



Construction Planning and Practice of University Virtual Simulation Experimental Teaching Center under the Background of New Liberal Arts

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Abstract

On the basis of the existing traditional liberal arts, the new liberal arts reorganizes the subject curriculum, integrates modern information technology into philosophy, literature, linguistics, management and other courses, provides comprehensive interdisciplinary teaching for students, expands knowledge and innovates the way of thinking. Based on the background of new liberal arts, this paper focuses on the increasingly important trend of the application of virtual simulation experimental teaching in university teaching and explores the construction and planning of virtual simulation experimental teaching centers under modern information conditions. Under the background of new liberal arts, this paper focuses on students, studies the sustainable development of virtual simulation experimental teaching centers, further improves the quality of experimental teaching in colleges and universities, and promotes the cultivation of innovative talents.

Subject Areas

Higher Education, Teaching and Learning Technologies

Keywords

New Liberal Arts Background, Experimental Teaching Center, Virtual Simulation, Planning and Practice

1. Introduction

In recent years, China's Ministry of Education, Science and Technology and other 13 departments proposed to jointly promote the construction of new liberal arts.

Under the new background of the continuous development of science and technology and the fourth industrial revolution, we must focus on the all-round development of interdisciplinary talents, take into full consideration the impact of science, technology and the industrial revolution on people's way of production, especially changes in the way of education and teaching, and promote the construction and development of disciplines (Luo, 2016) [1]. At present, with increasingly fierce international competition, innovation has become the primary driving force for development. Only innovative development can fundamentally improve the high-quality development of China's society, economy and science and technology. Innovation needs high-level and high-quality talents with innovative potential, which puts forward higher requirements for our education system to cultivate innovative talents. Based on the research of the Zhejiang Higher education Experiment research project on virtual simulation experiment teaching tourism management under the background of new liberal arts construction, this paper finds that pure theoretical education can cultivate talents with systematic knowledge, but it lacks practicality to cultivate excellent talents with innovative ideas, innovative consciousness and innovative ability (Su, 2018) [2]. Compared with theoretical education, experimental teaching plays an irreplaceable role in cultivating students' practical abilities and innovative abilities. However, in the past experimental teaching, teachers and students were limited by time, place, equipment and other aspects and could only carry out specific experiments. It was difficult to carry out experiments with high risks or harsh conditions, irreversible operation, high cost and huge consumption (Ji, 2017) [3], which seriously restricted the cultivation of students' practice and innovation ability.

New arts is compared with traditional arts, is the global new revolution of science and technology, economic development and socialism with Chinese characteristics into a new era as the background, break the traditional thinking mode of liberal arts, inheritance and innovation, cross and integration, coordination and sharing as the main way, promote multidisciplinary cross and depth fusion, promote the traditional arts of updates, from subject-oriented to demand-oriented, from professional segmentation to cross-integration, from adaptive service to support and guidance. With the rapid development of computer communication technology and virtual reality technology in recent years, colleges and universities have a more and more extensive and profound understanding of virtual simulation experiment teaching. Especially the development of virtual simulation experiment technology not only breaks through the limitation of time and space but also provides more convenient conditions for the completion of practical experiments with teaching functions (Zhang, 2021) [4].

2. Types of Virtual Simulation Experiment Teaching in Colleges and Universities

In terms of experimental characteristics and training mode, it mainly includes basic experiment, design experiment, comprehensive experiment and innovative

experiment, with different experimental purposes and requirements.

1) Basic experiment is mainly to train students' basic experimental knowledge and skills, content, methods and skills; experimental results are often determined (Wang, 2019) [5]. For example, in the deviation theorem verification experiment, students can combine and adjust basic means such as voltmeter, ammeter and sliding resistance and deepen their understanding of theoretical knowledge, practice and equipment operation ability through the experimental process and result verification.

2) The design experiment includes two aspects. One is that the experimental content is characterized by subjective design (Zhou, 2020) [6]. The other is that the experimental design is characterized by objective structure. For example, in the raw salt purification experiment as an example, students according to the requirements of the experimental project, actively consult the data, combined with the theoretical knowledge, design a reasonable experimental scheme, and in some key links to explain the reasons for the measures to be taken, to be well-grounded, submitted to the experimental teacher for review. Teachers carefully review the experimental design scheme submitted by students, comment on the overall experimental scheme submitted by students before the implementation of the experiment, and gradually guide students to perfect a unified and correct experimental scheme. This kind of experimental learning is mainly to cultivate students' thinking and skills in experimental design. Design ability itself is a kind of innovation ability. Therefore, design experiment is an important method and way to train students' innovation ability.

3) The comprehensive experiment mainly includes two aspects, one is the comprehensive experimental method and means, and the other is the comprehensive content. Its main purpose is to train students' ability to comprehensive use knowledge and comprehensive innovation (Wang, 2022) [7]. In the process of comprehensive experiments, students need to use different knowledge points and experimental methods in one or more courses, which play an important role in cultivating innovation ability. In the comprehensive experimental teaching of molecular biology, the virtual simulation experiment project will set up a learning system, demonstration system, operating system and evaluation system. Students' independent learning is the main task, supplemented by teacher guidance. Teachers are responsible for the explanation of experimental principles, the guidance of operational key points and monitoring of the experimental process, encouraging and guiding students to take the initiative in learning, enhancing students' interest in molecular biology experiments, and cultivating students' ability to find, analyze and solve problems. It lays a foundation for students to participate in teachers' research teams, innovation and entrepreneurship projects or college students' innovation competitions in advance.

4) Innovative experiment is an experiment in which students study independently and explore specific goals. This kind of experiment is analytical and innovative, which is an important point in cultivating students' creativity and autonomy. In recent years, the pharmaceutical engineering major of the South

China University of Technology has been actively carrying out exploratory experiment teaching in the professional experiment and comprehensive experiment teaching, introducing exploratory experiment projects, allowing students to accept a new open subject and explore solutions independently. With students' independent learning as the main feature, the relevant conditions and atmosphere are attentively created to cultivate students' innovation ability so that students become the talents needed under the new engineering system.

To sum up, in the teaching process, experimental classification only reflects the differences in experimental characteristics and direction. Each subject experiment teaching has different directions and different stages, and each experiment plays an irreplaceable role. Compared with science and engineering, the construction and development of new liberal arts virtual simulation experiment teaching center lag behind and the construction of liberal arts laboratory also shows unbalanced development and weak overall strength. The cultivation of students' abilities is a gradual process from a low level to a high level. The virtual simulation experimental teaching center for liberal arts should improve the information content and share the platform by means of information technology, and build it by relying on the dominant disciplines of the school. In the learning process of subject integration, different types of experimental teaching should be applied to cultivate students' independent innovation ability.

3. The Role of Experimental Teaching in the Cultivation of Innovative Talents

The virtual simulation experimental teaching center of liberal arts provides a new channel for teaching and learning liberal arts and science. It realizes the role of the subject through virtual simulation technology and enables students to devote themselves to experimental activities and master the learning process independently. The innovation of experimental way will bring students innovation of thinking and knowledge learning way, so that students in the process of solving some problems, the old and new knowledge will be integrated, combined with the new experimental way to try new methods, to carry out innovative practice activities.

3.1. The Cultivation of Innovation Consciousness

At present, theoretical teaching is obviously mechanical, which restricts students' innovation consciousness, and does not leave enough space for students to think independently from the teaching content to the teaching method. Experimental teaching in colleges and universities is an important supplement and verification of theoretical teaching, which can not only further deepen theoretical teaching but also effectively stimulate students' interest in independent learning, enhance students' ability to combine theory with practice, think independently and solve problems, and is conducive to the cultivation of innovative consciousness. It is necessary to cultivate students' sense of inquiry, stimulate

their experimental motivation, encourage their experimental creativity and guide them to think about more experimental approaches and methods.

3.2. The Cultivation of Innovative Thinking

In the process of experimental teaching in colleges and universities, on the basis of theory, students need to participate deeply, give full play to their own imagination, analysis, hypothesis, experimental verification, and finally draw a conclusion. At the same time, students should also find, analyze and solve problems independently in the experiment process, which is conducive to the cultivation of innovative thinking. By developing exploratory experimental teaching, improving experimental parameters or experimental devices and guiding students to do creative experiments, we can cultivate students' creative thinking. Teachers put questions, questions and doubts throughout the classroom teaching, and guide students to actively participate in the activities of teaching practice to develop thinking ability, especially creative thinking ability. In this way, students' innovation ability and practical ability will be effectively improved.

3.3. The Cultivation of Innovative Character

In the process of experimental teaching in colleges and universities, due to the limitations of subject differences, experimental conditions and experimental environment, it is inevitable to encounter setbacks and obstacles, and students need to actively think deeply, put forward innovative plans, and finally complete the experimental goals. Under the circumstance that different environments and conditions cannot meet the experimental requirements, students are required to constantly try and improve the experimental methods, which exercises student's spirit of exploration and innovation, and is conducive to the shaping of student innovative character.

4. Construction of Index System of University Virtual Simulation Experimental Teaching Center under the Background of New Liberal Arts

4.1. Teaching Idea

In this study, the virtual simulation experiment teaching idea is divided into three aspects:

- 1) Give full play to the important role of virtual simulation experiment teaching, strengthen students' attention to the practical learning of new liberal arts, enhance students' sense of social responsibility, cultivate students' practical and innovative ability, and stimulate students' innovative spirit.
- 2) Attach importance to the experimental teaching environment and conditions of new liberal arts, strengthen the coordinated development of experimental teaching and theoretical teaching, and form an atmosphere for training new liberal arts professionals and top-notch innovative talents.
- 3) Rationalization of experimental teaching orientation

The rationalization of the orientation of experimental teaching includes the rationalization of concept, function and education. Optimization guidance is a reasonable choice to determine whether the educational concept of the experimental training center is advanced and whether the school attaches importance to students' practice and creativity cultivation. The orientation of the experimental center reflects the importance it attaches to the coordinated development of experimental education and theoretical education. The reasonable orientation of educational goal means that the goal of the experimental teaching center is to form the ability required by a hierarchical structure, including basic ability, new technology application ability and comprehensive innovation ability.

4.2. Teaching System

A high-level virtual simulation experimental teaching center should have scientific and reasonable educational experience standards and a new training mode, and should cultivate talents jointly with other departments and enterprises. At the same time, in the construction of the education system, attention should be paid to cultivating students' basic norms and skills, advanced scientific experience and social practice should be closely linked. The basic standards of the experimental education system can reflect strict equipment standards and operating standards. The development of basic abilities in an experimental teaching system is closely related to the cultivation of scientific literacy, the ability to read and analyze experimental information, the ability to consult and sort out literature, the ability to write experimental reports, and the ability to organize and implement experiments.

4.3. Experimental Teaching Methods

The virtual experimental teaching system of colleges and universities should innovate and use diversified teaching methods and modern educational means, highlight students' ability to independent learning, improve experimental teaching by combining cooperation and exploration, and vigorously carry out design, comprehensive and innovative experimental projects. Its connotation includes: using virtual reality technology to optimize experimental teaching means, using on-site photography and real-time projection, combining teacher demonstration with educational means, and using other multimedia educational means to develop comprehensive experimental projects. Introduces students' questions, projects, topics and their methods of interaction, discussion, self-directed learning, collaboration, and research. Its content can be divided into heuristic education, problem education, project education, discussion education, open education, level education, other forms of education, independent learning, cooperative learning, research methods, projects and so on. Interaction based on specific situations, evaluation of educational methods and students' independent learning methods, evaluation of the effect of students' cooperative learning methods, evaluation of the effect of students' research-based learning methods, etc. Through

the combination of basic virtual simulation and advanced virtual simulation, the combination of classical theory and modern technology, the combination of virtual experience and real experience, the development of basic standards, the cultivation of basic skills and the cultivation of innovation ability, so as to meet the diverse learning needs of students, to cultivate students' innovation ability.

4.4. The Construction Mode of Experimental Teaching Team

High-level virtual simulation experimental education center should attach great importance to the construction of teaching staff, teaching and scientific research, strengthen the interaction with enterprises with high-level teaching and scientific research capabilities, and form a reasonable experimental teaching team structure. Pay attention to pilot planning and teacher construction, formulate corresponding policies and effective measures, encourage high-quality teachers to participate in pilot education. The teaching staff planning of the virtual simulation experimental teaching center includes the total number of full-time teachers, the distribution ratio of professional titles and the distribution ratio of degrees. The group learning of full-time teachers aged 50, 35 - 50 and below is implemented, and high-level teachers are encouraged and guided to participate in the construction and improvement of incentive policies and measures for experimental teaching.

The experimental teaching team is co-built with the theoretical teaching team, which is also interactive and compatible with education, scientific research and technology, so the requirements for the teaching management team are relatively stable. The experimental education team's age, position, knowledge, ability and quality structure are reasonable, forming a dynamic balance. Attach importance to the selection and use of full-time responsible persons, strengthen personnel training, interact with relevant departments, research institutes and enterprises, and extensively participate in the exchange of domestic and foreign counterparts. Establish a system for selecting and using full-time responsible persons, improve the training system of pilot training groups, the number of trainees and the training plan for young teachers. The number of young teachers receiving training, the number of exchanges with relevant ministries and commissions, research institutions, and enterprise representatives, the number of foreign exchanges and the number of domestic exchanges should be rationally distributed.

To form an experimental teaching team with a strong sense of responsibility, strong management ability, advanced educational concepts, high level of information technology, rich experience in experimental teaching, excellent teaching style and innovative spirit. Reflect the position of the person in charge of the center, educational level, professional and technical qualifications, experimental education level, theoretical education level, laboratory management level; the number of leading high-level research projects, the number of scientific research awards at or above the provincial level, the number of first-class courses at or above the provincial level, the number of high-level papers published, and the

number of patents obtained; The number of teaching materials compiled by the person in charge, the average age of teachers, the professional and technical positions of teachers, etc.

4.5. Device Configuration

In order to create modern virtual simulation experimental teaching equipment, the virtual simulation experimental center must meet the professional needs of education and experimental teaching, meet the needs of high-level personnel training, ensure the smooth operation of facilities, equipment, platform and website, attach great importance to laboratory safety, and regularly carry out education and training activities. Laboratory equipment and layout should meet the requirements of experimental teaching, ensure the quality of facilities and equipment, ideal combination, sufficient quantity, perfect matching, highlight professional characteristics, adapt to technological development and social needs change, and meet the needs of talent training. The total number of experimental teaching center equipment includes the number and area of laboratories, the number of basic equipment, the number of high-end equipment, the number of supporting software, the total cost of investment, and the intelligent laboratory management. Experimental teaching includes many professional characteristics to meet the needs of new technology development and social practice, and to meet the needs of high-level human resources training. Experimental teaching resources and equipment are effectively utilized, fully maintained and well-equipped. Specifically, it includes the operation of the high-end equipment, number of the use of high-end equipment, number of high-end equipment maintenance training, high-end equipment service quantity, homemade equipment scientific research project course and student number, number of homemade equipment maintenance, the experiment center of special funds, social donations, lab daily operation cost, equipment, the annual average maintenance cost, embrace school experiment consumable cost, high-end equipment, the equipment failure rate management specifications, equipment operation specifications, equipment maintenance process specifications, equipment upgrade specifications.

According to the requirements of the National Standards Organization for teachers and students to carry out safety and environmental protection training, which can be reflected in the following aspects: safety norms, national standards, improvement of emergency mechanisms and response measures, laboratory safety organization, the existence of safety mechanisms, the existence of systems and laboratory safety standards, equipment safety norms, safety inspection times, emergency training activities, procurement, storage, operation and disposal of laboratory dangerous goods, the number of teachers and students receiving safety education, the number of safety inspections and the number of experimental accidents. Strengthen the construction of experimental culture, which embodies the characteristics of professional experimental education. The number of activities arranged for experimental educational and cultural con-

struction can reflect the situation of participating in experimental educational and cultural construction.

4.6. Experimental Teaching Center Construction and Management Mode

To construct a high-level virtual experimental teaching center, we should adhere to the scientific guiding principle, perfect the education quality assurance system, give full play to the advantages of other enterprises and institutions, and establish a multi-disciplinary and multi-professional experimental teaching center with sustainable development. Adhere to the principles of deep integration of experimental teaching resources, highly open and sharing, efficient and scientific management, scientific planning and construction, in the context of new liberal arts to build a multi-disciplinary experimental teaching center.

Establish an experimental environment for students' independent experience and personalized learning, establish an evaluation mechanism to ensure accuracy, and improve the quality assurance system of experimental education and run well. It is embodied in laboratory education guarantee mechanism, experimental education evaluation system and student financial evaluation system. Carry out exchanges and cooperation between relevant organizations inside and outside the university, make full use of the advantages of scientific research institutions inside and outside the university, the quality of entrepreneurial talents and industrial technology, and foster mutually beneficial, open and common sustainable development practices inside and outside the university. By utilizing external communication mode, cooperation mode, scientific research institutions, entrepreneurial talents and technological advantages, we can achieve mutual benefit and a win-win situation both inside and outside the school, create a large number of virtual pilot projects, and promote sustainable development through cooperation. It is mainly reflected in the number of university-enterprise co-built laboratories, the number of experimental equipment, the number of scientific research achievements obtained through university-enterprise cooperation, benefit sharing, and the degree of transformation of scientific research achievements.

4.7. The Informatization Level of Experimental Teaching

We will strengthen the development and application of modern information technology to ensure effective use of resources, a high degree of openness and sharing, and sustainable development. Modern information technology is deeply integrated into experimental teaching and widely used in the process of experimental teaching, aiming at establishing a complementary experimental teaching network and intelligent management network. Mainly include, currently on the network server storage capacity, the possibility of extended storage capacity on the server can expand the capacity limit value, the software of experiment teaching and laboratory management system, the network learning, intelligent management system, including Internet virus resistance, the functions of information monitoring, intrusion detection, the user identity management and identifica-

tion system. At the same time, according to the different needs of students at different stages, it can be subdivided into general experimental teaching, scientific research experimental teaching and virtual experience experimental teaching resources. This can be explained from the total number of conventional virtual experimental courses, the number of high-risk experimental projects, large-scale virtual projects, high-cost experimental teaching projects and so on. Other experimental teaching resources describing virtual simulation experiments include the number of demonstration experiments, contour experiments, design experiments and teaching questions, the length of the video, the number of answers to experimental questions, and the convenience and legitimacy of public access to resources.

Establish an information management system, build a digital management platform, realize the informatization of experimental course management, experimental course record and evaluation system, give full play to the advantages of informatization, and improve the management level of experimental content, space, time, personnel and equipment. Reflected in the functions of information collection, information management, information dissemination, information sharing between teachers and students, the economic feasibility of public access to resources, students' period of the plan, the number of colleges and universities that have advanced laboratory equipment, the total number of social services, students' service plan, and improve the virtual experimental equipment and software in the role of experiment teaching. In addition, it includes the number of other colleges and universities planning to use experimental equipment, the total number of other organizations planning to provide services, and the total number of hours of social service, and the improvement of the virtual simulation experimental teaching center's overall social service capacity of applying information technology.

5. Conclusion

The construction of a virtual simulation experimental teaching center under the background of new liberal arts can promote the construction of intelligent experimental conditions, integrate information technology and experimental resources of universities, enterprises and regions, and create a hardware environment with professional characteristics, intelligent and efficient, and human-computer interaction. On the other hand, through the comprehensive integration and innovative application of virtual reality, media convergence and information technology, emphasizing the deep embedding of virtual simulation technology, breaking through the limitations of time, space and resources, this is a key measure and an important way to improve the quality of education in our country, promote the construction of disciplines, and cultivate high-quality compound talents. The student-centered virtual simulation experiment teaching can effectively implement the basic task of moral education, promote the reform of education and teaching, and realize the informatization of liberal arts experiment teaching. The

construction effect of the virtual simulation experimental teaching center affects the quality of virtual simulation experimental teaching, which still needs to combine with the development of science and technology, in-depth practice and exploration, and further improve the experimental teaching results.

Conflicts of Interest

The authors declare no conflicts of interest.

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