

The Application and Prospect of Virtual Reality Technology in Higher Education

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Abstract: With the rapid development of technology, Virtual Reality (VR) technology has emerged as an innovative force in the field of education. This article aims to explore the current application status of VR technology in higher education and its future development prospects. Through in-depth analysis of application examples of VR technology in classroom teaching, experimental simulation, skills training, and other aspects, it reveals its significant role in improving teaching quality and enhancing students' practical abilities. On this basis, it also provides an outlook on the potential application areas of VR technology in future higher education, such as remote collaborative learning and immersive historical experiences, with the hope of providing useful references and insights for educators.

Keywords: Virtual Reality technology; Higher education; Application paths

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1. Introduction

In recent years, with the continuous advancement of information technology, VR technology, as a cutting-edge technological means, is gradually infiltrating and profoundly changing the development landscape of various industries, and the field of education is no exception. Especially at the level of higher education, the application of VR technology not only provides students with a richer and more intuitive learning experience but also significantly optimizes traditional teaching modes and promotes the optimal allocation of educational resources^[1]. Based on this, this article will comprehensively analyze the application paths of VR technology in higher education and provide an outlook for its future development.

2. The application value of VR technology in higher education

2.1. Holographic simulation of classroom design, creating a realistic teaching environment

The application of VR technology in higher education enables high-precision three-dimensional modeling technology to recreate various discipline scenarios, such as cellular structures in biology, celestial movements in physics, and molecular structures in chemistry. This allows students to observe and learn in a nearly real virtual environment. Students can observe these microscopic or macroscopic phenomena up close, thereby

obtaining a more profound and intuitive learning experience. Teachers can also utilize VR technology to design interactive teaching sessions, allowing students to operate and practice in the virtual environment, further deepening their understanding of knowledge. This design of holographic simulation classrooms can not only effectively enhance students' learning interest and participation but also help cultivate their practical abilities and innovative thinking. In addition, VR technology can simulate complex experimental scenarios, enabling students to practice repeatedly in a safe environment, reducing errors and risks in actual operations ^[2]. For example, in medical education, VR technology can simulate surgical procedures, allowing students to perform surgeries in a virtual environment, thereby improving their surgical skills and abilities to respond to emergencies. Similarly, in engineering education, VR technology can simulate mechanical operations, circuit construction, and other experiments, helping students better understand and master professional knowledge.

2.2. Deep excavation of classroom interest, realizing high-quality resource sharing

The application of VR technology in higher education is also reflected in the deep excavation of classroom interest. Teachers can use VR technology to transform boring theoretical knowledge into interesting virtual scenarios, allowing students to learn through exploration, thereby stimulating their learning interest and curiosity ^[3]. For example, in history class, teachers can use VR technology to recreate historical events, allowing students to personally experience history in a virtual environment and feel the changes of the times and the transmission of culture. This teaching method can not only enhance students' sense of history but also cultivate their critical thinking and cross-cultural communication abilities. VR technology can also help people share high-quality educational resources. Universities can build a VR education platform to digitize excellent teaching resources and courses and upload them to the platform for students to learn independently ^[4]. Students can enter the platform through VR devices anytime, anywhere, and choose the courses they are interested in or need for learning. This teaching method breaks the limitations of time and space, making educational resources more fully utilized and shared. The VR education platform can also provide students with personalized learning paths and evaluation systems to help them better master knowledge and skills.

2.3. Aligning with the trends of higher education reform and meeting the development needs of students

VR technology not only innovates educational means but also highly aligns with the current trends of higher education reform and development. With the increasing demand for high-quality, composite talents in society, higher education is gradually shifting from traditional knowledge imparting to ability cultivation and quality enhancement. VR technology, with its unique immersive experience, high interactivity, and personalized learning paths, provides students with a more open and autonomous learning environment, contributing to the cultivation of their innovative thinking ^[5], problem-solving abilities, and team collaboration abilities. At the same time, VR technology can also promote interdisciplinary learning and research, breaking down disciplinary barriers and promoting the comprehensive and interdisciplinary development of higher education. Therefore, it can be said that VR technology is an indispensable support for the reform and development of higher education ^[6].

3. Application paths of virtual simulation technology in higher education

3.1. Application in classroom teaching

In the practice of higher education teaching, teachers can utilize virtual reality technology to create diverse

virtual classroom environments and simulate real disciplinary scenarios, such as geomorphological features in geography and ecological systems in ecology. Students can freely explore and learn in these virtual environments, interact with virtual objects, and thereby gain a deeper understanding of disciplinary knowledge and principles. Virtual reality technology also provides diverse learning resources and tools, such as virtual experimental equipment and virtual libraries, which can aid students in more efficiently conducting learning and research ^[7]. In physics courses, teachers can create virtual laboratories using virtual reality technology, allowing students to conduct physical experiments, observe experimental phenomena, record experimental data, and analyze and summarize their findings. This not only enhances students' experimental skills and practical abilities but also effectively cultivates their innovative thinking and problem-solving abilities. Virtual reality technology can provide personalized learning paths and feedback mechanisms, tailoring suitable learning content and difficulty based on students' learning progress and interests to help them better master knowledge and skills.

Taking accounting teaching as an example, virtual reality technology can simulate real financial environments and business processes, allowing students to play different roles such as accountants, cashiers, and auditors in a virtual environment to conduct financial operations and business processes. By simulating real financial cases and scenarios, students can gain a deeper understanding of accounting principles and business processes, master the use of financial software and tools, and improve their financial analysis and decision-making abilities ^[8]. Virtual reality technology can provide immediate feedback and evaluation, helping students promptly identify and correct errors, thereby enhancing learning effectiveness and quality. This teaching method not only enhances students' practical abilities and professional qualities but also improves their employment competitiveness and adaptability.

3.2. Application in experimental simulation

Virtual reality technology plays a pivotal role in experimental simulation. Through high-precision three-dimensional modeling and realistic physical simulations, virtual reality technology can recreate various complex experimental scenarios, such as chemical reaction processes, physical experiment phenomena, and biological anatomical structures. Students can conduct experimental operations in a virtual environment, observe experimental phenomena, record experimental data, and conduct in-depth analysis and summarization ^[9]. This virtual experimental simulation not only provides students with abundant practical opportunities but also greatly reduces experimental risks and costs. In chemistry experiments, VR technology can simulate dangerous chemical reaction processes, allowing students to observe and learn in a safe environment, avoiding risks and injuries in actual operations. In biology experiments, VR technology can simulate complex anatomical structures, aiding students in better understanding and mastering biological knowledge. Virtual reality technology can provide personalized experimental simulation paths and feedback mechanisms, tailoring suitable experimental content and difficulty based on students' learning progress and interests to help them better master experimental skills and practical abilities ^[10].

For example, in the teaching of the organic chemistry experiment "preparation of benzoic acid," teachers can utilize virtual reality technology to simulate the experimental environment and operational steps for preparing benzoic acid. Students can wear lab coats and protective glasses in a virtual environment, enter the virtual laboratory, select the required experimental equipment and reagents, such as benzoyl chloride, sodium hydroxide solution, and ethanol, and proceed with the reaction operations according to the experimental steps ^[11]. During the reaction, students can observe phenomena such as changes in solution color and temperature, and record experimental data. After the experiment, students can also analyze and summarize the experimental results, such

as calculating yield and analyzing reaction mechanisms. This virtual experimental simulation not only allows students to gain a more intuitive understanding of the experimental process and principles but also cultivates their experimental skills and operational abilities in a safe environment.

3.3. Application in skills training

The application of virtual reality technology in skills training similarly demonstrates tremendous potential and value. Virtual reality technology can construct highly realistic virtual scenarios and tasks, providing students with a training platform close to real working environments, enabling them to practice repeatedly in a virtual environment and thereby improve their professional skills and abilities to respond to practical problems. Taking medical skills training as an example, virtual reality technology can simulate various complex surgical scenarios and case situations, allowing students to perform surgical operations and diagnostic treatments in a virtual environment. Students can familiarize themselves with surgical steps and instrument usage, master surgical techniques and precautions through simulating real surgical processes^[12]. Virtual reality technology can provide immediate feedback and evaluation, helping students promptly identify and correct operational errors, enhancing surgical skills and safety. This virtual training method not only reduces training costs and risks but also improves training efficiency and quality, providing a more efficient and safe training means for medical education. Similarly, virtual reality technology can play an important role in engineering skills training. By simulating real experimental scenarios such as mechanical operation and circuit construction, virtual reality technology can aid students in better understanding and mastering professional knowledge, improving their practical abilities and innovative thinking. Students can practice repeatedly in a virtual environment, familiarize themselves with the usage methods and precautions of various equipment and tools, thereby improving their operational skills and safety. This virtual training method not only enhances students' practical abilities and professional qualities but also improves their employment competitiveness and adaptability.

4. Outlook on the application of virtual reality technology in higher education

4.1. Supporting remote collaborative learning

With the acceleration of globalization and the rapid development of information technology, remote collaborative learning has become a major trend in higher education. The introduction of VR technology provides strong support for remote collaborative learning. Students from different regions can use VR technology to enter a virtual classroom together for real-time interaction and communication, as if they are in the same classroom, thereby breaking geographical boundaries and enabling students to participate in learning anytime, anywhere, which promotes cross-cultural exchanges and the cultivation of team collaboration abilities^[13].

In the virtual classroom, students can use VR devices to engage in various learning activities, such as group discussions, project collaborations, and remote experiments. They can interact in real-time with other students through gesture recognition, voice communication, and other functions in the virtual environment, sharing learning experiences and insights. Teachers can use VR technology for remote teaching and tutoring, paying real-time attention to students' learning progress and status, and providing them with personalized guidance and support. In addition, VR technology can provide abundant learning resources and tools for remote collaborative learning^[14]. For example, virtual laboratories and virtual libraries can help students learn and research more efficiently. Students can perform experiments in the virtual environment, observe experimental phenomena, record experimental data, and analyze and summarize them. This virtual experimentation method not only

provides students with abundant practical opportunities but also greatly reduces experimental costs and risks.

4.2. Providing immersive historical experiences

With the development of virtual technology, students will no longer be limited to traditional teaching methods of history but will instead “experience” historical events through VR technology. For example, students can “travel” to ancient Rome to witness the glory of the Roman Empire firsthand, or “visit” the battlefields of World War II to feel the cruelty of war and the greatness of heroes. This immersive historical experience can not only stimulate students’ interest in learning but also enable them to more deeply understand the background and impact of historical events, cultivating their historical thinking and cultural literacy. VR technology can also provide rich digital resources for history teaching, such as historical scene reconstructions and interviews with historical figures. These resources can help students gain a more comprehensive understanding of history and broaden their historical horizons ^[15].

VR technology can also construct virtual museums and historical sites, allowing students to freely explore and learn in the virtual environment, feeling the heaviness of history and the charm of culture. For instance, students can use VR devices to enter the virtual Forbidden City, observe ancient artifacts and artworks up close, and learn about their craftsmanship and historical background. Alternatively, they can “visit” the virtual Great Wall and experience the grandeur and hardship of this magnificent project. This virtual visiting method not only provides students with a more intuitive and vivid learning experience but also protects historical sites and artifacts to a certain extent, achieving sustainable history education.

5. Conclusion

Virtual Reality (VR) technology, characterized by its distinctive technological capabilities and extensive potential applications, is facilitating transformative changes within higher education. As technological advancements progress and application scenarios diversify, VR is poised to assume an increasingly pivotal role in fostering innovation and development in this domain. Empirical evidence suggests that the integration of VR technology will contribute significantly to the enhancement and future progression of higher education systems.

Disclosure statement

The authors declare no conflict of interest.

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