Research on Practical Training Teaching of Professional Courses in Vocational Colleges Based on VR Technology

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Abstract. Traditional practical training lacks realism, cannot meet personalized needs, limits the cultivation of practical abilities, and has limited teaching resources; VR technology can provide simulated experimental environments, interactive training, and personalized learning experiences, providing students with more vivid, intuitive, and effective learning methods. By applying VR technology to professional course training and teaching, constructing VR training modules, developing new forms of integrated smart textbooks, and analyzing big data of teaching and learning processes, students can improve their learning experience and professional abilities, promote innovation in educational and teaching methods, and lay the foundation for cultivating high-quality skilled talents with practical ability and innovative spirit.

Keywords: VR technology; Professional course practical training teaching; Smart education.

1 Introduction

In recent years, with the development of information and digital technology, vocational colleges have begun to use the new generation of information technology to improve their teaching level. Some schools have integrated new digital technologies such as 3D digitization, virtual simulation, VR(Virtual Reality)/AR(Augmented Reality), holographic projection, etc[1]. into the training and teaching process, simulating the real job environment and ability requirements, and creating virtual simulation training and teaching bases to improve some of the "high investment, high difficulty, high risk, difficult to implement, difficult to observe, and difficult to reproduce" problems in practical training and teaching. In 2020, the Ministry of Education and nine other departments issued the "Action Plan for Improving the Quality and Excellence of Vocational Education (2020-2023)", proposing the "Implementation of Vocational Education Informatization 2.0 Construction Action"; In 2022, the Ministry of Education and five other departments released the Action Plan for the Integration and Development of Virtual Reality and Industry Applications (2022-2026), proposing the construction of a number of virtual reality classrooms, teaching and research rooms, laboratories, and

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virtual simulation training bases. The integration of information technology and education and teaching continues.

2 Research Status

At present, a large amount of research has been conducted on the teaching of vocational education courses based on VR technology both domestically and internationally[2].

In terms of foreign research, some universities and research institutions in countries such as the United States and Europe have begun to apply VR technology to the field of vocational education. They have carried out various types of research projects, including modeling and simulation, virtual experiments, skill training, etc. Through these studies, they found that VR technology can enhance students' learning outcomes, stimulate their interest in learning, and thereby enhance their professional abilities and employment competitiveness.

In terms of domestic research, many research institutions and schools have also conducted research on vocational education professional curriculum teaching based on VR technology. They mainly focus on establishing virtual simulation experimental platforms, developing virtual internship systems, and building online virtual training environments. The research results indicate that VR technology can improve students' practical and problem-solving abilities, and promote the integration of practice and theory.

In the future, the teaching of vocational education courses based on VR technology will continue to develop and grow. Researchers will focus on the construction of virtual experimental environments, interactive learning design, personalized learning paths, and other aspects to provide teaching plans that are more in line with student needs and subject characteristics. At the same time, we will also strengthen the establishment of teacher training, technical support, and evaluation systems, and promote the widespread application of VR technology in vocational education.

3 Existing Problems

The main problems in the teaching of traditional vocational education courses include:

Lack of realism: Traditional teaching methods often rely on imparting textbook knowledge and theoretical explanations, making it difficult for students to truly experience the process of practical operation or practice. In contrast, teaching based on VR technology can provide a more realistic and realistic virtual environment, allowing students to learn and practice more immersively[3].

Unable to meet personalized needs: Traditional teaching is often a fixed teaching mode that is difficult to meet the personalized learning needs of different students. Based on VR technology, teaching can be personalized according to the actual situation and learning style of students, providing a customized learning experience.

Restricting the cultivation of practical abilities: Traditional teaching often lacks practical elements, and students may still lack practical skills and problem-solving abilities after completing the course. Teaching based on VR technology can provide more

practical opportunities and simulation scenarios, helping students cultivate practical operational skills and problem-solving abilities.

Limited teaching resources: Traditional teaching involves limitations on experimental equipment, textbooks, and venues, making it difficult for schools and students to access the latest teaching resources. Teaching based on VR technology is not limited by time and space, and can be learned anytime and anywhere, providing more convenient and high-quality educational resources[4].

Overall, traditional vocational education courses have some drawbacks and cannot meet the demand for high-quality talents in today's society. The teaching method based on VR technology can make up for these shortcomings, provide a more vivid, intuitive, and effective learning experience, and help improve students' practical ability and professional literacy.

4 Measures

4.1 Building VR Practical Training Modules

Taking the automobile inspection and maintenance technology major in vocational colleges as an example, by constructing modules for automobile construction and disassembly, automobile maintenance and upkeep, automobile malfunction and repair, and new energy vehicle construction and maintenance, students can independently learn or group virtual exercises through the platform before practical training, and then carry out practical operations, breaking the boundaries of training time and venue.

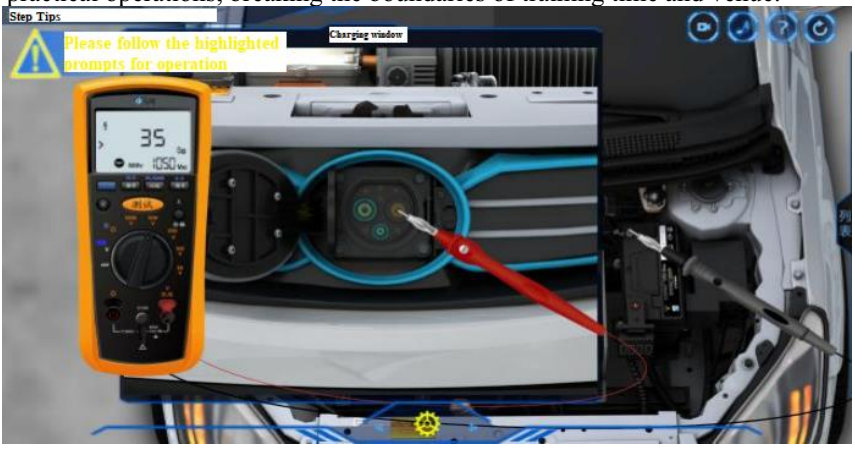

Fig. 1. Virtual Training for Vehicle High Voltage System Testing

Taking the construction and maintenance module of new energy vehicles as an example. This module includes the foundation of pure electric vehicles, the construction and disassembly of electric powertrain, the inspection and maintenance of the vehicle's high-voltage system, and the maintenance and upkeep of electric vehicles. The platform is mainly based on the Geely EV300 and focuses on understanding, operating standards, and troubleshooting various functional systems, as shown in Figure 1. It cultivates

students to master the principles, structure, circuit detection, maintenance, and repair of new energy vehicle control systems, as well as skills such as operating standards and safety precautions for new energy vehicle maintenance[5]. The virtual simulation of new energy vehicle construction and maintenance mainly focuses on the electric powertrain, with a focus on the technical principles, structural demonstrations, vehicle inspection and maintenance training in the four major fields of pure electric vehicles: battery, motor, electronic control, and charging. To troubleshoot faults in the electric power system and cultivate students' ability to analyze the circuits of the electric control system.

4.2 Developing New Forms of Integrated Smart Textbooks

In response to the difficult to concentrate observation of components, principles and structures that affect teaching effectiveness in classroom teaching, a series of new forms of integrated smart textbooks are developed by applying APP+AR technology, scanning knowledge point images in books, and digitizing corresponding teaching videos, 3D models, 3D animation principles, virtual interactions, and other content[6].

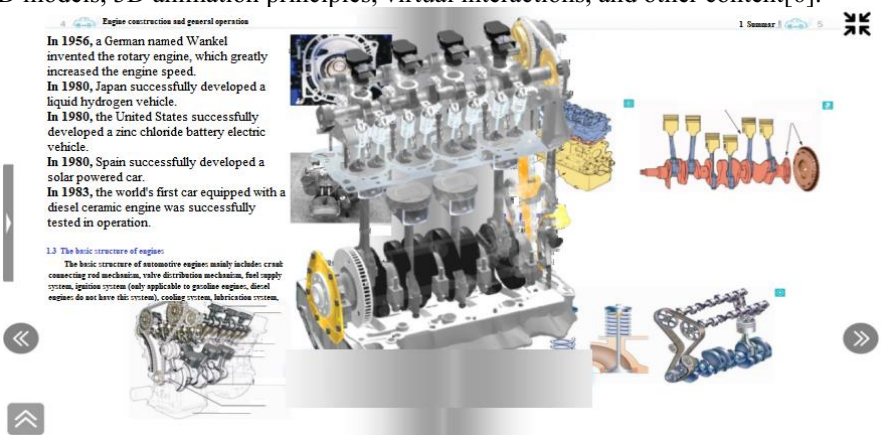

Fig. 2. 3D Model Display of Basic Structure of Automotive Engine

In classroom teaching, teachers can use the tablet app to scan the intelligent icons on textbooks to call up corresponding video courses, 3D models, 3D animations, and realistic training subtasks. By using projectors to demonstrate teaching, students can interact in real-time with course resources such as mechanical structures, principle animations, disassembly and assembly videos, and virtual simulations in the classroom, as shown in Figure 2. This compensates for the shortcomings of textbook flat presentation and makes the content in textbooks more intuitive and vivid.

4.3 Analyzing Big Data in the Teaching and Learning Process

By developing teaching analysis and learning behavior data analysis functions, leveraging the power of big data, data collection is carried out in an accompanying manner,

tracking the entire process of teaching and learning, and providing timely portraits and accurate recommendations to teachers and students. The teacher end of the platform has functions such as course management, class management, student management, and device management. Through the device management backend, remote setting of car bench faults and fault resets can be achieved, and real-time access to student learning data and ranking queries can be accessed. Student side analysis records all data information of each student during the learning process, including practical training data, theoretical learning data, self-directed learning data, and other parts. By analyzing student learning behavior data, different graphical statistical charts are formed. This not only helps teachers quickly grasp learning information and adjust teaching strategies in a timely manner, but also enhances the visibility and effectiveness of teaching, truly achieving the goal of "teacher led, student led".

4.4 Typical Case

Taking Hunan Automotive Engineering Vocational College as an example. It has established a "virtual simulation course", introduced VR/AR technology, and established a virtual training center on the school level platform. Based on core professional courses, the school innovatively carries out virtual simulation pre operation and real field practical operation follow-up training teaching mode. In addition, a "cloud training field" has been established to deploy a training operation platform in the cloud, allowing students to remotely issue operation instructions according to the training task book anytime and anywhere. The accompanying digital twin software generates data and images that are completely consistent with the actual operation, which are used for other students to observe and evaluate the effectiveness of the training.

Innovate the classroom teaching mode and expand the "classroom revolution" from "45 minutes" to a comprehensive classroom with all elements, both in and out of class, online and offline. Create three types of "smart classrooms": scenario based, community based, and appointment based, transforming closed, 36 hour traditional classrooms into open, real-time intelligent classrooms; Establish a 5G "cloud platform". Moving offline interactive classrooms to online, building efficient classrooms, and even achieving "cloud learning" from home, teachers and students can still meet in the cloud; Establish a virtual simulation course. Based on VR/AR technology, establish a virtual training center, innovate the pre operation of virtual simulation, and follow up on the follow-up of real field practice in the training teaching mode; Create a "cloud training ground". Based on digital twin technology, deploy a cloud based training operation platform and actively explore training methods for remote control and real field execution of "C+R" (Cloud operation&Real action) in 5G environments.

Deploy a training operation platform in the cloud, issue operation instructions remotely, and use digital twin software to generate data and images that are completely consistent with actual operation, helping students to observe the operation process in depth and improve training effectiveness.

5 Conclusions

Through VR technology, the supporting digital application of textbooks, teaching resources, and practical training resources has been promoted, meeting the requirements of existing integrated theoretical and practical training teaching. The construction and reform of professional courses, comprehensive innovation and improvement of teaching methods have been achieved, promoting students to better understand course content, enhance learning interest, and improve learning effectiveness. Although VR technology has broad prospects in vocational education, it also faces some challenges. We still need to overcome some technical and economic challenges. For example, the cost of virtual reality devices is relatively high, and not all schools and students can afford it. In addition, the development and research of virtual reality content also require significant investment and human resources. Therefore, it is recommended that the education and technology sectors strengthen cooperation, promote the development and popularization of virtual reality technology, reduce device prices, and promote the research and development of diversified content. It is necessary to consider the correct use and management of virtual reality technology. Virtual reality technology can provide an immersive learning experience, but it may also have an impact on the physical and mental health of students. Therefore, it is necessary to develop relevant education policies and student protection measures to ensure the healthy and safe use of virtual reality technology in education.

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