, which reflects the experimental teaching reform and innovation brought about by the integration of information technology and education and teaching and the deep integration of discipline and specialty[1].

3. Practical Cases of Virtual Simulation Experiment Teaching in Foreign Universities

As an important part of the cooperation project of "Inter-school Innovation in the Field of Indian-American Higher Education", 20 top universities in the United States use the distance education network of Indian Manlu University to offer online courses in computer science, information and communication, biotechnology and material science for students of hundreds of Indian universities, and carry out online cooperative research and technical exchanges with Indian universities. Collaboration .On this basis, Manlu University of India has launched a number of construction projects such as virtual learning environment, online joint research center and online laboratory (ONLINE LABS).

Yale University in the United States takes advantage of the instantaneity, participatory, situational, ubiquitous and pleasant advantages of mobile experiments. Tablet computers are used to complete the experiments of molecular biology, cell biology and developmental biology. Teachers share the data and images obtained from the digital microscope of the central laboratory with students through mobile applications on the iPad. By connecting a remote controlled digital microscope with a tablet computer, students can record, analyze and annotate the experimental data, and archive the acquired experimental images for later use.

The University of Redlands in Australia takes advantage of the portable tablet computer, high resolution display

and touch screen to replace bulky experimental instruments, video equipment and other expensive tools for field practice teaching, shooting and annotating topographic pictures, collecting and sharing rock data, quickly obtaining reference materials and recording and analyzing collected data.

The University of Victoria in Canada has built a 3D laboratory and an anthropology creator laboratory, equipped with the latest high-tech equipment such as 3D scanner and printer, motion sensor and laser cutting machine. Its purpose is to cultivate and stimulate students' innovative ability and exploratory spirit. These laboratories not only provide specialized venues and tools, but also allow students to operate and study fragile objects such as fossils and cultural relics (such as ancient Egyptian vases scanned and printed in 3D), and encourage collaboration among creators.

4. Main Development Directions

4.1. Accelerating the application of emerging information technology in the field of education and teaching

The rapid development of the new wave of educational technology, which is dominated by information technology, has greatly improved the outlook in the field of education. At present, mobile learning has become an indispensable part of education. Learning analysis and open educational resources have been gradually applied in Colleges and universities, so that students can truly become active learning subjects, fully demonstrating the important role of information technology in promoting the modernization of education[2-4].

4.2. Integrating educational resources in online learning, mixed learning and cooperative learning

The practice of educational reform in recent years has shown that face-to-face teaching, online learning and mixed learning can effectively overcome the shortcomings of traditional teaching in providing more cooperative learning opportunities for students. It is not only conducive to giving full play to learners' information skills, enabling students to fully exchange their opinions on exploring topics and experimental projects, but also enriching, vivid and flexible teaching contents. And easy to get.

4.3. Educational teaching based on information network technology has changed from single teaching form of theoretical courses to complementary teaching of theory and practice.

In order to overcome the shortcomings of online education and online courses, such as lack of experimental links and weak practical ability of students. In some open network courses, virtual laboratory-based practical teach-

ing content is added, and three forms of experimental means are adopted: mobile interactive experiment based on hand-held devices (tablet computers, smart phones, wearable computers); personalized autonomous experiment based on virtual world and educational game software; remote interactive collaborative experiment based on telepresence technology[5].

4.4. Promote students to change from single consumer to creator and designer

In recent years, a new trend in the field of higher education is that creation, innovation and creation have gradually become synonyms of active learning and practical teaching. In this regard, some exploratory changes can be made:

First, in the past, there were no laboratories or practical teaching links in Colleges and departments. Practice teaching was regarded as an organic part of curriculum and degree plan, and policies and conditions were formulated to attract more students to innovate, create and design with the teaching content.

The second is to actively construct an innovative environment and physical space conducive to students' cooperative learning, independent experiments and collaborative exploration, an interdisciplinary Creator Space (Creator Laboratory) and an open laboratory equipped with traditional hand-made tools and advanced digital equipment (such as laser cutting machines, microcontrollers, 3D printers, etc.).

The third is to integrate the creative space into the experimental teaching process, and to open educational resources to local creative customers. The aim is to integrate producers, educators and researchers to explore how to promote learning and form different learning styles[6].

4.5. Attaching importance to and strengthening the construction, use and maintenance of open educational resources

As an important element of learning infrastructure, open education resources exist in many forms and can be freely accessed by anyone on the Internet. At present, the value of open education resources has been recognized all over the world. Foreign government agencies and universities attach great importance to its construction, use and maintenance[7].

4.6. Building future teaching laboratory with complete digital learning conditions and virtual experimental environment

The future classroom and laboratory is a new research field, which is characterized by the integration of innovative education concept, advanced science and technology, psychology, communication, ergonomics and space construction theory. It pays attention to highly interactive,

open, enlightening and natural, flexible, safe and efficient humanized design, and then carries out group discussions, exploratory experiments and experiments for students as the main body. Research-based learning provides strong support. The aim is to create a new teaching environment with information technology, which takes students as the main body, stimulates active learning interest, cooperates with each other, highly interacts, hands-on implementation, virtual experiment and process visualization, and embodies the concept of "classroom is laboratory"[8-9].

5. Unresolved Issues

The construction of virtual simulation experiment teaching center is a complex system engineering involving multi-layers, multi-fields and multi-links. It needs not only top-level design and overall planning to guide, but also team cooperation and joint research to ensure.

Firstly, we need to break through the common key technologies that support virtual experiment teaching, such as visual design software tools and integrated environment of virtual experiment, virtual experiment scene and object construction of highly simulated, multi-domain modeling and assembly of virtual experiment components, etc. Secondly, it is necessary to develop a virtual simulation experimental teaching management system and open sharing platform, which integrates physical simulation, virtual experiment, innovative design, intelligent guidance and teaching management, and can satisfy the experimental teaching requirements of multi-region, multi-school and multi-discipline specialties, and has good autonomy, interactivity, expansibility, compatibility and security.

6. Epilogue

Promote the deep integration of information technology and education and teaching, strengthen the demonstration and leading role of experimental teaching demonstration center, radiate advanced experimental teaching ideas, innovative experimental teaching methods, fruitful experimental teaching reform results and high-quality experimental teaching resources to the whole country, so as to benefit more teachers and students.

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