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Research on the Learning Environment Design of Information Technology Courses Based on Virtual Reality Technology

Jia Hanjie, He Jingru, Zhao Yuqian

School of Education Science, Yan'an University, Yan'an, 716000, Shaanxi, China

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Abstract: Under the wave of educational digital transformation, virtual reality (VR) technology has brought new opportunities for the teaching reform of information technology courses. This paper first analyzes the connotation, characteristics and teaching functions of VR technology, pointing out its features such as immersion, interactivity and imagination, which can effectively improve students' learning participation and knowledge mastery in classroom teaching, experimental teaching and skill training. To accurately grasp the application of VR, this study designs questionnaires, collects and analyzes data, and reveals problems existing in the application of VR in information technology teaching, including insufficient technology popularization, poor adaptability of teaching resources, and limited operational proficiency of teachers and students. On this basis, this paper designs the learning environment from three dimensions: physical environment, learners' emotional environment and supporting technical environment, and clarifies the basic process and requirements of constructing a VR-adapted learning environment for information technology courses.

1. Introduction

With the further advancement of educational informatization, technologies such as big data, artificial intelligence and large models have been deeply integrated with virtual reality technology. Virtual reality technology can provide a highly simulated learning environment for teaching. Boasting the advantages of immersion, interactivity and multi-sensory perception, VR can stimulate students' learning interest, create learning and life scenarios, organize learning content, and provide corresponding feedback according to students' operations, enabling students to be immersed in virtual environments and fully mobilize their autonomous learning ability to comprehensively construct logical thinking [1]. Compared with traditional teaching environments, VR technology, based on real situations, actively constructs teaching environments and simulates various instruments and equipment used in primary and secondary school information technology courses, supporting independent exploratory learning in virtual spaces. However, some schools still have relatively limited information technology teaching equipment, and the consumable nature of experimental equipment restricts the in-depth development of some teaching activities. Therefore, it is necessary to systematically study the design of VR-based learning environments for information technology courses, so as to provide theoretical guidance and practical paths for information technology teaching

with VR technology.

2. Connotation and Teaching Functions of Virtual Reality

2.1 Connotation of Virtual Reality Technology

Virtual reality technology emerged in the last century. It is a three-dimensional virtual world generated by computers, allowing users to feel immersed and observe things in the created scenarios [2]. With the continuous development of VR, the design of VR-based teaching resources can bring fun to information technology classrooms and present abstract concepts vividly and stereoscopically to students [3]. Compared with traditional digital simulation systems, VR has the basic characteristics of immersion, interactivity and imagination [4].

First, immersion enables users to have an immersive experience similar to real-life sensations—visual, auditory, tactile and olfactory—when using VR.

Second, interactivity allows users to communicate and interact with virtual characters in daily ways in virtual scenarios for a more authentic experience.

Third, imagination enables users to acquire new knowledge and experience in preset virtual environments, summarize them into unique cognition, and effectively improve their thinking and practical abilities.

2.2 Teaching Applications of Virtual Reality Technology

The gradual promotion of VR in education has effectively improved teaching efficiency and significantly enhanced students' learning interest. By building virtual scenarios, many teaching skill trainings difficult to implement in reality can be carried out [5].

2.2.1 Immersive Experience in Classroom Teaching

VR has been applied in classroom teaching. Its most basic use is to visualize basic concepts in textbooks or create imaginative immersive scenarios. This application greatly compensates for the limitations of traditional classrooms, such as flat texts or pictures, monotonous teaching methods and insufficient teacher-student interaction. With its powerful functions, VR enriches classroom teaching, facilitates understanding of teaching content and cultivates learners' imagination [6]. For example, Dr. Zhang Lichun's research shows that applying VR in art classes can not only display images of artworks but also realistically restore the historical scenes of artworks, creating a vivid classroom atmosphere [7]. When learners experience virtual scenarios, their interest is fully stimulated, promoting the improvement and development of their cognitive abilities.

2.2.2 Low-Cost Simulation in Experimental Teaching

Some experiments require safe environments and complex or expensive equipment, which are sometimes unavailable in real teaching. VR provides an effective solution to these problems. Computer-based VR can build highly simulated virtual experimental environments, significantly reducing experimental risks while providing learners with near-real experimental experiences [8]. VR can simulate experimental scenarios, allowing students to operate and learn in virtual spaces before transitioning to real experiments, thus greatly saving experimental resources. In professional fields, VR can also be used to virtually create and test 3D architectural models before physical construction, effectively reducing costs [9]. In short, VR turns high-risk or high-cost experiments—such as chemical reactions, human anatomy and celestial motion—into safe simulated operations, enabling students to explore repeatedly and safely in virtual spaces.

2.2.3 Integration of Theory and Practice in Skill Training

In skill training, VR can simulate realistic real-life scenarios. With VR devices, users can position themselves in virtual environments and perform a series of simulated operations. Similar to laboratory experiments, such skill training can be practiced repeatedly with high accuracy and safety via VR [10]. This application mode not only helps learners gain visualized practical experience in virtual environments but also effectively bridges theoretical learning and practical exploration. VR provides a safe and repeatable practice platform for skill training. For instance, students can practice complex or dangerous operations repeatedly in risk-free environments. This training method not only improves learners' confidence and skill proficiency but also helps them respond correctly naturally in real situations, ensuring safety.

3. Current Situation of Virtual Reality Technology in Information Technology Teaching

To better understand the learning environment of the VR information technology course based on real-world scenarios, a questionnaire has been designed. The survey mainly focuses on questions such as whether VR technology has been used and the quality of the experience. Based on the existing problems, corresponding measures for improvement are proposed.

3.1 Questionnaire Design

This survey questionnaire was designed based on the actual learning environment of the VR information technology course. The questionnaire was distributed and collected electronically. The questionnaire was designed for different groups to answer. The questionnaire contained various types of content, aiming to lay a foundation for the analysis of the current application of virtual reality technology in information technology courses.

This questionnaire was designed with 10 questions, covering aspects such as the application of virtual reality in teaching, its usage in information technology classes, attitudes towards VR technology, and the prospects of VR technology.

3.2 Questionnaire Distribution and Data Collection

The questionnaire was mainly distributed to middle school students via WeChat and other social platforms. A total of 119 responses were collected, all valid. The data were counted through the questionnaire platform, showing direct results. The sample included representatives from different regions, being random, objective, authentic and representative.

3.3 Survey Data Processing

Based on 119 valid samples, the data on VR application in middle school information technology courses are as follows:

VR cognition and classroom use: More than 50% of students have never heard of VR, and only 23.53% know and have used it; 55.46% have never used VR in school information technology classes.

Students' attitudes toward VR: 86.55% like VR, 63.03% are very willing to accept it, 23.53% hold a neutral attitude, and 13.45% reject it.

Recognition of VR teaching: 84.87% of students believe VR benefits information technology teaching, with a small number thinking the opposite.

Feedback on current teaching methods: 24.3% are used to existing methods, 39.5% adapt to them, 18.49% think teaching is boring, and some express dissatisfaction.

Problems in VR teaching: More than 70% of students report immature technology, shortage of teaching software and equipment, high costs and teachers' lack of VR knowledge, along with other scattered reasons.

Perceived advantages of VR teaching: Most students think VR makes learning more intuitive and helps master knowledge comprehensively; 66.39% think it facilitates teaching, and 46.22% think it cultivates learning interest.

3.4 Analysis of Survey Results

The survey results indicate that the application of VR technology still requires further development and improvement. Overall, it is manifested in the following issues:

The popularity of VR technology in information technology classes is extremely low, and its application is severely insufficient. More than half of the students have never heard of VR, and the classroom usage rate is low, indicating that schools have not yet incorporated VR into regular teaching, resulting in a disconnection between technology and the classroom.

The current teaching methods lack appeal. Nearly 20% of the students consider the teaching to be boring and have dissatisfaction. The traditional mode is difficult to meet learning needs, and the teaching experience and effect need to be improved.

The implementation conditions of VR teaching are lacking, and the practical obstacles are prominent. More than 70% of the students report that the technology is not mature, there is a shortage of equipment and software, the cost is high, and the professional ability of teachers is insufficient. Both the software and hardware and the teachers' qualifications do not support the application of teaching.

The gap between cognition and application. Students have high acceptance and recognition, but they have very little contact and use. The high expectations and low popularity form a clear contradiction, and high-quality technology has not been transformed into teaching resources.

4. Construction of VR-Based Learning Environment for Information Technology Courses

The survey reveals that VR is mainly applied to curriculum teaching environment design in information technology courses. The construction of a VR learning environment includes physical, mental, interpersonal and technical environments [11]. Combined with the characteristics of teaching and learning environments for information technology courses, the VR-based environment design covers classroom physical environment, learners' emotional environment and supporting technical environment.

4.1 Classroom Physical Environment Design

The physical classroom environment serves as the material foundation for teaching and learning activities, which mainly consists of the natural teaching environment, teaching facilities and classroom layout environment. The natural teaching environment refers to the peripheral environmental conditions of the school and classroom. It involves whether the classroom is situated in a quiet surrounding, and whether there are excessive factories or private commercial stores around the campus. Noise pollution and harmful gas emissions from such establishments will adversely affect the physical health and teaching activities of teachers and students. Teaching facilities refer to essential teaching hardware and equipment such as multimedia devices, VR equipment and network infrastructure. It is required that such facilities be fully equipped, age-appropriate for learners, compatible with teaching materials, and simple and user-friendly in operation. The classroom layout environment demands that classroom decoration and arrangement be designed in accordance with

disciplinary characteristics. Given that the course offered is Information Technology, the classroom interior is designed with a strong technological ambiance, supplemented by posters of science and technology to stimulate students' learning interest visually. In the teaching process involving VR equipment application, the classroom network layout shall meet the operational requirements of VR devices. Seating arrangements shall be adjusted flexibly according to diverse group activity modes; diversified seating layouts facilitate the smooth implementation of classroom teaching. The design of the physical environment for Information Technology classrooms covers multiple dimensions. Researchers shall optimize the design in compliance with pedagogical principles, support the construction of VR learning environments, and ultimately improve classroom teaching efficiency.

4.2 Learners' Emotional Environment Design

The information technology class based on virtual reality technology takes students as the main body and teachers as the leading role. In the virtual environment, students are the main objects of research, so in designing related activities, the learner-centered approach should be adopted, with the students' needs as the fundamental starting point. Teachers are not only the organizers of teaching activities but also the guides and evaluators of teaching. They play an important role in the entire information technology mental environment [12]. In this emotional environment, dedicated technical workers develop software and provide technical guidance for students and teachers, enabling both sides to better understand VR technology and equipment. This helps students psychologically accept the application of VR in information technology classes and stimulates their curiosity for VR learning. Teachers must be rigorous in lesson preparation and teaching to provide timely guidance for students. In VR-based information technology classes, teachers, students, and demand transformation tools are all important and should cooperate with each other.

4.3 Supporting Technical Environment Design

In the construction of information technology classroom environment, the technical environment is one of the indispensable key parts. This technical environment includes not only the provision of VR platforms and devices, but also daily maintenance and updates by technicians. VR technicians should keep up with technological updates and have basic understanding of teaching. In designing VR-based information technology classes, technicians can communicate with teachers in advance to clarify teaching requirements, and develop corresponding virtual products or update equipment programs according to teaching plans and textbooks. Teachers should express needs clearly to reduce information deviation. Core technologies for information technology classes include 3D modeling, stereoscopic display, and human-computer interaction. For specific information technology courses, 3D modeling can be used to render learning scenarios; learners can wear head-mounted displays to immerse in virtual environments and observe experimental phenomena; hand controllers enable interaction with virtual equipment to complete operations. Therefore, suitable VR devices should be selected for information technology classes. Different courses need different virtual scenes, and technical equipment should be updated in a timely manner.

5. Conclusion

This research draws on the design of VR learning environments and constructs a learning environment design scheme for information technology courses based on virtual reality technology. Through analyzing current VR technologies and learning environments, this study completes the construction process of VR-supported information technology learning environments. With specific solutions and design schemes, it promotes the development of information technology classes and

improves students' information literacy. However, this research still has limitations. For example, the constructed virtual scenes are limited, the number of VR devices is insufficient to ensure one for each student, and some students experience dizziness when using VR equipment. It is expected that future technological development can solve these problems in a timely manner, so as to further improve the efficiency of information technology teaching and cultivate citizens with information awareness and computational thinking.

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