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Research on Practice Innovation of Virtual Simulation in Medical Laboratory Based on 3D Fusion of Clinical Thinking, Operating Ability and Post Connection

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Abstract: In order to solve the pain of the traditional teaching of medical laboratory, the virtual simulation teaching mode of "clinical thinking - operation ability - post connection" was constructed. Through the integration of virtual simulation technology and the core requirements of inspection posts, the hierarchical training module is designed to optimize the teaching process and evaluation system. Practice shows that the model can effectively enhance students' clinical thinking ability and practical proficiency, shorten the period of job adaptation, and provide an innovative path for medical laboratory application talents training.

Keywords: Medical examination; Virtual simulation; Three-dimensional fusion; Practical teaching

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1. Introduction

Medical laboratory is a bridge subject connecting basic medicine and clinical medicine. It requires a high level of clinical thinking, operational skills, and post-adaptation ability. Traditional teaching is restricted by expensive equipment, high risk of bio-safety, and limited practice opportunities, so it is difficult to combine thinking training with post-connection. Virtual simulation technology relies on the advantages of immersion, repeatability, zero risk and so on to provide technical support for solving the above predicament. This study focuses on the integration of "clinical thinking - operational competency - post convergence", and explores the innovative application of virtual simulation in medical laboratory teaching.

2. Core connotation of three-dimensional fusion teaching of medical laboratory virtual simulation

2.1. Clinical thinking cultivation: Constructing speculative logic based on case orientation

The case-oriented teaching method is the core of cultivating clinical thinking of medical laboratory students. In order to break the separation of classroom theory and clinical scenario, we introduce a variety of real clinical cases into the virtual simulation platform. Instead of simply remembering the flow of the test items, the students synthetically judged the pathological significance of the test data according to the basic conditions and clinical symptoms of the patients, and gradually developed the habit of rigorous analysis. Relies on the virtual case to infer repeatedly, can continue to exercise the student independently to judge, the synthesis analysis ability, lets the clinical thought throughout the study process.

Based on the virtual simulation carrier to carry out case reasoning, clinical thinking training can be normalized. In traditional teaching, the number of typical cases is limited, and it can not be repeated to carry out the rewinding exercise, while the virtual platform can store a large number of different types of test cases with different difficulties, so as to support students to carry out independent thinking and simulation analysis anytime and anywhere. Students can analyze difficult cases many times to sort out ideas, compare the different perspectives of research and judgment of the differences in conclusions, and timely find their own thinking loopholes. This flexible training form can improve students' knowledge logic system step by step and promote clinical thinking from passive reception to active construction.

2.2. Operational ability training: Strengthening practical operation norms by combining actual situation with actual situation

The training mode of combining the actual situation with the actual situation effectively makes up for all kinds of shortcomings existing in traditional practice teaching. Due to the limitation of consumable materials, quantity of equipment, and safety of operation, it is difficult for students to guarantee the number of practice sessions. The virtual simulation system restores all kinds of inspection instruments, operation procedures and standard actions. Students may first repeatedly practice the operation steps in the virtual environment, become familiar with the key of the instrument, use of reagents, sample processing, and other contents of the whole process, correct irregular actions in advance, and consolidate the operation basis.

After the virtual training meets the requirements, it can greatly improve the overall efficiency of practical training. After practicing the virtual scene, the students have mastered the standard operating procedures and points for attention. After entering the real training field, they can quickly start to practice, so as to reduce the waste of materials and potential safety hazards caused by unfamiliar operation. Virtual and real training cooperate to form a progressive training mode of simulation and operation, which ensures that each student can get sufficient training opportunities and strictly follows the operation standards of the industry, so as to enhance students' practical ability and operation accuracy in an all-round way [1].

2.3. Job adaptation: Anchoring teaching objectives to job standards

The key to realizing the seamless connection between teaching and employment is to define the teaching direction according to the post standard of clinical examination. At present, there is a clear division of labor in the medical laboratory profession. Different posts have corresponding work content, ability requirements and professional norms. This teaching mode comprehensively investigates the working rules, competence standards and vocational requirements of the inspection posts in medical institutions at all levels, and

integrates the content of post work into the virtual simulation teaching module to enable students to clearly understand the actual work content and competence requirements of the post at the school stage.

Designing teaching contents according to post standards can gradually narrow the gap between students' abilities and post requirements. The virtual simulation scene completely reproduces the working environment, working process and post cooperation mode of the laboratory department of a hospital. Long-term immersive post-oriented training can help students to adapt to the working environment in advance, abandon the inherent thinking of campus learning, set up the sense of job responsibility, and effectively shorten the adaptation period after graduation.

3. Design principles of three-dimensional fusion teaching of virtual simulation for medical laboratory

3.1. Competency-based principle: Focus on core accomplishment layered design

The competency-based principle takes students' comprehensive accomplishment promotion as the core and runs through the whole process of three-dimensional integrated teaching design. Students majoring in medical laboratory need to have three core competencies at the same time: thinking, practice and duty performance. Based on this characteristic, the teaching contents are divided into different levels according to the ability and difficulty, from basic skills and basic thinking training to comprehensive skills, complex case analysis and full post performance training, which match the learning rules of students step by step.

The stratified teaching design can give consideration to the growing needs of different basic students. For the students with a weak foundation, we should set up the virtual training module at the entry level, emphasizing the basic knowledge points and simple operation exercises to lay a solid foundation for learning; for the students with strong ability, we should open the high-level comprehensive training module, arrange the complex examination of cases and comprehensive operation tasks, and tap the learning potential of students. We shall follow the competency-based layered design, no longer adopt the unified teaching content and training standards, so that each student can be improved within their own capacity, and ensure the steady improvement of the overall teaching effect.

3.2. Principle of complementarity between reality and virtuality: Synergy between virtual training and real training

Virtual reality complementation is the basic principle of virtual simulation practice teaching. Only when they perform their respective duties and cooperate can the teaching value be maximized. Virtual simulation is good at completing the training contents with high risk, high loss and strong repetition. It can simulate the scene of extreme sample processing, dangerous reagent operation, instrument fault check, etc. At the same time, the virtual platform can dynamically replay the operation process, which is convenient for students to check their problems and teachers to guide them.

The real training particularly emphasizes the training of students' physical operation, on-the-spot response, and on-the-spot cooperation, which can not be completely replaced by virtual training. Facing real samples, real instruments, and emergent situations, students need to accumulate on-the-spot experience in the physical environment and perceive the real working state. In the teaching process, the virtual training is taken as the carrier of preview and repeated consolidation, and the real training is taken as the link of ability landing and actual combat testing.

3.3. Post-oriented principle: To meet the core demands of clinical posts

The principle of position-oriented requires that the teaching contents and training items should be in line with the actual development of the industry and the core needs of the post. With the development of the medical industry, testing technology, testing equipment, and working processes are constantly updated. The updating speed of traditional teaching content lags behind the industry change. The mode continuously follows up on the technical updates and post function adjustments of the examination department of a medical institution, updates the virtual simulation teaching resources in a timely manner, and ensures that the training items and knowledge content keep pace with the current post work [2].

Optimizing the teaching system based on post demand can enhance the pertinence and practicability of talent training. In the design of training tasks, complete reference to the work of daily job settings, the post commonly used inspection items, high-frequency work scenarios, and essential vocational skills as the focus of teaching. At the same time, incorporate job professional norms, service requirements, teamwork, and other workplace literacy content, so that students not only master professional skills but are also more familiar with job requirements. Adhere to the position-oriented teaching design, train talents more in line with industry employment standards, and enhance the employment competitiveness of students.

4. Practice path of three-dimensional fusion teaching of virtual simulation in medical laboratory

4.1. Development of modular teaching resources: covering the whole process of verification scenario

The development of modular teaching resources is the foundation of the implementation of the 3D integrated teaching model, which is divided into different functional modules according to the complete workflow. Based on the links of clinical testing, basic modules such as sample collection, sample processing, project testing, result analysis, and report issuance shall be set up in sequence, and special modules such as biochemical testing, immunological testing and microbiological testing shall be subdivided according to the direction of specialization, so as to cover all kinds of clinical first-line testing scenarios fully. Each module sets up training content independently, and connects with each other, forming a complete teaching resource system.

The content of each module is detailed according to the three-dimensional training goal, and the training requirements of thinking, operation and post are considered. In a single module, not only was standardized operation training content designed, but it was also matched with clinical cases and post work requirements. Modular resources have the characteristics of flexible access; teachers can freely combine the contents of modules according to the teaching progress and teaching objectives to carry out special training or comprehensive training. Rich and systematic teaching resources provide solid content support for the three-dimensional integration of teaching.

4.2. Immersive teaching process construction: Thinking, operation and job progression

Constructs the progressive immersion teaching flow, follows from the theoretical pondering to the start of operation, and again arrives at the post-performance study rule. At the initial stage of teaching, students shall be guided to carry out analysis, research and judgment, sort out the inspection ideas and complete the preliminary training of clinical thinking by relying on virtual cases; at the middle stage, the whole process

of operation shall be practiced by relying on the virtual simulation system, and the operation details and use methods of instruments shall be familiar with so as to enhance the practical ability; finally, the real job scenes shall be recapitulated to enable students to complete a whole set of work tasks as on-the-job personnel and complete the role change from learner to practitioner.

Immersive scenes create a sense of strengthening students and enhance the overall learning effect. The virtual simulation platform uses pictures, sound effects and interactive functions to restore the real environment of the examination department. The whole process is linked; the first stage of learning results for the latter stage of training to lay the foundation, and gradually achieve thinking ability, operational skills, and job adaptation. Progressive process design makes the 3D training objectives no longer separated from each other, to achieve the organic integration of the three [3].

4.3. Establishment of a diversified evaluation system: Placing equal emphasis on process and result assessment

The establishment of a diversified evaluation system, breaking the traditional single to the final score as the standard of the assessment model. The evaluation dimension centers on the three parts of clinical thinking, operation ability and post performance, and aims at analyzing the case thinking and judging the accuracy of the examination of thinking ability; aims at the normalization of the steps of the examination of operation ability, the proficiency of movement and the ability to use instruments; aims at the workflow of the examination of post performance, professional accomplishment and cooperation ability, and measures the comprehensive level of students in an all-round way, and the evaluation result is more objective and comprehensive.

Adhere to the combination of process assessment and result assessment, and guarantee the integrity and guidance of evaluation. Process assessment records the length of training time, times of training, errors of each operation, improvement of case analysis, and dynamically grasps the changes of learning status and growth of students. Combining the two kinds of assessment methods, we can not only find and correct students' learning problems in time, but also objectively judge their comprehensive ability.

5. Application value of three-dimensional fusion teaching of virtual simulation in medical examination

5.1. Improving the quality of talent cultivation: strengthening the coordinated development of comprehensive capabilities

Three-dimensional integration of virtual simulation teaching mode, to promote the coordinated development of students' ability to enhance the overall quality of medical laboratory professionals. Traditional teaching often separates theoretical thinking and practical skills to carry out teaching; students tend to have solid theoretical knowledge but weak practical ability, or be skilled but lack clinical thinking. This model integrates the three kinds of abilities into one, carries out the training synchronously in the same teaching scene, guides the students to use theoretical thinking to guide the practice work, and completes the case study and judgment based on the practice results.

Long-term integration of training, to shape the industry requirements of composite professionals. Students are no longer limited to mastering a single knowledge or skill, but to form a "thinking, able to operate, understand the post" comprehensive ability system; comprehensive literacy is improved. Compared

with the students who are trained under the traditional teaching mode, the students who accept the three-dimensional integration teaching are more flexible in knowledge application, more comprehensive in problem solving, significantly enhanced in comprehensive strength, and steadily improved in overall talent training quality.

5.2. Optimizing the allocation of teaching resources: reducing costs and security risks

The application of virtual simulation technology can effectively optimize the resource allocation of medical laboratory practice teaching and greatly reduce the teaching running cost. A large amount of reagents, specimens and disposable materials are needed in medical laboratory training. The purchase and maintenance of various precision testing instruments are expensive. The virtual simulation system relies on the digital carrier to carry out the training, does not need to consume materials, and the instruments and equipment only need to be put into the preliminary stage construction; the later stage maintenance cost is low, effectively alleviating the university practical training funds shortage, and allows the limited teaching resources to obtain highly effective use.

A digitized training mode can reduce all kinds of safety risks in practical teaching. Corrosive, toxic, and infectious reagents and biological samples are often used in medical laboratory training. Improper operation may cause safety accidents and threaten the safety of teachers and students. In the virtual scene, students can completely simulate the dangerous operation process, so that they can practice without touching the real dangerous goods and avoid the hidden danger of biological safety and chemical safety. At the same time, the virtual platform can simulate all kinds of dangerous accident scenes, train students' emergency handling ability, and complete safety education and emergency training [4].

5.3. Adapt to the development needs of the industry: shorten the period of job adaptation

The teaching mode closely meets the needs of the profession posts, and the students can adapt to the clinical examination posts quickly and shorten the adaptation period effectively. Nowadays, the medical profession requires the laboratory technicians not only to master the operation skills, but also to be able to analyze the test results independently, cooperate with clinical diagnosis and treatment and comply with the post norms. Students are familiar with the working environment, business process and professional requirements in advance, and do not need to spend a lot of time to re-learn the basic work after entering the workplace.

The talent training direction is highly in line with the needs of the industry, and further enhances the recognition of professionals in the industry. Graduates who have been trained by 3D integration teaching have a quick start, good professional quality, and can quickly integrate into the team and complete the job independently. At the same time, the teaching mode keeps up with the development of industry technology, keeps updating the training content, ensures that students master the cutting-edge technology and working methods, and keeps the talent training pace with the development of the industry, so as to realize the accurate match between the education output and the industry demand.

6. Conclusion

A three-dimensional virtual simulation teaching mode of "clinical thinking - operation ability - post connection" is constructed in this study, which effectively solves the prominent problems of traditional teaching of medical laboratory, and realizes the deep fit of thinking training, skill training and post demand.

Through resource integration, process optimization, and evaluation innovation, the mode can significantly improve teaching effectiveness and help students to transition from theoretical study to clinical posts smoothly. In the future, it is necessary to deepen the integration of virtual simulation technology and teaching content, continuously connect with new industry standards, constantly improve teaching modules and the training system, and give full play to the advantages of virtual simulation teaching, so as to provide more solid support for the cultivation of high-quality medical laboratory talents.

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Disclosure statement

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