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Construction of Virtual Simulation Experiment Teaching in Colleges and Universities

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ABSTRACT: Virtual simulation experiment course is a new challenge for experimental teaching in higher education. This paper summarizes the background, application scenarios, problems and contents of virtual simulation experiment teaching in colleges and universities, and finally puts forward countermeasures and suggestions, in order to provide valuable reference for virtual simulation experiment teaching.

KEYWORDS: Colleges and universities; Virtual simulation; Teaching construction.

I. INTRODUCTION

With the rapid development of technology, virtual simulation technology has become an increasingly important teaching tool in higher education. Virtual simulation technology can simulate various scenarios and environments in the real world, provide students with real and comprehensive practical experience, and play an important role in improving students' practical ability and improving teaching quality.

Virtual simulation technology is a kind of virtual environment created by computer technology, which can simulate physical phenomena, environmental conditions, object states, etc. in the real world, and can also construct a fictional environment beyond reality. It combines technologies from multiple fields such as computer graphics, human-computer interaction, and physical simulation to provide an immersive experience that makes users feel like they're there. Virtual simulation technology has the following characteristics: (1) Highly flexible: virtual simulation technology can be simulated and experimented anytime and anywhere, and the virtual environment and experimental conditions can also be changed at any time, so as to obtain more flexible and diversified experimental results. (2) High realism: Virtual simulation technology can create a very realistic virtual environment, which can simulate various details and features in the actual scene. (3) Strong interactivity: virtual simulation technology can realize the interaction between users and the virtual environment, and interact with virtual objects through various ways such as touching, moving, and rotating, so as to enhance the sense of participation and immersion. (4) Highly economical: virtual simulation technology can save a lot of experimental costs and time costs, and at the same time, it can also optimize the experimental scheme and reduce the number of unnecessary experiments through simulation prediction. (5) High reliability: Virtual simulation technology can avoid the risks and dangers that may occur in traditional experiments, and at the same time, it can also improve the reliability and accuracy of experiments through data analysis and simulation prediction.

II. APPLICATION SCENARIOS OF VIRTUAL SIMULATION TECHNOLOGY IN HIGHER EDUCATION

At present, virtual simulation technology mainly has the following types of application scenarios in higher education courses: (1) Scientific research: In scientific research, virtual simulation technology can simulate natural phenomena and social phenomena to provide data and support for scientific research. For example, the virtual simulation experiment course of field plant survey and observation can use drone aerial photography, panoramic photography and other technologies to virtually simulate the core elements of plants, such as morphological structure, ecological function, and community species composition. Students can not only be familiar with the ecological functions and main plant species of plants, master the survey and measurement methods such as water content, groundwater level, peat sedimentation dating, etc., but also summarize the geographical distribution and evolution of hidden plants, and discuss conservation strategies. (2) Skills training: In vocational education and skills training, virtual simulation technology can simulate the actual working environment and help students'



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master practical skills. For example, the special education virtual simulation experiment is helpful for the training of the professional quality of special children's education, and through online virtual simulation teaching, students can quickly grasp the knowledge essentials of the comprehensive practice of special children's education, so as to have the skills to provide high-quality professional services for special children's education. (3) Experimental simulation: In the fields of engineering and medicine, experiment is an important means to improve students' practical ability and innovation awareness. However, due to expensive equipment and dangerous operation, many experiments cannot be carried out in the classroom. Virtual simulation technology can simulate the experimental environment, carry out experimental operations through computers, and improve the safety and efficiency of experiments. For example, the surgical virtual simulation experiment course can visualize and virtualize the irreversible treatment process of surgery, so that students can be proficient in the examination, diagnosis, treatment plan formulation and operation technology of surgery under the premise of non-invasive, risk-free, low-cost and reproducible, and efficiently obtain comprehensive training in this skill. (4) Distance education: Virtual simulation technology can be used for distance education, allowing students to learn through the Internet at home or elsewhere. For example, virtual simulation labs allow students inside and outside the school to watch teachers explain their knowledge online and learn related technologies remotely through virtual classrooms.

III. PROBLEMS AND CHALLENGES

(1) Teaching reform is facing new challenges

The virtual simulation experiment course needs to carry out a comprehensive reform of traditional experimental teaching, and needs to redesign the experimental scheme, teaching materials, teaching methods, etc., which puts forward higher requirements for teachers' teaching ability and curriculum design ability. Teachers need to change their educational and teaching philosophy, put students in more active learning roles, and enhance their ability to learn independently and cooperatively through experiments. Teachers also need to flexibly use different teaching strategies and teaching methods according to the requirements of different experiments and the characteristics of students. In the construction of virtual simulation experiment courses, teaching challenges also include how to ensure the authenticity and effectiveness of virtual simulation experiments, how to evaluate students' learning effects, and how to solve technical problems.

(2) There are few professionals

The construction of virtual simulation experiment courses requires a variety of technical equipment, and requires a lot of manpower, financial resources and technical support. Through the analysis, it is found that no university personnel can complete the course construction independently, and the participation of enterprise personnel is required. Most of the existing virtual simulation experiment courses are jointly developed by universities and enterprises, and most schools do not have the ability to develop independently, and colleges and universities are relatively short of professionals who can independently complete virtual simulation experiment courses. At present, the virtual simulation platform can realize more complex virtual simulation experiments and diversified experimental content, which involves multidisciplinary content knowledge. An excellent and high-quality virtual simulation experiment course, including instructional design, technical support, content production, testing and evaluation, optimization and improvement, etc., requires not only the developer to be familiar with the course content, but also to have an understanding of content production and program development. At the level of basic content of the course, teachers already have an in-depth understanding of professional knowledge, but for the development of courses on the virtual simulation platform, some teachers have not yet mastered the intelligent technical means such as artificial intelligence, human-computer interaction, virtual reality, and augmented reality, and lack of program development ability and experience. The follow-up development process and optimization and improvement have high requirements for teachers' technical ability.

(3) The co-construction and sharing mechanism is insufficient

The construction of virtual simulation experiment course requires a large number of educational resources, but the distribution of educational resources is uneven, and it is difficult for schools to build and implement virtual simulation experiment courses due to the lack of educational resources in some areas. In addition, on the virtual simulation experiment platform, some courses are only allowed to be used on campus, and non-students from the university cannot participate in the courses. Some courses are duplicated, resulting in a waste of educational resources.



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Therefore, the educational resources will be integrated and shared, saving educational resources, and improving the utilization efficiency of educational resources. Through sharing, high-quality educational resources will be disseminated to a wider range of regions and schools through the network and other means, so as to promote the balanced development of educational resources. Let some high-level virtual simulation experiment courses can benefit more schools and students, so as to improve the overall level of education.

(4) The evaluation criteria are not uniform

Virtual simulation education has been vigorously developed in colleges and universities, and virtual simulation experiment teaching is becoming more and more popular in colleges and universities. However, due to the wide variety of virtual simulation experiment courses, covering multiple subject areas, the courses have their own unique characteristics and objectives, and it is difficult to establish a unified evaluation system. In addition, the application of virtual simulation technology in education and teaching is relatively new, and it is constantly updated and developed, and the evaluation system needs to be continuously updated and improved. The virtual simulation experiment course involves computer simulation, virtual reality and other technologies, and the evaluation process needs to take into account the authenticity and operability of the virtual environment, which is more complex and difficult than the traditional experimental course. Therefore, the current evaluation of virtual simulation experiment courses lacks a unified evaluation index system that fits the times and technological development, which provides scientific guidance for the construction of virtual simulation experiment courses, which leads to the phenomenon of emphasizing quantity and ignoring quality in the construction of virtual simulation experiment courses, which restricts the sustainable development of virtual simulation experiment teaching in colleges and universities.

IV. THE MAIN CONTENT OF VIRTUAL SIMULATION EXPERIMENT TEACHING CONSTRUCTION

Carrying out the construction of virtual simulation experiment teaching project is helpful to promote the informatization of experimental practice teaching in colleges and universities, expand the breadth and depth of experimental teaching content, extend the time and space of experimental teaching, and improve the quality of experimental teaching and the level of experimental education. The content of the virtual simulation experiment teaching project should be combined with the training standards of experimental practice teaching talents in colleges and universities, different disciplines and professional expertise, the latest scientific research achievements in related fields, and the talent training goals. The research and development of the project is aimed at completing the teaching requirements and content, the principle is accurate, the content is compact, the duration is reasonable, the difficulty is appropriate, there are detailed experimental operation instructions, the experiment should be divided into basic experiments, comprehensive experiments, innovative experiments, etc., for students of different grades There are different levels for choice, through experimental training can understand, master and integrate the relevant knowledge fields. The virtual simulation experiment and the physical physics experiment are organically combined, and the deep learning is led from shallow to deep. In the experiment, the virtual experiment teaching is placed before the course teaching, the teacher understands and is familiar with the experimental process and experimental operation, and the teacher designs thinking questions in advance to guide students to find and think about problems in the virtual experiment. Then, enter the classroom with questions, use discussions, speeches and other forms in the classroom, and combine with the teacher's lectures to carry out learning; Carry out corresponding practical operation experiments to gain practical operation ability and intuitive understanding of experimental phenomena. Virtual experiments are used to assist physical experiments, so as to achieve the combination of virtual and real, and virtual to practical.

The construction of the project should first focus on a course, refine a certain part of the experimental content, clarify the purpose of the experiment, clarify the experimental principle, design the experimental procedure, stipulate the evaluation system of the experimental results, etc., and combine the Internet and 3D technology to complete the production. In the production process, the production of human-computer interaction interface should be expressive and appealing, and the final presentation effect of the project should be realized through the application of typical software and the secondary development of functions.



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V. COUNTERMEASURES AND SUGGESTIONS

(1) Promote the reform of experimental teaching

The transformation of teachers' teaching concept is one of the important factors to promote the reform of virtual simulation course teaching and experimental teaching. In order to promote the transformation of teaching concepts, it is essential to provide relevant training and support to promote the reform of experimental teaching. Schools and departments can arrange relevant training courses, invite experts and experienced teachers to share experience and knowledge, and provide necessary technical support. Second, schools can establish a community of teachers who teach virtual simulation labs and encourage teachers to share experiences and exchange ideas. At the same time, schools can set up an incentive mechanism to motivate teachers to innovate and explore in the teaching of virtual simulation experiment courses. Teachers are encouraged to establish partnerships with external organizations with which they can teach virtual simulation labs, learn about the latest technologies and applications, and apply this experience and knowledge to their own teaching.

(2) Introduce and train professional talents

In the face of the challenges posed by technology in the virtual simulation experiment course, the school can introduce talents to assist the professional teachers in the construction and implementation of the virtual simulation experiment course. In addition to the introduction of human resources, professional teachers should be trained. It is necessary to cooperate with professional institutions to carry out regular training on the development of virtual simulation experiment courses, improve the ability of professional teachers to independently develop virtual simulation experiment courses, help teachers understand the production process of virtual simulation experiments, software structure design, VR teaching system and other knowledge, and promote the development of professional teachers into teachers who combine theory and practice.

(3) Establish a sharing mechanism

First of all, it is necessary to build an educational resource sharing platform to provide high-quality and diversified educational resources for teachers and students. The platform should cover multiple subject areas, including virtual simulation experiment courses, online courses, teaching videos, teaching materials, etc. The platform also needs to provide corresponding search and evaluation functions to make it easier for users to find and select the right resources. Secondly, through publicity and training, we should strengthen the popularization and promotion of the concept of sharing educational resources. Institutions and individuals of all kinds should be encouraged to actively contribute their own educational resources, and at the same time, the intellectual property rights of resource providers should be respected and a fair resource sharing mechanism should be established. In addition, a collaboration mechanism should be established between universities, enterprises and research institutions to jointly promote the sharing and development of educational resources. Through joint construction of sharing platforms, resource exchanges and sharing, research and development, etc., complementary advantages can be achieved and the quality and quantity of educational resources can be jointly improved. The establishment of a sharing mechanism and the balanced development of educational resources require the joint efforts of all parties to form a joint force. Only through the joint promotion of various ways can we make full use of educational resources and optimize the allocation of educational resources, and promote educational equity and development.

(4) Strengthen curriculum management

Improving the evaluation system can standardize the construction of virtual simulation experiment courses, design and develop virtual simulation experiment courses with high academic value and scientific and technological content, and promote the high-quality development of virtual simulation experiment courses. The perfect evaluation system can guide teachers and students in colleges and universities to screen and use high-quality virtual simulation experiment course resources, promote the normalization and high-level development of virtual simulation experiment courses in colleges and universities, create efficient classrooms that combine offline and online, and realize the quality and efficiency of college teaching. The school needs to establish a sound curriculum management mechanism and evaluation system, regularly monitor and evaluate the virtual simulation experiment course, find problems and deficiencies in a timely manner, and take corresponding measures to improve them. In the early stages of curriculum design, it is necessary to develop clear learning objectives and evaluation criteria. Learning objectives should be clear, measurable, and relevant to real-world application. Assessment criteria should be tailored to each learning objective to



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ensure that students' learning outcomes are assessed comprehensively and objectively. Students' feedback and suggestions in learning are also an important part of course evaluation. Teachers should collect feedback and suggestions from students in a timely manner and make improvements. At the same time, teachers should also make improvements in curriculum design based on the evaluation results to improve the quality and effectiveness of the curriculum. In addition, course management is the key to ensure the smooth development and effective management of virtual simulation experiment courses. It is necessary to establish a sound management mechanism, including curriculum planning, resource management, teacher training, student management, etc., to ensure the orderly development of the curriculum and the realization of good results. These measures can not only improve the quality and effectiveness of the curriculum, but also enhance students' learning motivation and learning effect, and promote the improvement of students' comprehensive quality.

VI. CONCLUSION

The construction of virtual simulation experiment course is an important part of the high-quality development of higher education. Virtual simulation technology can highly simulate the real situation, complete high-risk and irreversible operations in the virtual situation, and save experimental costs to a greater extent. The combination of virtual simulation technology and experimental teaching has opened up a new way for experimental teaching to cultivate innovative talents. All schools can concentrate superior resources to build high-quality virtual simulation experiment courses, innovate and build high-quality simulation courses to meet different needs, guide students to actively participate in virtual simulation experiment teaching, and promote the diversified development of teaching methods, so as to promote the sustainable development of virtual simulation experiment courses.

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