Construction and Application of Computer Virtual Simulation Teaching Platform for Medical Testing

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Abstract. At present, virtual simulation experimental teaching has become the mainstream experimental teaching method in colleges and universities. Compared with the traditional classroom experiments, virtual simulation experiment teaching is not limited by time and space, and there is no need to worry about the risk of experiment. Students only need to wear VR devices through computers or mobile phones to enter the virtual simulation lab for experiments. The realism and interactivity of virtual simulation technology allows students to immerse themselves in it. Based on this situation, this paper discusses the construction and application of medical laboratory computer virtual simulation training teaching platform.

Keywords: Medical Laboratory, Virtual Simulation, Practical Teaching Platform, Application

1. Introduction

China has a large population and a great demand for public medical resources. However, it takes a long time to train a qualified medical personnel. Therefore, it is urgent to use virtual reality technology to improve the efficiency of medical education personnel training and improve the supply quality of medical personnel in China. Practical medical talents training focuses on practice. Modern educational technologies such as virtual simulation have brought greater convenience to medical education and will certainly promote the in-depth reform of medical education [1]. Taking the medical profession that pays attention to practical training as an example, the teaching process is usually faced with problems such as lack of practical resources, high real operation cost and high risk. Therefore, Fantasy Technology has made great efforts to create a medical virtual simulation practical training platform. This platform takes improving students' clinical experience as the starting point [2], takes three-dimensional real scene technology as the core, and enables teaching to be completed in virtual scenes. At the same time, it is characterized by a realistic sense of presence, rich interaction and real-time assessment to improve students' interest and efficiency in independent learning and operation [3].
2. Application of virtual simulation training platform

Medical examination is a very practical subject. Practical training and clinical practice run through the whole teaching process. The quality of practical teaching environment is directly related to whether students can master the course. Psychologist Ritra's research shows that when the same knowledge is presented in different teaching methods, the effect is significantly different. In order to construct the virtual simulation teaching platform of medical test, teachers can adopt the teaching mode of "doing middle school ", so that the information of various media can act on the students' senses at the same time, which is helpful

Improve students' understanding and practice ability until appropriate behavior patterns and behavior system [4] are formed. Building virtual simulation training platform has a good application prospect, which can solve the following problems: solving the problem of high, fine and expensive instrument training in medical laboratory technology; standardizing the standardized operation training of laboratory technology; avoiding the biosafety problem of laboratory technology training; saving the cost of reagent consumables for laboratory technology training; solving the shortage of morphological resources in clinical laboratory; improving the [5] of students' interest in learning medical laboratory courses.

3. Features of virtual simulation training platform

3.1. Convergence with the medical laboratory industry

At present, the inspection report of registered and printed hospitals is directly completed by the LIS system. Therefore, the functional modules of the virtual simulation training platform for medical laboratory should be consistent with or similar to the LIS system of laboratory [6], such as introducing quality manuals, rules and regulations, SOP and other documents related to actual work on the platform, and then integrating virtual experiments into it. It is beneficial for students to understand and understand the current management methods and requirements of hospital inspection information, so as to further improve their post adaptability.

3.2. Combination of short and long term

The construction of virtual simulation training teaching platform requires the input of hardware, software, capital and manpower. As the development of instruments and inspection projects, the platform renewal needs professionals who know both professional and familiar with information technology, which requires the college to give policy support [14]. Use various ways to raise funds for platform construction, actively accumulate and sum up construction experience, and update the platform content in time with the progress of laboratory medicine.

3.3. Combination of line and line

According to the practice of Fei Chang [7] of Hunan Medical College, the students who use virtual simulation platform account for 80% of the total number of students, and the students who often use them account for about 50% of the total number of students. Therefore, how to improve the utilization rate of the platform, improve the enthusiasm of students to learn, while avoiding the shortcomings of virtual simulation training, such as people and machines without emotional communication, long virtual
teaching time will make students feel lonely and depressed, can not cultivate students' hands-on ability and team spirit [8-11], pay attention to the joint construction of traditional experiment and virtual simulation experiment teaching resources, pay attention to the seamless docking between traditional experiment and virtual experiment. Online, students complete virtual operation; offline, take the network curriculum knowledge competition, network curriculum design competition to let students participate in the design and implementation of network curriculum teaching links, to achieve the "online" and "offline" integration.

3.4. Combination of Foundation and Application

Virtual simulation training platform focuses on solving practical experiments, practical training due to resource constraints (such as flow cytometry, blood cell analyzer, automatic biochemical analyzer and other instruments expensive), conditions constraints (such as high requirements for laboratory environment, difficult to prevent microbial pollution, high requirement of virus culture condition, long period and so on), and poor practical training effect. At the same time, it takes into account the integration of curriculum, pays attention to the combination of virtual experiment and clinical typical cases, and forms a systematic system [12] based on organs, systems and diseases. For example, the knowledge of multiple myeloma tests, including basic clinical tests, hematological tests, biochemical tests and immunological tests, can be integrated into clinical tests of multiple myeloma.

3.5. Process and summative evaluation

The design of virtual simulation training teaching platform should reflect the diversity of evaluation subject and evaluation index. Diversity of evaluation subjects: including tripartite evaluation, that is, self evaluation, internal evaluation and off-campus evaluation; diversity of evaluation indicators: including the condition quality, process quality and result quality [13] of medical laboratory technology courses. Therefore, the role of the virtual simulation teaching platform for medical laboratory should include teachers of medical laboratory technology, students of medical laboratory technology, internal supervision, school and enterprise experts, graduates of medical laboratory technology, experts of hospital laboratory department, non-user units and so on. They complete different evaluation tasks around the students' experimental process and serve the experimental teaching. We should pay attention to the process evaluation of students' virtual training, and better combine process evaluation with summative evaluation.

3.6. Humanistic Care and Quality Education

To cultivate students' comprehensive quality as the core, pay attention to humanistic care and quality education. With the increasing contradiction between doctors and patients and the overall characteristics of "self-centered" students after 00, teachers should strengthen professional quality education, such as medical ethics and humanistic care, and emphasize "people-oriented" virtual simulation teaching in the process of practical teaching and virtual teaching. For example, in virtual operation, students are always required to simulate communication with patients, and to strengthen privacy protection for real patient image data.

4. Structure framework of virtual simulation training platform
4.1. Virtual simulation content

The course of medical examination is investigated and analyzed, and the modules that need to be simulated are determined according to the practical training requirements of clinical examination, hematology, biochemistry, immunology, microbiology and parasitology. On the one hand, no less than 1 080 p high-definition video shooting and finishing the current mainstream instruments (automatic biochemical analyzer, blood routine analyzer, etc.), types of test specimens (blood, urine, feces, etc.), classic manual operation items (white blood cell count, gram staining, etc.), reagents used (calibration fluid, quality control fluid, etc.) and tools (pipette, sample gun, etc.); on the other hand, the abstract principles of professional courses are docked with technicians by drawing, writing, etc., to form a development idea based on video and pictures.

4.2. Virtual Simulation Structure

Virtual simulation using SQL Server 2012 database planning management practical teaching platform. Platform management includes user management, course management, resource management and examination management. The user management and development software is C/S architecture, setting up client and server, building database and Server independently by server, and realizing the interactive operation of virtual experiment in constructing 3D virtual scene. It includes grade management, class management, role management and user introduction. The course management is divided into six modules according to the course of medical laboratory specialty: clinical examination foundation, hematology test, biochemistry test, immunology and test, microbiology and test, parasitology test. The resources of each course are divided into practical training materials, micro-class resources, clinical cases and virtual experiments according to the content; resource management is convenient for teachers to add, delete, edit and block the experimental content according to their own teaching ideas; examination management includes administrators, teachers and students.

4.3. Platform resources

According to the principle of "taking reality as the basis, filling up the reality with the deficiency, combining the reality with the reality, the energy is not empty ", the resources are divided according to the professional curriculum. 3d simulation software, such as 3 Dmax, Maya, Unity3D, is used to make model resources, using physical photo synthesis, data mining and finishing synthesis, and manual modeling to show the structure and function of medical inspection equipment, manual operation flow, and abstract knowledge points with 3d perspective, highly realistic scene. According to the sample object and test items, the hospital laboratory experts, professional teachers and technicians establish different scenarios. The B/S structure is adopted, and the network browser is used as the system running platform to realize free access from time, space, number and equipment restrictions, such as PC, mobile phone, ipad.

5. Teaching effect of virtual simulation teaching platform for medical testing

In order to improve teachers' enthusiasm for the application of virtual software and the use of students, the teaching mode of combining real experiment with virtual experiment is set up. Before class, students log on to the virtual operation platform to preview, design the experimental scheme and complete the virtual operation; in class, let the students complete the corresponding virtual experiment again, and the
results can only enter the real laboratory through the examination requirements. According to the problems reflected in the students' virtual operation background and the weaknesses in the experimental design, the teacher focuses on the analysis and explanation to assist the students to complete the task. After class, the students submit the experimental data and the experimental report to complete the review. This part of the experiment mainly solves the real laboratory can not open in real time, breaks the traditional experiment teaching to the time, the empty limit, the student may log in the system anytime, anywhere, completes the virtual operation. In the comprehensive quality evaluation of virtual simulation training teaching, the real training results account for 80 and the virtual operation accounts for 20. The evaluation of real training includes three parts: job operation time, operation times and operation effect, as shown in Table 1, professional quality, professional ability and professional knowledge, and virtual training is shown in Table 2.

**Table 1.** Score Table for Comprehensive Quality Evaluation of Virtual Simulation Training

| Level 1 indicators | Secondary indicators and scores | Level 3 indicators and observation points |
|--------------------|---------------------------------|-----------------------------------------|
| Practical Training (80 points) | Professional quality (20 points) Professional ability (30 points) Professional knowledge (30 points) | Strict measurement standards, take good care of instruments and equipment, focus on team in order to operate, quality control, analysis of the results of the project involved in the principles, methodological characteristics |
| Virtual Training (20 points) | Operation time (5 points) | Number of experiments in which the time to complete the virtual operation meets the requirements |
| | Operational effects (10 points) | Be able to master operational matters needing attention and consult literature to solve problems |

**Table 2.** Comparison of Average Quality Score between Experimental and Control Classes (x±s)

| Group Number | Midterm results | the result of the final exam |
|--------------|-----------------|-------------------------------|
| Lab class 51 | (8.3±0.7)*      | (8.5±0.8)*                   |
| Control class 50 | (7.6±0.2)*  | (7.7±0.1)*                   |

Note: * P<0.05 per cent compared to control classes

Through comparison (as shown in Table 2), it was found that the average score of the experimental class was higher than that of the control class (2.03= P<0.05, 2.531, P<0.05). It shows that the enthusiasm of the traditional teaching class is not high, and the virtual simulation teaching class arouses the
enthusiasm of the students, from "want me to learn" to "I want to learn ", which effectively improves the students' ability to master the test knowledge and skills.

6. Conclusion

When the second wave came, there were some confirmed cases in some areas, but they were all under control. It is not only us who are affected, but also some medical students and frontline medical staff. Clinical practice teaching is the focus and difficulty of medical education in China, and it is also the key to improve medical students' practical ability and comprehensive quality. In order to reduce the impact of the epidemic on the clinical practice skills of medical students, many medical colleges and universities have adopted the medical virtual simulation training platform to help students carry out online skills training. Teachers can teach through the medical virtual simulation training platform, with built-in 3D animation to demonstrate the operation process, as well as example demonstration videos for students to imitate and learn. At home or at school, students can practice in a virtual space through computers, mobile phones or VR devices, and follow the steps to learn independently. In addition, there are online assessment module to learn the content of real-time assessment, timely detection of errors. This is equivalent to equipping students with "one-to-one" tutors, enabling "hand to hand" teaching. The practical application has told us how necessary and significant it is to build a medical laboratory computer virtual simulation training and teaching platform.

Acknowledgments

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