ISSN 2616-7433 Vol. 5, Issue 14: 106-111, DOI: 10.25236/FSST.2023.051419

Construction and Application of Network Practice Teaching Platform for Medical Imaging Technology in Higher Vocational Education

Ning Zhang, Fan Zhang

Shangqiu Medical College, Shangqiu, 476100, China

Abstract: *With the advancement and utilization of medical imaging technology, practical education in the field of vocational medical imaging has emerged as an indispensable aspect of nurturing skilled professionals. However, conventional practical teaching approaches are increasingly constrained by factors like time, space, human resources, and materials. To effectively enhance the caliber and efficiency of practical instruction, the implementation of a network-based virtual practical teaching platform has become an unavoidable trend. This article delves into the establishment and utilization of such a platform tailored for vocational medical imaging programs. It offers a comprehensive breakdown of the creation of virtual practical resources and the deployment of instances from the network virtual practical teaching platform. The goal is to offer insights that can guide the overhaul of practical teaching methods within vocational medical imaging programs.*

Keywords: *Medical imaging technology; Vocational education; Network virtual practice; Teaching platform*

Medical imaging technology is an interdisciplinary field involving medicine, computer science, physics, and other disciplines. In practical clinical work, professionals in medical imaging technology need to possess extensive theoretical knowledge and practical operational experience. However, traditional medical imaging technology education focuses more on theoretical imparting and may not sufficiently cultivate students' practical skills, leading to improper operations in practical applications[1].Currently, with the rapid development of emerging technologies such as virtual reality and simulation, online education and distance learning have gained increasing attention.

1. Advantages of network virtual practical teaching platforms

The field of medical imaging technology is widely applied and constantly evolving. In this field, network virtual practical teaching platforms are powerful tools that offer unique advantages and significantly improve the education and training of students in medical imaging technology[2].The following are the advantages of network virtual practical teaching platforms:

(1)Practice in a safe and convenient environment: In the study of medical imaging technology, students typically need to use traditional imaging equipment such as X-ray machines, CT scanners, and MRI machines. These devices are expensive and difficult for students to access. Network virtual practical teaching platforms provide virtual simulation environments that allow students to have opportunities for experimentation and practice without the need for actual equipment.

(2)Provide rich experimental opportunities: In traditional teaching environments, students may have limited opportunities for experimentation. However, network virtual practical teaching platforms can provide more opportunities as they offer a unified platform with various types of imaging experiments, such as MRI, X-ray, ultrasound, and more. This diversification and unrestricted experimental opportunities help students better understand different scenarios and applications.

(3)Support self-directed learning: Network virtual practical teaching platforms enable students to explore the field of medical imaging autonomously, thereby supporting their self-directed learning. Students can log in anytime and anywhere to start practicing, allowing them to self-monitor and control their learning according to their abilities and learning goals.

(4)Improve learning efficiency: Traditional teaching methods often impose time and space limitations on students' learning of medical imaging. However, network virtual practical teaching

ISSN 2616-7433 Vol. 5, Issue 14: 106-111, DOI: 10.25236/FSST.2023.051419

platforms offer diverse experimental opportunities without time and space constraints, thereby improving learning efficiency. Students can flexibly arrange their learning time and teaching format, making the most of their learning time.

In conclusion, network virtual practical teaching platforms are highly valuable teaching tools, especially in the field of medical imaging technology. They enhance students' learning efficiency and self-directed learning abilities, provide diverse experimental opportunities, and improve students' understanding and mastery of medical imaging disciplines[3].

2. Construction of Network Virtual Practice Teaching Platform

The construction of a network virtual practice teaching platform is the foundation for implementing network virtual practice teaching. The network virtual practice teaching platform mainly includes three aspects: hardware equipment, software systems, and network topology.

2.1 Hardware Equipment

In the network virtual practice teaching platform for the medical imaging technology profession, hardware equipment is the key foundation for image processing, analysis, and activity simulation. The medical imaging technology profession mainly includes traditional medical imaging and computer-aided medical imaging[4].In these areas, special attention should be paid to the requirements of hardware equipment. Traditional medical imaging requires the use of specialized equipment such as X-ray machines, CT scanners, and MRI machines for image acquisition. These devices need to have high resolution and sensitivity to produce high-quality, clear, and accurate images. In the virtual practice teaching platform, high-performance graphics cards can be used to accelerate image rendering and display[5].At the same time, corresponding software is needed to process and analyze these images. Therefore, the server configuration needs to consider large-capacity memory and high-speed hard drives to store and process a large amount of image data. Computer-aided medical imaging is a new direction in medical imaging technology that involves analyzing and quantitatively processing medical images. It requires the use of knowledge in computer science, mathematics, physics, etc., to research and develop new algorithms and models.

2.2 Software Systems

The software system of the virtual practice teaching platform for the medical imaging technology profession is an important teaching tool. The software system includes server operating systems, virtual machine software, and virtualization management software. The server operating system is the foundation of the network virtual practice teaching platform. The operating system should be stable, secure, and reliable, such as commonly used Linux or Windows Server. These operating systems can provide good stability, security, and compatibility and can effectively support the operation of virtual machine software. Common virtual machine software includes VMware, VirtualBox, etc[6].When choosing virtual machine software, compatibility with the selected server operating system should be considered to ensure software security. Virtualization management software is used to manage and maintain virtual machines. Virtualization management software can provide functions such as resource pooling, automated scheduling, load balancing, virtual machine replication, backup, and recovery. Common virtualization management software includes vSphere, OpenStack, etc. When choosing virtualization management software, it should be based on actual application needs to ensure that the software can meet the requirements and has good compatibility and security.

2.3 Network Topology

In the network virtual practice teaching platform for the medical imaging technology profession, the design and implementation of network topology are crucial. Network topology refers to the connection methods and structure between various nodes (hosts, servers, devices, etc.) in the network. A good network topology should ensure the stable, fast, and reliable operation of the teaching environment, and also needs to meet the requirements of reasonable resource utilization and security isolation. The design of network topology needs to be based on specific teaching needs. Generally, hierarchical, segmented, and redundant design methods can effectively improve the stability and reliability of the teaching network. For example, the network can be divided into an internal and external network, with the internal network dedicated to teaching experiments and the external network used for external

ISSN 2616-7433 Vol. 5, Issue 14: 106-111, DOI: 10.25236/FSST.2023.051419

communication and internet access. In the internal network, further segmentation into subnets can be done to allocate different teaching resources to different subnets, improving resource utilization and access speed, and also setting up security isolation strategies.

3. Construction of Virtual Practice Teaching Resources

The construction of virtual practice teaching resources is the core of network virtual practice teaching. Virtual practice teaching resources mainly include laboratory manuals, simulation software, virtual simulation platforms, and multimedia teaching resources.

3.1 Laboratory Manuals and Simulation Software

In the virtual practice teaching resources for the medical imaging technology profession, laboratory manuals and simulation software are essential teaching resources. These resources can help students gain a deeper understanding of the course content and improve their practical skills and application abilities through hands-on operation.

The laboratory manual is the core reference material for experimental operations. It should provide detailed descriptions of the experimental process, methods, precautions, and data analysis, enabling students to complete the experiments quickly and accurately. The laboratory manual needs to be rigorous, detailed, and easy to understand, and should reflect the actual operational procedures of the experiments, making it easy for students to grasp the experimental operation skills and quickly master the experimental content, improving operational efficiency.

Simulation software can simulate experiments in a virtual environment, allowing students to conduct virtual experiments and improve their practical operation skills, while reducing teaching costs. The use of simulation software enables students to become familiar with the experimental process and operational steps in a virtual environment, strengthen the application of theoretical knowledge, and improve practical operation skills. Additionally, simulation software has good interactivity, allowing students to make choices and adjustments based on their actual situations, achieving the effect of active learning.

The construction of laboratory manuals and simulation software needs to be designed and developed based on the specific conditions of the course. Generally, the laboratory manual can be categorized and managed with tags to improve the efficiency of students' experiments and make the experimental operation more flexible. When designing simulation software, the resources required for the experiments, such as tools, software, and data, should be integrated into the simulation software to ensure that students can complete the experimental operations in the simulation software and learn to analyze experimental data.

3.2 Virtual Simulation Platform

A virtual simulation platform is an important tool for virtual practice teaching, typically used for simulating and emulating complex experiments. A virtual simulation platform can simulate actual working environments, allowing students to engage in practical operations in a virtual environment, improving their emergency handling capabilities and work efficiency. Common virtual simulation platforms include VMware vSphere, Cisco PacketTracer, etc., which should be selected according to actual application needs. For example, in medical imaging technology practice teaching, a medical imaging simulation platform can be used to perform virtual operations, simulating different types of cases and imaging examination methods, including CT, MRI, and other medical imaging techniques. Students can perform various examinations in the virtual environment, such as determining image contrast, conducting analysis and diagnosis, better mastering the practical application of medical imaging technology.

A virtual simulation platform not only improves students' practical capabilities but also reduces teaching costs and risks, especially in experiments with high levels of danger. Through a virtual simulation platform, the experimental environment can be simulated, avoiding dangerous factors during the experimental operation process, improving the safety and stability of the experiment. Furthermore, a virtual simulation platform can facilitate interactive teaching, using images, captions, sounds, and other means of explanation to better guide students' learning.

The selection of a virtual simulation platform should be based on actual application needs,

ISSN 2616-7433 Vol. 5, Issue 14: 106-111, DOI: 10.25236/FSST.2023.051419

considering software and hardware requirements, supported operating systems, databases, and other factors to ensure stable operation of the platform and compatibility with the actual application scenarios.

3.3 Multimedia Teaching Resources

In the medical imaging technology profession, multimedia teaching resources can be applied in many aspects, such as anatomical knowledge of medical imaging, processing procedures and techniques of medical images, and relevant knowledge in clinical applications. Through multimedia teaching resources, teachers can demonstrate case analysis, image interpretation methods, and standardized operational procedures to help students better understand course content.

For example, creating an animated video of medical imaging can demonstrate the entire process of patient examination, including pre-examination preparation, examination process, and post-examination handling. This can help students better understand patient interaction and operational standards. Using virtual environments, 3D presentations of bones, muscles, and organs in medical imaging anatomy through electronic whiteboards, videos, etc., can visualize abstract concepts, enabling students to better understand and memorize relevant knowledge.

Multimedia teaching resources can also provide valuable learning materials for students in the medical imaging technology profession. By creating audio courses, the main course content can be condensed into shorter time frames to convey core concepts and knowledge to students, providing useful learning resources. During laboratory operations, shooting videos of the experimental process can help students review and reflect on the operation process, thereby reinforcing learning outcomes.

Establishment of a Network Virtual Practical Teaching Platform The establishment of a network virtual practical teaching platform serves as the cornerstone for the implementation of network-based practical education. The network virtual practice teaching platform mainly includes three aspects: hardware equipment, software systems, and network topology.

4. Application Examples of Network Virtual Practice Teaching Platforms

4.1 Case Analysis

Case analysis is a focal point in teaching medical imaging technology. By analyzing and diagnosing actual cases, students can enhance their diagnostic thinking and analysis skills. The network virtual practice teaching platform builds a case analysis module that provides actual case data and image materials for students to analyze and diagnose, preparing them for actual clinical work. The network virtual practice teaching platform can provide a more diverse and realistic environment for case analysis teaching. For example, it can offer multiple cases involving different organ diseases. Students can perform in-depth analysis and diagnosis using multi-angle, multi-level image data, and learn different methods and techniques for handling different cases. In the case analysis module, students can become familiar with medical equipment, diagnostic standards, and operational procedures through virtual diagnosis. The virtual imaging diagnosis tools in the virtual practice teaching platform allow students to conduct simulated diagnoses, thereby improving their diagnostic skills and proficiency, and quickly understanding the imaging characteristics and treatment methods of different cases.

4.2 Experimental Simulation

Experimental simulation is one of the highlights of virtual practice teaching. Through experimental simulation, interference from actual equipment and environments can be reduced, and students' psychological preparedness and practical operation abilities can be strengthened. The network virtual practice teaching platform utilizes virtual simulation platforms and simulation software to allow students to engage in experimental simulations, improving their practical skills and adaptability. For example, in medical imaging processing experiments, students can use imaging processing simulation software on the network virtual practice teaching platform to simulate actual imaging processing processes and conduct experiments and learning based on them. Experimental simulation makes it easier for students to understand complex medical imaging processing techniques and makes teaching more vivid and interesting, enhancing students' motivation to learn.

ISSN 2616-7433 Vol. 5, Issue 14: 106-111, DOI: 10.25236/FSST.2023.051419

4.3 Hands-on Practice

Hands-on practice is an essential part of virtual practice teaching. Through hands-on practice with actual equipment and scenarios, students can improve their practical operational abilities. The network virtual practice teaching platform simulates actual operation scenarios, provides actual equipment and tools, and allows students to engage in hands-on practice to deepen their understanding and knowledge of actual work environments. For example, in radiology image acquisition operations, students need to simulate actual operation scenarios and conduct image acquisition practice on the virtual practice teaching platform. This type of hands-on practice not only improves students' practical operational abilities but also allows them to fully understand the precautions and operational procedures during image acquisition, enhancing their understanding and recognition of the medical imaging profession. The hands-on practice functionality provided by the network virtual practice teaching platform allows students to engage in actual operational practice in different scenarios, such as online simulated teaching experiments, material downloads and uploads, real-time Q&A, etc., enabling students to better master actual operational methods and improve their practical skills. Through hands-on practice, students can also learn about the operational principles and usage of various equipment and tools, helping improve their adaptability and analytical decision-making abilities.

4.4 Diagnostic Discussions

In the medical imaging technology profession, diagnostic discussions are of great importance. Through diagnostic discussions, students can understand the practical application and clinical operational procedures of medical imaging diagnosis, grasp the imaging characteristics and diagnostic methods of different diseases, and engage in exchanges and discussions with classmates to identify their shortcomings and make timely improvements. The network virtual practice teaching platform creates a network discussion platform and organizes classroom discussions to provide students with an open and interactive environment for diagnostic discussions. Students can engage in remote diagnoses through the online platform and participate in real-time communication and discussions through classroom discussions. Additionally, the network virtual practice teaching platform can incorporate collaborative learning and group cooperation in diagnostic discussions, better stimulating students' learning interest and creativity, and enhancing their medical imaging diagnostic abilities. In the process of conducting diagnostic discussions, the network virtual practice teaching platform needs to pay attention to the quality and effectiveness of the discussions. Teachers need to establish detailed grading criteria for evaluating and providing feedback to students participating in discussions. Additionally, the platform needs to provide sufficient technical support and services to ensure that students can smoothly engage in diagnostic discussions and exchanges.

4.5 Teaching Evaluation

Teaching evaluation is an important component of network virtual practice teaching in the medical imaging technology profession. Through online tests, quizzes, and questionnaires, teachers can understand students' grasp of the teaching content and process, as well as their evaluation and feedback on teaching quality. Based on students' feedback, teachers can make improvements to teaching content, methods, and approaches to enhance teaching quality and effectiveness. To ensure the accuracy and effectiveness of teaching evaluation, the network virtual practice teaching platform needs to have a well-established evaluation system and mechanisms. Teachers need to develop reasonable teaching objectives and plans and design and adjust teaching content based on students' actual levels and needs. Online tests and quizzes should have a certain level of difficulty and specificity to reflect students' actual levels and mastery. Questionnaires need to include well-designed questions and formats to accurately collect students' feedback. Teaching evaluation not only helps teachers understand students' learning conditions and teaching quality but also helps students self-evaluate and reflect, improving their learning motivation and outcomes. In the medical imaging technology profession, teaching evaluation can help students master complex medical imaging processing techniques and practical application skills, better adapting to increasingly complex medical imaging tasks.

5. Conclusion

This article starts with the characteristics of vocational education in the medical imaging technology profession and utilizes multimedia technology, virtual reality technology, and simulation technology to

ISSN 2616-7433 Vol. 5, Issue 14: 106-111, DOI: 10.25236/FSST.2023.051419

construct an advanced network virtual practice teaching platform. The platform aims to enhance students' operational skills and their ability to handle actual work, while also cultivating more professionals for the industry. Through experimental verification, this teaching platform has shown significant potential for promotion in vocational education in the medical imaging technology profession. We hope that this work can provide valuable insights for vocational education in the medical imaging technology profession and related research fields.

References

[1] Liu Yang. (2020) Construction and Application of Network Virtual Practice Teaching Platform for Vocational Education in Medical Imaging Technology. People's Health, 6, 274.
[2] Yang Lihua, Liu Yuanyuan, Ren Hongli, et al. (2023) Exploration of the Training Mode of Vocational Education in Medical Imaging Technology with the Integration of "Work Position, Course, and Certification". Science & Technology Wind, 14, 37-39. DOI: 10. 19392/j. cnki. 1671-7341. 202314013.
[3] Liu Yuanyuan, Feng Hua, Wang Zanli, et al. (2023) Research on the "Three Teachings" Reform of Vocational Education in Medical Imaging Technology. Science & Technology Wind, 5, 127-129. DOI: 10. 19392/j. cnki. 1671-7341. 202305042.
[4] Cui Junsheng. (2021)Exploration on the Construction of Teaching Resource Library for Medical Imaging Technology in Vocational Colleges. Science & Technology Wind, 19, 165-166. DOI: 10. 19392/j. cnki. 1671-7341. 202119074.
[5] Yue Ruomeng. (2020) Exploration on the Construction of Teaching Resource Library for Medical Imaging Technology in Vocational Colleges. Health Vocational Education, 38(3), 15-16.
[6] Deng Xiaoxu. (2018)Analysis of Practical Training Teaching in Vocational Education of Medical Imaging Technology. Shandong Industrial Technology, 7, 232. DOI: 10. 16640/j. cnki. 37-1222/t. 2018. 07. 213.