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Virtual-real Mixed Teaching in "Clinical Basic Laboratory Technology" Reform Strategy and Preliminary Exploration in Experimental Course

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Abstract

The key to curriculum reform lies in changing the learning style, and establishing a technology platform is an effective method of achieving this reform. This paper analyzes the problems that exist in the current experimental teaching of medical technology and proposes a reform strategy for a mixed teaching system that combines virtual and real methods. This strategy includes team teaching, mutual teaching and promotion, the integration of virtual and real components, and additional assessment. Taking the course "Clinical Laboratory Technology" as an example, this study explores specific methods to implement teaching reform. By adopting the hybrid teaching mode, universities can create more experimental courses, increase the number of hours students spend on experiments, effectively enhance and broaden students' practical skills, and keep up with the latest technologies in medical laboratory. This approach can effectively reduce the cost of experiments, improve the efficiency of experimental learning, maintain the advanced nature of experimental teaching, and comprehensively enhance the overall quality of experimental teaching. It provides a reference and guidance for the advancement of subsequent teaching reforms in medical laboratory technology.

Keywords

Virtual simulation, Mixed teaching, Medical laboratory technology, Teaching mode

Introduction

The clinical laboratory technology experiment course is one of the core medical experiment courses of a laboratory major. Its mission is to use modern biomedical experimental technology to detect samples of human blood, body fluids (including cerebrospinal fluid, serosal effusion, articular effusion and amniotic fluid, etc.), secretions (vaginal secretion, semen and prostate fluid, etc.), excreta (feces, urine and sputum, etc.), parasites (nematodes, fluxes and tapeworms) and shed cells using reagents and instruments To obtain credible results and data to provide an objective basis for preventive health care, diagnosis of diseases and scientific research. The course is closely integrated with clinical practice, requiring students to be able to master the basic principles of the experiment, operation techniques and accurate issuance of test reports. In recent years, with the integration of multiple disciplines, clinical laboratory technology has become a highly comprehensive application technology. The automatic instruments represented by blood cell analyzer, blood sedimentation analyzer and urine analyzer have been widely used in clinical practice, and the position of instruments in clinical examination is becoming more and more important.

The rapid emergence of these new technologies and methods leads to a serious lag behind the clinical practice of laboratory teaching content of medical laboratory technology majors, which puts forward new challenges to the experimental teaching of clinical basic laboratory technology.

Virtual Reality Technology (VR) is the use of a computer virtual system to imitate the real scene technology. It is a new experimental research technology produced with the development of computer application technology and has now developed into a strategic emerging technology for human understanding, transformation, and creation of the objective natural world. Blended teaching is a new teaching strategy and teaching form, which integrates teaching in real places and online teaching controlled by students into a teaching mode [1]. The teaching of medical technology requires the improvement of students' operation skills and innovative thinking, and the teaching of clinical laboratory technology experiments should focus on cultivating students' skills in close connection with clinical practice. The adoption of a blended teaching mode can not only stimulate students' ability to independent learning and inquiry practice but also promote the cultivation and development of talents' innovative ability and broad vision [2]. Based on the relevant teaching experience of clinical basic medical laboratory technology, this research group summarized the current problems faced by experimental course teaching, proposed a strategy for the reform of the virtual-real mixed teaching system, and explored specific measures for the reform of experimental course "Clinical Basic Laboratory Technology", aiming to solve the problems faced by current experimental courses. It provides valuable reference suggestions for experimental teaching staff.

1. Current teaching problems of medical technology experimental courses

1.1 The change in the academic system leads to the shortage of experimental teaching hours

In 2013, the Ministry of Education adjusted the catalog of undergraduate disciplines in universities, upgraded the medical laboratory from a second-level discipline to a first-level discipline, renamed Medical Laboratory Technology, shortened the academic duration from five years to four years, and awarded the degree of science [1]. The reduction of the academic system leads to a corresponding reduction in the total number of class hours of all courses of inspection technology, which may cause the teaching content to be not reduced but the teaching progress to be accelerated, or the content of some experimental courses can not be fully learned, resulting in poor learning of students and difficult to guarantee the teaching quality.

1.2 Lack of multi-level and diversified teaching system

At present, the teaching methods and forms of medical technology experimental courses are relatively simple. The teaching process is to select the experimental content, the teacher explains the experimental principle, instruments and reagents, demonstrates the experimental steps, and then the students copy them, according to the required process, and the control test steps are completed mechanically. This single teaching and training mode does not highlight the principal position of students, lacks multi-level and diversified teaching elements, and cannot fully mobilize the initiative and enthusiasm of students in doing experiments.

1.3 Lack of comprehensive and scientific experimental design

At present, the experimental teaching of medical technology is still mainly based on traditional manual operation projects, and most of the comprehensive or scientific experimental teaching projects involving large-scale automatic instruments and equipment are not opened, resulting in a serious disconnect between teaching and clinical practice. It is difficult for students to learn the latest experimental techniques and means, and their scientific research ability cannot be cultivated and improved, which is also a common problem and phenomenon in all kinds of experimental teaching at present [3].

1.4 Limitations of experimental conditions such as funding, environmental protection and safety

Due to the high cost of running a school, some universities can only choose to carry out old, economical and easy-to-operate experimental projects. In addition, the requirements of environmental protection, economy and ethics continue to improve, especially the experiments involving private samples or biosafety, students can only learn theories or watch experimental teaching films, and can not exercise hands-on skills. Due to many limitations in experimental teaching, the current training of technical talents cannot meet the actual clinical needs of modern laboratory medicine [4].

2. The strategy of mixed teaching system reform

2.1 Establish a team teaching model

In the traditional experimental courses of inspection technology, a teacher is responsible for teaching from beginning to end, and students can only passively accept aesthetic fatigue. The team teaching model can reasonably arrange related experimental courses mixed with virtual and real according to the content of experimental chapters that different teachers are good at teaching. It can not only strengthen the teachers' in-depth understanding of the content of the experimental course, give full play to the teachers' academic expertise, but also make use of different teachers' teaching styles, characteristics, methods and means to meet the diversified needs of different students' learning interests.

2.2 Form a model of mutual learning

There are many experimental hours of clinical basic laboratory technology, and the addition of virtual simulation experiments makes the work of experimental content more complicated, so the identity barrier between teachers, experimenters, and students should be broken. The "mutual teaching and learning" mode among teachers, experimentalists, and students is established to realize the superposition effect of roles, namely, "teacher teaching and student learning, real teaching and student learning, student teaching and student learning, student promoting real learning, and student-teacher learning", which fully reflects the student-centered, mutual teaching and learning mode between teachers, experimentalists, and students.

2.3 Design complementary curriculums

Traditional experimental courses are simple in content, which are the most basic and have high biosafety coefficient and cannot cultivate students' ability of innovative thinking and independent construction of knowledge system. We have added automation, high-tech equipment and dangerous biological samples to the virtual simulation experiment course. Students can design experimental ideas according to teaching needs, independently explore experimental schemes in the simulation operation, and select experimental equipment to obtain relevant results in the learning process. We will effectively learn the advantages of the two teaching methods of virtual simulation experiment and real experiment, make up for the shortcomings of the single experimental teaching mode, and comprehensively improve the teaching quality of experimental courses by constructing the teaching mode of virtual and real combination.

2.4 Add virtual experiment assessment indicators

In the practice of experimental teaching, the result of grade assessment can not only reflect the objective level of students' practical ability but also guide students to take the initiative to study hard. The focus of experimental teaching is to cultivate students' active hands-on ability and innovative research spirit, and examination is an effective means to fully mobilize and tap students' subjective initiative. The virtual simulation experiment evaluation index is added to the experimental course results, and the evaluation items are embedded in the software to objectively evaluate the students' practical operation results. By combining the objective results of the virtual simulation experiment with the subjective results of the real experiment, it can more accurately, objectively and truly reflect the comprehensive technical ability and level of the students for the experimental course.

3. The exploration of a mixed teaching system

3.1 Realization of the multi-level and diversified teaching team

Establish multi-level and diversified teaching roles: one leader is specifically responsible for the leadership, coordination, communication, and control of experimental curriculum teaching reform. According to the characteristics of knowledge background, he is also responsible for the teaching tasks of some chapters and the combination of virtual and real experiments. Two core members are responsible for the assessment and evaluation of the virtual-real combination teaching tasks in some chapters and the virtual simulation experiment part respectively, and the roles can be changed according to the teaching year. One core assistant member is an experimenter, who is mainly responsible for the pre-experiment and experiment preparation of the virtual and real mixed experimental courses. At the same time, two to three outstanding students in the proposed class are selected as experimental assistants,

and become the backbone members of auxiliary teaching and teacher-student mutual teaching. The whole teaching team embodies the hierarchical and diversified characteristics of knowledge, skills, personality and roles, and realizes the characteristics of complementary advantages and collaborative development of the team [5].

3.2 The realization of the system of "teachers and students" mutual education and mutual promotion

In the process of mixed virtual-real experimental teaching, the case-based model of "teacher-real student" mutual teaching and mutual promotion is adopted, and two courses, blood analyzer, and urine analysis, which are closely combined with clinical practice, are taken as examples [6]. Assigned by the teacher in advance to the experimentalists and students. The experimenter led the student assistant to start the preparation process of the experiment, to understand the difficulties, doubts and precautions in the experiment in advance, and to clarify the requirements of the instruments and reagents required for the experiment. Students study and discuss together with group students, show the experimental scheme in the experimental class and complete the experiment. In the process of teaching implementation, each student leader led the group members to reach an experimental consensus after full discussion. The teacher selection team explained and demonstrated the experimental process. Promote the excellent experimental process and method, and suggest the precautions of key steps, to achieve a good teaching atmosphere in which teachers, experimenters and students learn from each other and promote mutual progress.

3.3 Add the realization of virtual and real complementary courses

Based on the principle of "combining virtuality with reality, complementing each other, and being able to be real without being false", the complementary courses of virtuality and reality have been added [7]. The experimental teaching of special clinical sample detection that cannot be carried out in the experimental course of Basic Clinical Laboratory Technology, limited by hardware conditions and limited by time and space will be carried out in practice and exploration of complementary experimental teaching. The specific additional cases are: applied to special clinical sample experimental teaching that cannot be carried out, blood testing of anemia diagnostic thinking and skills, chronic myeloid leukemia experiment; Pathogen of nongonococcal urethritis of reproductive system; Cryptococcus meningitidis ink stain for cerebrospinal fluid examination; Serosal effusion test for mycobacterium tuberculosis acid-fast staining, parasite test for Plasmodium test. Applied to the experimental teaching limited by hardware conditions: blood gas analyzer, blood coagulation analyzer, and plasma protein biochemical analyzer for blood testing; Dry chemical and sediment analyzer for urine testing, fecal analyzer for stool testing. Applied to experimental teaching limited by time and space conditions: hemoglobin electrophoresis of blood test, comprehensive test of virtual simulation laboratory.

3.4 Realization of comprehensive assessment of virtual and real complementary experiments

Take "normal performance (40%) + simulation operation assessment (30%) + virtual simulation comprehensive experiment assessment (30%)". The usual grade is composed of classroom performance and experiment reports. Classroom performance mainly evaluates students' realistic experimental attitude and teamwork ability. The experimental report focuses on the examination of the experimental analysis and discussion, and the correctness of the experimental results. Simulation operation test students' understanding of computer simulation experiment operation and hands-on ability. Virtual simulation comprehensive test test: through the platform software embedded in the virtual test department comprehensive test test. Students can perform many skillful operations in the training mode at ordinary times, and then students can choose the assessment mode for assessment. After the end of the experiment, the software automatically scored the students and finally obtained the objective assessment results. Through the above assessment methods, students are guided to cultivate a positive learning attitude and serious research spirit and pay attention to the improvement of experimental thinking and virtual experiments.

4. Conclusion

The experimental course in medical technology not only teaches basic experimental skills but, more importantly, fosters students' heuristic scientific thinking. Today, with the rapid development of medical laboratory technology, teachers should keep up with the pace of technological innovation. They should utilize virtual simulation experiment teaching platforms and adopt a mixed teaching innovation mode. This will help cultivate high-quality medical laboratory professionals who possess strong scientific research abilities and are in line with the current development trends.

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References

[1] Li Xi, Wang Jian, Qi Yunwei, et al. Reform and practice of mixed teaching of Clinical laboratory technology experimental course under the background of "Rain Class" [J]. International Journal of Laboratory Medicine, 2019, 40(12): 1528-1531.

[2] Zheng Wenzhi, Dong Sufang, Li Yongli, et al. Application of flipped classroom combined with traditional teaching method in experimental teaching of Clinical Basic Laboratory Technology [J]. Diagnostic Theory and Practice, 2021,20(01):113-116.

[3] Dong B, Wu T, Yao Z, et al. Teaching reform and practice of bioengineering comprehensive experiment based on virtual simulation technology [J]. Sheng Wu Gong Cheng Xue Bao. 2022, 38(4): 1671-1684.

[4] Li Zongji, Zhang Aijun. Application and effect evaluation of virtual and real interactive teaching mode in experimental teaching of clinical basic laboratory science technology [J]. China Educational Technology and Equipment, 2021(08): 125-127.

[5] Zhu Yayan. Research on the design of team teaching Model in undergraduate teaching in China [J]. Jiangsu Science and Technology Information, 2013(10):36-37.

[6] Ruan Jie, Li Ruixi, Chen Yaqin, et al. Student interteaching model in "Clinical Fundamentals Examination [J]. Laboratory Medicine and Clinic, 2018, 15(21):3313-3315.

[7] Tang H, Li C, Zhou Y, Liu Y. Development of the virtual simulation experiments for Microbial Engineering and perspectives on its shared application [J]. Sheng Wu Gong Cheng Xue Bao. 2021, 37(12): 4439-4445.