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Application of Virtual Simulation in Experimental Teaching of Pharmaceutics

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Abstract: *As a new teaching mode, virtual simulation technology has prominent advantages in the experiment teaching of pharmaceutics. As the limitation of time and space in traditional experiment and the remaining problems in the teaching mode, students can learn more from the pharmaceutical experiment more truly combining the virtual simulation.*

Keywords: *Experimental Teaching, Pharmaceutics, Virtual Simulation*

1. Introduction

Experimental teaching is the continuation of theoretical teaching. As for the current teaching process, the teaching methods and media will have a direct impact on students' interest in learning and understanding of knowledge, and then affect the final teaching results [1-2]. The traditional teaching methods have been studied thoroughly. And the future teaching methods will be more integrated with the new modern information technology. In recent years, with the deepening of the national reform of pharmaceutical experimental courses, the combination of information technology and experimental teaching has become more popular in teaching, which is a direction of curriculum reform [3-5]. Virtual simulation technology in China is developing rapidly, especially in education related fields [6]. Therefore, the application of virtual simulation technology to the experimental teaching of pharmaceutical preparations has broad prospects.

2. Current situation of pharmaceutical experimental teaching

Pharmaceutical courses are mostly based on experiments, which is an important link for students to transfer from book theory to practical practice. A good experimental teaching can enable students to grasp the concepts and put them into use cleverly. In the process of learning pharmaceutical specialized courses, the students should memorize some common and necessary basic theories and operate on their own. The teacher need to stimulate students' ability to find and solve problems, and cultivate their rigorous scientific thinking and innovation ability. The most direct way to cultivate this innovative ability is to directly operate various pharmaceutical experiments. Experimental teaching is a teaching activity in which students select experimental objects and cause changes in relevant internal factors of experimental objects under artificial control. Through observation, measurement, analysis, synthesis and design, students can independently acquire knowledge, develop ability and develop quality. Experimental teaching can be divided into two stages. The first is the initial stage of experimental teaching, in which students master basic knowledge, basic methods and basic skills through basic operation training under the guidance of teachers. Second is the advanced stage of experimental teaching. With the deepening of the teaching process, the students' awareness of active experiments is gradually enhanced, and the requirements for independent experiments are constantly improved. The experimental teaching activities gradually shift to students' independent design of experimental programs, independent control of the experimental process, independent analysis of experimental results and writing of experimental reports.

The experimental teaching method of pharmaceutical that we are familiar with is to use blackboard writing and multimedia for auxiliary teaching. These can help students better understand relevant knowledge and achieve corresponding learning goals. However, these multimedia are basically two-dimensional technologies, which still require students to master the final knowledge and technology with their own understanding ability, producing higher requirements for students' understanding ability. In addition, for some abstract knowledge, students are limited to reading experimental teaching materials,

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pictures and videos about the production line of pharmaceutical enterprises, and can not really experience the process. The learning effect is very small. Therefore, in the relatively short experimental process, students are blind in doing experiments and have no deep understanding. For the practical training that are harmful, dangerous or have high requirements for the environment, the students are not impressed by the teacher's explanation only or the simple traditional experiment, instead of the practical operation link. The dynamic three-dimensional (3D) scene and interactive characteristics of virtual simulation technology can just become an excellent auxiliary tool in pharmaceutical preparation experiments.

3. Virtual Simulation in Experiment Teaching

Virtual simulation technology uses computer graphics, sensor technology, psychology, artificial intelligence and other technologies to create a three-dimensional virtual space that can be manipulated by users [7]. People can use computers to create realistic 3D virtual environments, convert various motion information into computer data, and feel the 3D world through vision, hearing and touch. Relying on virtual reality, multimedia, human-computer interaction, database, network communication and other technologies, a highly simulated virtual experimental environment and experimental objects are constructed. Students carry out experiments in a virtual environment to achieve the teaching objectives required by the syllabus. The combination of virtual simulation and pharmaceutical professional experiments can reflect the three functions of virtual simulation technology.

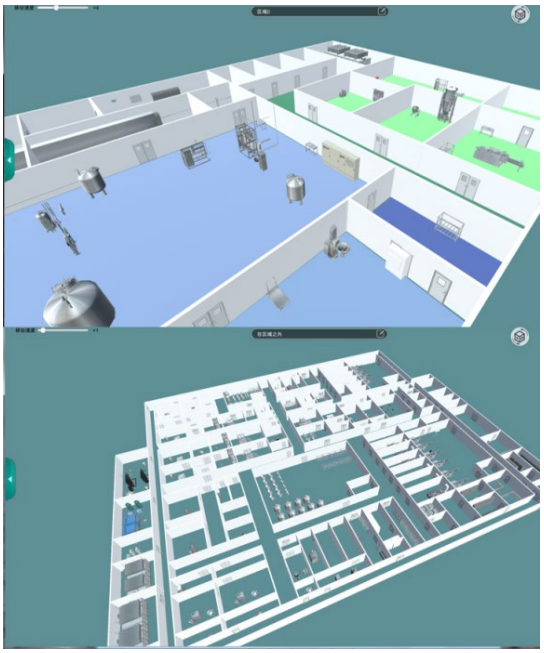

Figure 1: The 3D view of equipment model, workshop design and plant layout, which can be carried out by the software.

First of all, virtual simulation can realize experimental operations in high-risk or extreme environments, inaccessible or irreversible environments. For example, the corresponding cleanliness level requirements of the pharmaceutical production workshop limit the number and the activity area of students, affecting the effect of practice (Figure 1). The virtual simulation software can display the composition and principle of the equipment in the form of video, animation, virtual simulation, etc. The design of the production workshop and the layout of the factory meet the GMP requirements. More than 200 3D high simulation equipment can be produced and commissioned, running state simulation, and material change process simulation. In addition, visiting some extremely high-risk production workshops, such as explosion-proof workshops, will bring hidden dangers to students' personal safety and affect the normal operation of the factory (Figure 2). We can simulate accident handling process through animation, special effects, etc. Secondly, virtual simulation can realize the smooth implementation of experimental teaching in the case of insufficient funds for experimental projects such as high cost or high consumption, large-scale or comprehensive training (Figure 3). Finally, virtual simulation technology can inspect students' basic experimental skills for some basic experiments. Virtual simulation is the focus of experimental teaching content and technology updating, which makes it possible for students to contact with cutting-edge content and advanced technology as soon as possible. The seamless connection

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between experimental teaching and major engineering practice shortens the distance between experimental teaching and engineering practice. The breakthrough of the reform of teaching mode and teaching method in colleges and universities promotes students' independent learning, research-based learning and paperless learning. It is suitable for experiments that do not have conditions, and can repeat experiments, experiment at any time, and experiment anywhere.

The platform adopts permission management, which is not limited to specific role permissions. The platform supports the virtual simulation experiment, which can be used for experimental teaching design, including experimental step prompts. The intelligent examination module adopts the label design of test questions, and the paper generation is accurate and fast. At the same time, the system automatically adjusts the difficulty of the test questions according to the error rate of the answers, and adapts to the teaching needs of different schools. The platform will collect a large number of experimental teaching, learning and assessment data, which can form a complete analysis of teaching behavior through integration.

Figure 2: 3D Safety drill.

4. Application of virtual simulation technology in pharmaceutical experimental teaching in our university

The Department of Pharmacy of our school has two majors, pharmacy and pharmaceutical preparations. The college has a provincial pharmaceutical demonstration teaching center, which provides comprehensive experiments, design experiments and open experiments for students. The experimental content covers pharmaceutical chemistry, pharmacology, pharmaceutical analysis and pharmaceutical preparations and other aspects, enabling students to have a comprehensive and systematic experimental study of pharmaceutical preparations, understanding the relationship between various disciplines of pharmacy, as well as the drug development and production process. Students can receive systematic training in pharmaceutical research practice. The construction of pharmaceutical virtual simulation platform can make up for the defects of pharmaceutical professional experiments.

With professional experimental projects as the main body, the virtual simulation system is divided into three modules, namely, test, simulation and interaction, based on the knowledge points, standard operations and test questions that the experiment needs to master. Students can realize online operation and real-time assessment. The platform can be used for experimental teaching design, including experimental step prompts, and the addition of test questions in the experiment, which can be freely set. It is a virtual experimental teaching to meet the personalized needs. The functional examination module adopts the label design of test questions, and the test paper formation is accurate and fast. At the same time, the system automatically adjusts the degree of difficulty of the test questions according to the error rate of answering questions to adapt to different teaching needs. Use video, animation, virtual simulation and other forms to show the experimental operation and equipment principle, so that students can understand knowledge more intuitively and stimulate students' learning initiative, enthusiasm and creativity.

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Figure 3: Simulating half-hardware of pharmaceutical factory.

5. Conclusion

For students, most of their innovations are just the discovery of facts that they did not know in the past. Experimental teaching is intended to help students achieve great innovation in the future. More importantly, the main task is to enable students to experience the joy and confidence of innovation, stimulate their desire for innovation, create conditions to maintain this valuable quality, encourage them to continue to study the "new" found, and cultivate their innovation ability. As an important part of higher education teaching, professional experimental teaching is an important teaching link to improve students' practical ability, innovation spirit and professional ability. The level of laboratory construction affects and restricts the improvement of the overall level of colleges and universities. The introduction of virtual simulation technology can shorten this gap, give play to the unique and irreplaceable role of virtual simulation experiment teaching, effectively improve the teaching ability, expand the practice field, and meet the core requirements of enriching the teaching content.

To sum up, the application of virtual reality technology includes both the virtual experiment content and the virtual verification of new experimental schemes. It can promote students' mastery of experimental ability and promote the teaching scope of complex and expensive experiments. Besides, it can reduce the cost of students' innovative practice, solve the teaching management of innovative experiment, provide scientific evaluation of the whole experiment process and record the innovative solutions.

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