Research on the application of VR/AR technology in civil engineering construction technology teaching

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Abstract: Technologies such as AR and VR are mainly used in architectural design, construction and architectural technology research. At the same time, they integrate the current advanced information technologies, such as big data, digital technology, network information application technology and cloud computing, and have been successfully applied in needed fields and work scopes. The combination of AR with big data and Internet of Things provides refined data support for bidding, material transportation and cost control on the Internet. However, how to stimulate students' interest in learning, how to mobilize students' desire to explore learning, how to cultivate students' innovative spirit and stimulate students' potential are all important problems that teachers face in the real teaching process. This technology utilizes computer-generated virtual environments to simulate construction scenes realistically, providing new tools and methods for engineering management. Therefore, it is necessary to leverage emerging information technologies to develop a new teaching model that breaks through the limitations of traditional teaching, reduces learning costs, and enhances learners' subjective initiative and interest. This article mainly explores and analyzes VR/AR technology in teaching based on civil engineering construction technology.

1. Introduction

Technologies such as AR and VR are mainly used in fields such as architectural professional design, building construction, and architectural technology research. The two simultaneously integrate current advanced information technologies such as big data, digital technology, network information application technology, and cloud computing, and successfully apply them in required fields and work scopes [1]. The traditional teaching method of civil engineering construction courses is mainly theoretical lectures. With the development of multimedia information technology, the use of PPT has enriched subject teaching and made some construction processes and links more vivid [2]. Currently, civil engineering students have heavy curriculum tasks and short apprenticeships and internships organized by schools, which results in many students having rich theoretical knowledge [3]. The combination of AR, big data and the Internet of Things provides refined data support for bidding, material transportation and cost control on the Internet. The digitalization of AR technology provides model resources for mobile virtual office in operation management, and promotes the electronization and informatization in engineering management [4]. However, how to stimulate students' interest in learning, how to mobilize students' desire to explore learning, how to cultivate students' innovative spirit and stimulate students' potential are all important problems faced by teachers in the real teaching process [5].

The application of VR is causing great changes in the field of education, and universities are actively promoting the application of VR in teaching. Civil engineering is the foundation of the development of social infrastructure and industrial buildings, and it is an inevitable requirement to promote its high-quality development [6]. This technology can simulate the construction scene realistically by using the virtual environment generated by computer, and provide brand-new tools and methods for project management. Combining these two new technologies and applying them to practical architecture majors means that undergraduate students should not only master computer programming and engineering management information technology on the basis of learning

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architectural theory knowledge, but also conduct in-depth analysis and research on AR technology and VR technology, which further increases the learning pressure and burden of architecture students [7]. In this teaching mode, students can't understand what they have learned emotionally. Although they are rich in theoretical knowledge, they are seriously lacking in practical experience [8].Therefore, it is necessary to leverage emerging information technologies to develop a new teaching model that breaks through the limitations of traditional teaching, reduces learning costs, and enhances learners' subjective initiative and interest. On the other hand, student internships do not bring economic benefits to construction companies, so the course internship process often becomes a formality, mainly consisting of sightseeing tours without effectively combining theoretical knowledge with practice [9]. This article mainly explores and analyzes VR/AR technology in teaching based on civil engineering construction technology.

2. Development Status of Civil Engineering and Intelligent Construction

2.1. Current Development Status of Civil Engineering

Civil engineering is a general term for many construction technologies. It includes the materials, equipment and techniques used in topographic survey, construction design, project construction, building maintenance, facility repair and other techniques [10].Virtual simulation technology can not only improve the planning and design accuracy before construction, but also monitor and adjust the construction scheme in real time during the construction process, effectively ensuring the smooth progress of the project as planned. This is an investigation on the improvement of classroom teaching, as shown in Figure 1.

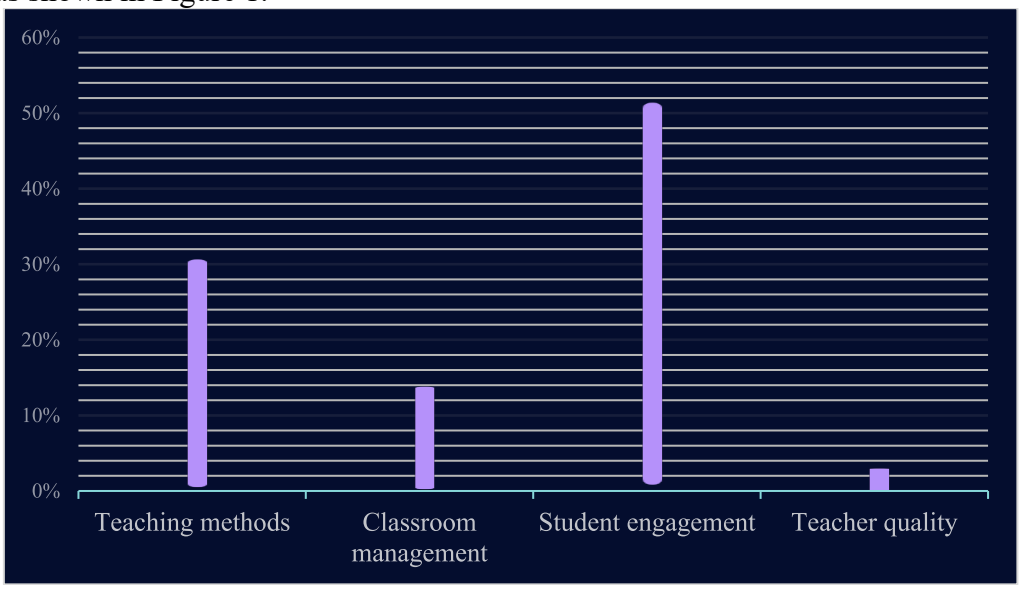

Figure 1 Aspects that should be improved in classroom teaching

At the same time, VR technology can also infer actual problems that may occur and arise during the construction phase of civil engineering based on dynamic simulation information, and find effective methods to correct the problems in a timely manner. The improvement of students' classroom participation not only requires teachers to guide students positively in teaching, making students clear about learning objectives, but also to stimulate students' interest in learning. The main purpose of the course is to enable students to master the basic theoretical knowledge of civil engineering construction technology and to learn through the course. Teachers should cultivate students to independently analyze and solve problems related to construction technology and construction organization and management in civil engineering construction, while also training students' ability to propose innovative technologies. It also enables students to become familiar with common construction techniques and processes in the civil engineering direction, so as to cultivate application-oriented talents who can adapt to the needs of the country and the market. Finally, VR technology can display the progress of the construction project and each construction process in real

time and dynamically. Once problems arise during the construction process, the construction progress can be adjusted in a timely manner.

2.2. Development status of VR/AR technology

AR construction is a new technology that meets the strategic needs of the country and the upgrading and transformation of the construction industry. It can master computer related development languages and use modern methods for AR surveying, AR design, AR construction, AR operation and maintenance management, etc. In civil engineering construction, the basic principles of virtual simulation technology mainly include virtual reality, augmented reality, etc. Due to the digitization, informatization, quantification, and standardization of all application processes of AR technology in the design and construction of building projects, all relevant construction parameters have also been solidified. It can provide the most powerful reference data on issues such as scientific control of project costs, project construction quality, and construction schedule realization. When there are many similar components in different functional areas, students will confuse them, and rework caused by component assembly often occurs in actual construction and production. In recent years, research on safety culture in the construction industry has shown an overall upward trend. As shown in Figure 2.

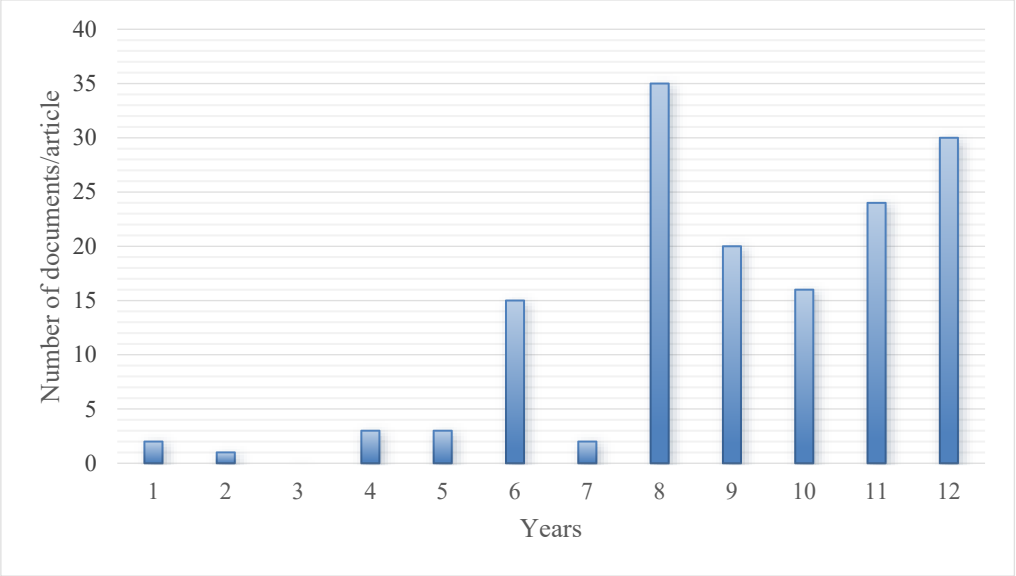

Figure 2 Overall form of construction safety culture

The explanation of a large number of theoretical knowledge makes the teaching content lack of interest, which can not arouse students' interest in learning and desire to explore, which directly leads to poor classroom effect. The curriculum emotional attitude and values based on the development of Hui ethnic group lion dance mainly enable students to experience, appreciate and create the local and national intangible cultural heritage, deepen their feelings of loving local culture, and improve their artistic taste and aesthetic taste. Therefore, introducing AR and VR technologies into the teaching of civil engineering construction courses can solve the shortcomings brought by traditional separated teaching.

3. Application practice of AR technology and VR technology in civil engineering construction teaching

3.1. Establishment of classroom teaching model

Taking a virtual construction project case as the teaching object, a whole set of teaching model of construction engineering AR is needed. The traditional experience-based civil engineering construction course can't be updated in time, but the civil engineering construction course based on VR and AR technology can be updated quickly, which can improve students' learning enthusiasm. Some experiments can't get experimental results in a short time due to the limitation of class time or

course hours, and students' willingness to participate is not strong. By doing so, we aim to cultivate students' love for their hometown, their own and other ethnic groups, and their motherland. To promote the application of AR and VR technology in civil engineering teaching, the AR Center of the college has independently developed an AR and VR simulation teaching platform system for civil engineering majors through the secondary development of mainstream AR and VR software. As shown in Figure 3.

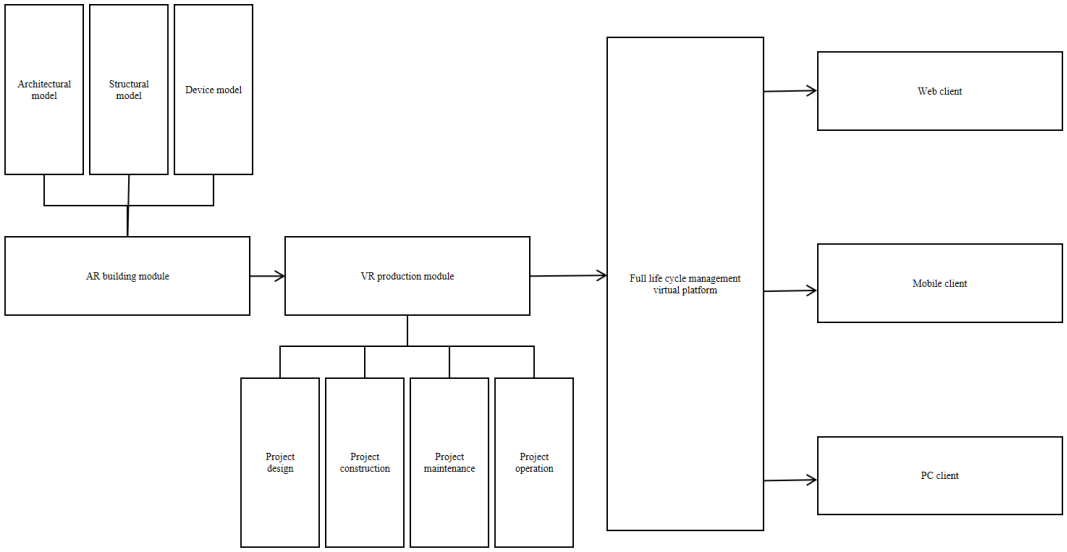

Figure 3 AR and VR simulation teaching system

Educators should enhance students' sense of national mission and social responsibility so that they can gradually form a positive attitude toward life, correct values, and a scientific worldview. Especially in the stage of VR scene design, the roles of team members are clear and the division of labor is cooperative, which completes the scene of VR construction site well. Using VR to build a virtual laboratory can completely break the space limitation, and students can enter the virtual laboratory at any time to conduct various construction process tests. Omni-directional monitoring is to use various sensors and monitoring equipment to collect information and data such as construction materials, construction progress and hazard factors involved in the project. Researchers should reuse advanced data analysis equipment for analysis. In the construction planning stage, virtual simulation technology is widely used for 3D modeling and construction simulation, allowing engineers to preview and optimize construction plans in a virtual environment, reducing changes and rework in actual construction. The establishment of these classroom teaching model resources can be achieved through the creation of student works in AR and CAD classes.

3.2. Cognitive learning of virtual scenes at construction sites

According to the characteristics of the actual construction process, the virtual construction site can be divided into different categories, such as layout scene, foundation construction scene, decoration project scene and main project scene, and each scene should be explained and taught with theoretical knowledge. This process of changing from passive to active can enhance the interest of learning and change the tedious process of construction safety teaching, and there is no restriction of region, time and space, and there are no problems such as practice, venue, consumption of materials, machinery, safety and transportation costs. Combining it with VR technology, students can be immersed in the scene, experience virtual real scenes, stimulate students' thinking ability, and make the classroom "live". At the same time, VR can also exercise students' practical ability. According to the specific characteristics of construction, it can be divided into construction site layout scene, foundation construction scene, main project simulation scene and decoration engineering scene. In terms of quality management, IoT technology is similar. AR, based on its real-time monitoring of devices, controls quality through various data analysis and parameter comparison, and automatically and intelligently improves and operates on problems,

replacing human work to a certain extent. When designing complex modeling, it is also necessary for the instructor to work together with the VR designer. In addition to possessing subject and course knowledge, the instructor must also collaborate. It is also necessary to express theory through practice, fully considering the operability, interactivity, innovation, and so on of the curriculum.

4. Conclusions

With the advancement of human science and technology, we will face many major projects in the future, and intelligent construction technology will be fully applied in civil engineering. Within the limited teaching time, the teaching method that combines AR and VR technology provides an immersive, vivid and practical way to make the classroom more immersive, vivid and practical. Let students, as direct participants in the classroom, acquire knowledge in a more proactive way, making the entire classroom "alive" and the atmosphere more harmonious. Introducing AR and VR technology into the teaching of civil engineering construction courses can significantly improve students' enthusiasm and initiative in learning courses, and at the same time, it can promote the improvement of students' innovative thinking and practical abilities. The application of AR and VR technology in the theoretical and practical aspects of construction course teaching is a new breakthrough in civil engineering construction teaching. The development and construction of an intelligent society are accelerating. It is not difficult to find from the current development status and application advantages of intelligent construction that the application of intelligent construction technology can make technological progress and innovate more construction methods in civil engineering. The practice of VR in civil engineering construction teaching fully demonstrates the organic integration of VR and education, reflects the advantages of "Internet plus education", can effectively improve teaching efficiency and quality, and will promote the reform of interactive teaching innovation system in the future.

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