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Research on the Application of Immersive Virtual Reality in Vocational Education

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Abstract: *The teaching work in vocational institutions has certain unique characteristics, emphasizing skill transmission alongside theoretical guidance, which imposes higher demands on teaching methodologies. Taking common teaching issues in vocational institutions as the starting point, this paper analyzes the advantages and application methods of immersive virtual reality in vocational education. It elaborates on measures such as establishing a work system, organizing resource collection and processing, standardizing teaching procedures, and implementing tracking optimization. Finally, from a developmental perspective, it examines future application requirements of this model, seeks technical optimization, and aims to provide more services for the advancement of vocational education.*

Keywords: *Immersive virtual reality teaching; Vocational colleges; Work systems; teaching process*

1. Preface

Vocational colleges, in a narrow sense, specifically refer to higher vocational institutions, while in a broader sense, they also include secondary vocational schools. These institutions primarily focus on full-time higher vocational education at the associate degree level, with a standard academic duration of three years. Unlike most undergraduate institutions, vocational colleges place greater emphasis on cultivating students' practical skills, training various skilled and technical professionals for society. China boasts a vast number of vocational colleges across its regions, with over 11,000 institutions nationwide by the end of 2025, enrolling more than 54 million students (including secondary vocational schools, higher vocational colleges, and vocational undergraduate programs). On one hand, this system meets the high demand for technical talent in society; on the other hand, it necessitates continuous improvement in teaching management to ensure the quality of talent cultivation [1].In this context, some modern technological methods have received attention, including immersive virtual reality teaching models. Analyzing their application advantages, methods, and other content has certain practical significance.

2. Common problems in vocational college teaching

2.1 High cost and loss

In the current teaching process of vocational colleges, they often face cost pressures, including direct economic expenditures and the consumption of various resources. Some vocational colleges offer majors such as mechanical design and manufacturing, electrical automation, etc., which require the procurement and use of various large equipment. Such equipment is expensive (especially new and imported equipment), and is frequently used in the teaching process. Wear and tear problems are also prominent, requiring vocational colleges to invest more funds in maintenance. If there are a large number of students on campus and repeated practice further increases the demand for equipment and exacerbates the problem of wear and tear, it brings certain economic pressure to vocational colleges[2].

2.2 Difficulty in Implementation

The problem of difficult implementation is not uncommon in vocational education work, and has been continuously troubling vocational education work for many years. This problem refers to the existence of high-risk scenarios, complex technology applications, and research scenarios in the conventional vocational education process. The former brings safety hazards, while the latter has the

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basic characteristic of difficult implementation, which is not conducive to ensuring teaching quality[3].In majors related to chemical industry, high-voltage power, deep-sea operations, and aerospace teaching, the risks of practical operation are relatively high, and it is difficult to provide practical guidance space for students. Even if students' theoretical learning achievements are solid, it is difficult to improve the comprehensiveness and depth of knowledge mastery through high-quality practice, and the effectiveness of the school is limited.

2.3 Insufficient reuse capability

In vocational education work, some resources and teaching methods need to be repeatedly applied to deepen students' understanding of knowledge and provide more convenience for their active learning. Currently, some vocational colleges adopt conventional teaching models, and various teaching resources and methods cannot be reused, which limits students' learning. In medical related teaching work, anatomy teaching is difficult to repeat. After a single dissection is completed, resources are consumed (corpses), making it difficult to serve students' learning repeatedly. There are also some teaching tasks with special content that involve complex technical principles or micro operations. After completing the information display during the teaching process, it is difficult to reproduce it in a targeted manner, which is not conducive to students' subsequent learning[4].

3. Advantages of Immersive Virtual Reality Mode in Vocational College Teaching

3.1 Controllable Cost and Loss

In vocational college teaching, the application of immersive virtual reality mode has the advantages of controllable cost and loss. Compared with conventional teaching methods, immersive virtual reality teaching focuses on the application of technology equipment and resources, which can complete the transmission of relevant knowledge in virtual or semi virtual form. Vocational colleges do not need to purchase a large number of high-end and large-scale equipment. In the process of organizing teaching applications, virtual technology also reduces the consumption of resources and can control teaching expenses. As mentioned earlier, the mechanical design major can use computers and integrated equipment to present the ways, processes, and principles of mechanical design. Through parameter adjustment and VR reproduction, process observation can be conducted to guide students in practical operations. This not only does not affect teaching quality, but also simplifies teaching methods and processes, and reduces costs.

3.2 Less difficult to implement

The application of immersive virtual reality teaching mode in vocational colleges also has the advantage of less implementation difficulty. This advantage is reflected in two aspects: first, safety and reliability, and second, the entire teaching process is controllable. When organizing high-risk scenarios and technical teaching, schools can use virtual reality technology to complete scene construction, and students can use terminal devices (such as VR glasses and computers) to access and participate in practical learning in virtual scenes, which can basically eliminate safety issues during the learning process. Complex teaching content such as deep-sea homework and aerospace education can also be presented through virtual reality technology, guiding students to perceive and participate in interactive learning through immersive virtual reality scenes, reducing the difficulty of teaching some professional knowledge.

3.3 Strong reusability

The immersive virtual reality teaching mode has the advantage of strong reusability and can serve the teaching activities of various majors in vocational colleges. In the process of organizing anatomy teaching, teachers can use information technology to record and process the teaching process into 3D and digital resources after completing part of the classroom teaching, and save them to the school database. When students have a weak grasp of classroom content and anatomy knowledge, they can download relevant resources, view them on their own, and use immersive virtual reality technology to directly enhance their perception, intuitiveness, and three-dimensional understanding of the relevant knowledge, thereby improving learning effectiveness. During the repeated presentation of complex knowledge, immersive virtual reality technology can also enhance its level of concretization and

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consolidate students' learning outcomes.

4. Application methods of immersive virtual reality mode in vocational college teaching

4.1 Building a Work System

In vocational college teaching, the application of immersive virtual reality mode requires a good system setup, including terminal service equipment, remote work system, database, and communication module.

Terminal service equipment includes VR glasses, sensing devices, etc., mainly serving terminal applications, including immersive learning for students, teaching operations and guidance for teachers, etc. Auxiliary tools should also be purchased and configured as a whole, such as microphones, speakers, etc. Remote work system is the main work platform for immersive virtual reality mode, centered on various information devices, including scanning devices, computers, integrated work tools, etc. Taking computers as an example, it is necessary to ensure that they meet the real-time and fast processing needs of large amounts of data, and can also meet the needs of multiple students for synchronous learning. Consider purchasing high-performance computers or building them as small computer groups for teaching services. The virtual memory, video memory, and disk space of the host should be at least 32GB, 16GB, and 8TB, respectively. The virtual memory, video memory, and disk space of the extension should be at least 16GB, 4GB, and 1TB, respectively. All types of work equipment need to be regularly inspected and updated to ensure they match teaching needs.

In terms of database construction, a hierarchical classification model is adopted and necessary encryption processing is carried out to avoid information loss and theft. The communication system adopts a wired and wireless parallel mode. The classroom, multimedia classroom, laboratory, and training area use wired mode to improve communication efficiency, while other areas allow wireless access. For example, students in apartments and outside the campus can participate in learning and download materials through portable devices, and independently organize the use of immersive virtual reality mode to absorb knowledge..

4.2 Collection and processing of organizational resources

One of the characteristics of immersive virtual reality teaching mode is the application of various information resources to organize teaching, replace or semi replace traditional resources, simplify the learning process, and reduce teaching difficulty. This requires good collection and processing of resources.

In terms of resource collection, it is proposed to adopt focused web crawler technology, take the Internet public resource pool or other semi open and open resource centers as the object, configure a suitable number of focused web crawlers, collect the target data, and after screening, the school will focus on processing to form information resources that can be applied to the immersive virtual reality teaching mode. If the teaching content is "mechanical design", several keywords can be determined to provide working logic for web crawlers, including "mechanical design", "electrical automation", "CNC machine tools", etc. After selecting the keywords, they are entered into the computer to form a default program, and then managed by the main machine to form several web crawler working groups focusing on "target keywords". They collect resources from different databases, collect information that matches the characteristics of the keywords, and then the school organizes screening to remove resources with low relevance, retain valuable resources, and use information technology to form three-dimensional and digital materials for mechanical design teaching.

4.3 Standardize the teaching process

The application time of immersive virtual reality teaching mode is relatively short, and most vocational colleges lack corresponding work experience, which may affect the effectiveness of application. In future work, it is advocated to analyze and standardize the teaching process, so that it can properly serve teaching work. A teaching mode with four stages can be set, namely: VR preview → VR explanation → VR practical guidance → VR evaluation feedback.

VR preview. The school completes the collection and processing of resources to form a resource library, which is open to teachers and students on campus, and informs them of immersive virtual

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reality teaching and learning methods. Teachers and students are guided to independently download resources, and with the help of pre class and holiday time, they can initially perceive the learning content and improve the preview effect. During the preview process, teachers also organize necessary interventions by collecting raw materials and various theoretical information related to the teaching content through information technology, forming data packets, and sending them to students to enhance their learning relevance and clarity of knowledge presentation.

VR explanation. Entering the classroom teaching stage, teachers can use VR technology to organize knowledge transmission and teaching. After students have gained a preliminary understanding of the learning content during the pre class time, and with the guidance of the teacher, they further delve into relevant knowledge through VR technology. The teacher then analyzes and presents key and difficult knowledge in a targeted manner based on the students' learning situation, achieving a three-dimensional explanation. During the explanation process, teachers can use VR technology combined with materials to provide detailed explanations of knowledge, especially complex knowledge related to micro and design, in order to further improve students' perception quality and real-time thinking effect of relevant information.

VR practical guidance. After the theoretical knowledge is taught, teachers can set up several virtual and semi virtual practical projects based on the learning content, such as adjusting mechanical design through parameters, simulating nursing, garden design, etc., to guide students to practice and operate knowledge in the virtual space. During the practical process, teachers can control the teaching process through parameter settings and real-time management, ensuring that students can deeply perceive knowledge and think about relevant issues, avoiding situations where the teaching process is too fast or not detailed enough.

VR evaluation feedback. Organize VR assessment feedback every certain period, set assessment items through virtual scenes, guide students to participate in the assessment in groups or as individuals, such as whether they can proficiently complete the design, use English to complete conversations, etc., use virtual technology to improve testing efficiency, visually assess students' learning outcomes, and carry out subsequent teaching management based on the problems exposed by students.

Vocational colleges can also fine tune their teaching processes based on the characteristics of different majors, or encourage teachers to analyze and adjust to match student needs and teaching features.

5. Prospects for the Application of Immersive Virtual Reality Mode in Vocational College Teaching

5.1 Improve teaching content

In the future teaching work of vocational colleges, the application prospects of immersive virtual reality technology are broad, and further optimization needs to be sought based on the current actual situation. Considering the short application time and lack of experience of this mode, efforts can be made to improve the teaching content in the future. The vocational college alliance mechanism can be adopted in various regions, with organizational support provided by education management departments. Local vocational colleges can be directly targeted, and exchange mechanisms can be established to encourage them to share their experience in immersive virtual reality teaching models and unresolved issues. For example, 3D resources, information data, courseware, etc. used in organizing teaching for tourism, marketing, and design majors can be shared on the exchange platform, reducing the difficulties of each vocational college collecting and managing teaching resources separately, and comprehensively promoting the development of local vocational education.

5.2 Strengthening Technical Management

From a characteristic perspective, immersive virtual reality teaching mode belongs to a form of information-based teaching, which requires a large amount of information technology to support teaching work. In the future, attention should be paid to technology management, the matching of technology and teaching work, including various unpredictable dynamic changes. Due to the scalability of teaching networks and databases, the scale of some vocational colleges continues to expand. Currently, teaching networks and databases can meet the needs of multiple teachers and students to participate in teaching synchronously, but there may be resource constraints in the future. Schools can

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add fieldbus modules to their regular work networks, utilizing bus technology to enhance the expansion capabilities of their educational network. Even if the number of students increases in the future, this technology can improve the openness and synchronous service capabilities of the educational network, matching the needs of a large number of teachers and students to participate in immersive virtual reality teaching activities at the same time.

5.3 Improving Team Adaptation

The proposal and application time of immersive virtual reality teaching mode is relatively short, and a considerable number of vocational colleges do not understand its characteristics and advantages, nor have they done a good job in management. The academic team's ability is weak, and in the future, efforts should be made to improve team adaptability. Vocational colleges need to strengthen the skill management of their internal teacher teams, enhance training, and ensure that relevant teachers understand the application methods of immersive virtual reality teaching models. On this basis, schools should also attach importance to job design and social recruitment, requiring personnel involved in classroom teaching and academic management to fully understand the information teaching mechanism, be proficient in applying immersive virtual reality teaching methods, and serve student learning.

6. Conclusion

In summary, the application of immersive virtual reality teaching mode in vocational colleges has certain positive value and should be given more attention in practical work. From the current situation, the teaching work in some vocational colleges is still in good condition, but there are still various problems, including high costs and losses, and difficulties in implementation. By applying immersive virtual reality teaching mode, the above problems can be controlled to a certain extent. In specific work, it is advocated to do a good job in building the work system and resource processing, standardize the teaching workflow, and track and optimize its application situation. From a development perspective, vocational colleges and education departments should also pay attention to the shortcomings of immersive virtual reality teaching models in the future, seek more breakthroughs from the perspectives of content and technology, fully leverage their advantages, and serve students' growth.

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