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Analysis of the Information Technology Supporting the Virtual Simulation Experiment Teaching

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Abstract: The experimental teaching occupies a very important position in modern education. It is very important to carry out innovative quality education for students. As a necessary and beneficial supplement of traditional experimental teaching, the virtual simulation experiment teaching can not only save a lot of educational funds, but also make the experiment extend effectively in time and space. This paper describes the important role of the virtual simulation experiment teaching, and analyzes the information technology supporting the virtual simulation experiment teaching, and gives some suggestions for the reform of experimental teaching promoted by information technology.

Keywords: Virtual simulation, experimental teaching, information technology.

1. Introduction

As a part of the virtual environment, the virtual simulation laboratory is the mirror image of the field of science and technology in reality. The virtual simulation experiment teaching has produced more and more important influence on scientific research and education training. Characterized by the application of information technology, the virtual simulation experiment teaching adapts to the requirements of schools opening and resource sharing in higher education. It provides advanced means, open platform and high-quality resources for students to carry out exploratory learning, independent experiment and innovative practice. Meanwhile, it also adds impetus to the reform of experimental teaching.

2. Terminology

The virtual simulation experiments originated from the end of the twentieth century. It is generated by the reality technology, including computer, multimedia, sensing

technology, simulation technology, and virtual reality. It can replace or partly replace the traditional experiments. The virtual simulation laboratory allows experimenters to directly participate in the interaction of experimental virtual objects so as to obtain various experiences in real experiments. The main characteristics of the virtual simulation experiment include: (1) Interactive. The experimenter can use or assemble the instruments and equipment in the virtual environment by himself, and can get corresponding operational feedback. (2) Participatory. Sharing in the virtual simulation experiment contains experimental mode, experimental instruments, experimental software packages, etc. (3) Autonomy. What makes the virtual simulation experiment different from the traditional experiment is that the experimental mode is not fixed according to the specific framework. Students can design experiments according to their own thinking and needs, which has good autonomy.

3. Analysis

The virtual simulation experiment teaching reflects the important characteristics of multimedia, human-computer interaction, database and network communication technology. Based on the analysis of related literature, data and network information, the following information technologies which are widely used in virtual simulation experiment teaching are proposed.

3.1 Multimedia Technology

The multimedia technology refers to the text, graphics, images, animation, sound, video and other media information are comprehensively processed by computers to construct vivid 2d and 3d scenes. At the same time, the computer has the ability to display different media forms through the establishment of logical relations and human-computer interaction, and realize the input and output of information between human and computer through graphical interactive interface and window interactive operation. Based on interactive multimedia technology, the virtual simulation experiment teaching has the image, vivid, intuitive and efficient characteristics. Effective application of multimedia technology in university teaching can improve the expressive force of the teaching content, so that the students can actively participate in multi-media activities via multi senses, mastering the knowledge actively instead of passive acceptance[1].

3.2 Man-Machine Interaction Technology

The man-machine interaction technology refers to using the technology of computer input and output devices to communicate effectively between a person and a computer. In terms of the virtual simulation experiment teaching, the more typical applications such as "desktop" computer based on multimedia technology touch-screen, 3D

three-dimensional display, 3D/4D printer, etc. Then there is geo-spatial tracking technology in smart phones, and the motion recognition technology for wearable computers and immersive games, and human machine interface technology based on brain waves. It seems obvious that a new approach to the process of man-machine interaction should be developed that should be based on the latest achievements in software engineering, possibilities regarding new unconventional hardware systems and a deep knowledge of human behavior[2].

3.3 Visualization Technology

The application of computer graphics and image processing technology to large amounts of data in the form of graphics or images display on the screen, so that people have a deep and unexpected insight, that is, visualization technology. The main process of visualization is modeling, which maps the data to the geometry of the object, and rendering, which represents a geometric element as a graph or image. Visualization technology has been a widely applied, ranging from simulation of nuclear reactor operation process, data analysis of seismic fault zone, to prediction of stock market and demonstration of molecular structure [3]. The application of visualization technology in virtual simulation experiment teaching will promote the fundamental reform of experimental teaching methods.

3.4 Simulation Technology

Based on cybernetics, system theory, similarity principle and information technology, the simulation technology uses computers and special equipment as tools to conduct dynamic test, performance analysis and comprehensive evaluation of actual or imagined objects by using mathematical models. Based on the "virtual equipment" realized by simulation technology, the high-precision mathematical model of the actual equipment is established by the full-software simulation method, and the realistic operating environment is constructed by the application of virtual reality technology. Simulation technology offers a potential solution[4].

3.5 Virtual Reality Technology

The integrated application of computer 3d graphics, image processing and display, sensing, human-computer interaction and other technologies, provides users with a multi-dimensional human-computer interface to observe and interact with the virtual world, so that they can directly participate in, deeply explore the role and changes of simulation objects in the environment, and generate a sense of immersion. The "virtual scene" and "virtual environment" constructed by the application of virtual reality technology can enable students to experience the changes of real environment, operation process and operation state in person, achieving unprecedented teaching

effect.

3.6 Augmented Reality Technology

As a new technology developed on the basis of virtual reality technology, it is also called mixed reality. Augmented reality technology integrates application of multimedia, interactive, three-dimensional modeling and display, multi-sensor information integration, real-time tracking and fusion techniques. The computer generates virtual object, environment and system information are superimposed into the real scene in real time. It enhances the user the perception and understanding of the real world, and then gets sensory experience beyond reality through the helmet display system and register system. It has the characteristics of information integration between the real world and the virtual world, strong real-time interaction, and the ability to add positioning virtual objects in the three-dimensional space. AR can be applied on many different fields such as medical, business, industry, entertainment and so on[5].

3.7 3D Printing Technology

3D Printing is a novel method of manufacturing parts directly from digital model by using layer by layer material build-up approach[6]. Initially, 3D printing has been applied in aerospace, regenerative medicine, equipment manufacturing and maintenance, and achieved rapid development. Subsequently, new technologies such as 3D biological printing, metal printing, nanoparticles and superposition printing have been derived, showing a very broad application prospect. 3D printing technology opens up a new learning space for students. Learners enter the learning space through designing, making, displaying and other roles to experience the fun and vitality of the learning process. In addition, 3D printers can transform abstract spatial concepts into real, three-dimensional color models, and some hard-to-understand spatial concepts and structures become more concrete and intuitive as they are introduced into the real world. Through direct participation and personal experience, students' thinking ability, design ability and practical ability have been comprehensively improved.

4. Conclusion

The rapid development of information technology has provided a strong support for the construction and application of virtual laboratory, virtual simulation experiment system, collaborative experiment platform, immersive experiment software and open educational resources, which has brought about profound changes in the concept, mode, method and means of experimental teaching.

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