Research on the Application of Virtual Reality Technology in Architectural English Teaching

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Abstract. The purpose of this study is to deeply analyze the application scope of virtual reality technology in architectural English teaching, and to use specific examples and effectiveness evaluation to prove its potential value in enhancing students' professional English ability and practical skills. It also deeply explores the design of teaching content integrated with virtual reality, technical implementation, educational application, and student response and communication interaction. 120 third-year students majoring in architecture used Oculus Rift S helmets to study in a 16-week course. The teaching content included virtual site visits, design discussion, and simulated project management. The results of the teaching effectiveness evaluation showed that the students' mastery of professional knowledge vocabulary increased from 65% to 85%, their practical application ability was significantly improved, the task completion time was reduced by 33.3%, the English oral and written scores increased by 60%, and their curiosity and involvement, teamwork and communication skills were also significantly improved. The conclusion shows that virtual reality technology has significantly improved the teaching effect of architectural English with the help of immersive and interactive teaching methods.

Keywords: virtual reality, architectural English teaching, immersive learning, interactivity, teaching effect evaluation

1 Introduction

In the context of global integration and continuous innovation in the construction industry, architectural English application plays an irreplaceable role and its importance is becoming increasingly prominent. However, the traditional education model is subject to certain limitations in cultivating practical skills and is difficult to meet the high standards of English communication skills in the workplace. The rapid progress of virtual reality technology has brought new prospects to the education system. As a breakthrough teaching strategy, virtual reality technology uses immersive experience and interactivity to create a more lively learning atmosphere for learners, effectively making up for the shortcomings of traditional teaching [1]. This paper aims to explore the application of virtual reality technology in architectural English teaching. Through specific case analysis and effectiveness evaluation, it con-

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firms its potential for improving learners' professional language ability and practical skills. The study will carefully explore the operation process of virtual reality technology in teaching design, technical implementation, teaching operation and student evaluation, and evaluate its impact on educational effectiveness, in order to provide innovative thinking and practices for architectural English teaching, improve teaching quality, and cultivate professional talents that better meet market demand.

2. Overview of Virtual Reality Technology

Virtual Reality (VR) technology was first proposed and defined by Jaron Lanier of VPL Research in the United States in 1989. This innovation uses a computer-generated virtual space that integrates lifelike vision, hearing, and touch to allow users to interact with virtual objects through specific input and output devices, thereby creating an immersive and real feeling and experience [2]. Figure 1 shows the basic principle of virtual reality. The figure shows that the light beam is released by the VR screen, reflected and refracted on the VR lens, and finally reaches the user's eyes, creating a virtual space in which the user can immerse himself. In virtual reality technology, immersive experience is one of its most prominent features. Immersive experience is achieved based on ultra-high-definition vision, instant image transmission and precise head positioning technology. As shown in the figure, after the subject puts on the virtual reality helmet, he can feel the virtual environment as if he is in the real world, and his head movements can be reflected in the virtual space in real time, thus enhancing the immersive experience of the subject. In addition, virtual reality also has excellent interactivity [3]. Users can transmit data such as hand movements and eye movements to the computer through light sensing technology and visual tracking system, allowing users to communicate seamlessly with virtual objects. This interactivity not only enhances the user's sense of immersion, but is also widely used in education, training and simulation operations.

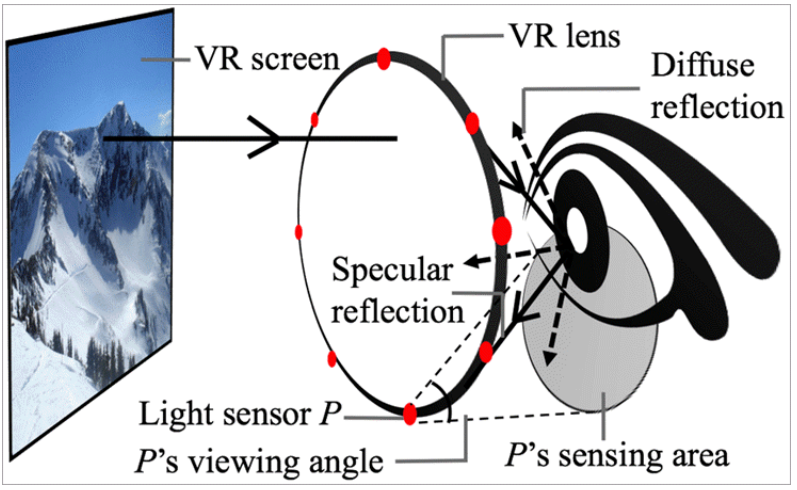

Figure 1 Basic principles of virtual reality

3. Application of virtual reality technology in architectural English teaching

3.1 Teaching content design

In the field of educational content conception, virtual reality technology is widely used to create simulated teaching scenarios to help scholars master the vocabulary and application skills of architectural English. Figure 2 shows the procedure of virtual reality teaching, covering three core steps: algorithm construction, model construction, and visual response. In the initial stage, with the help of algorithm development, teachers use professional modeling tools such as Revit and AutoCAD to create fine architectural models and scenes, including fine architectural structure design, interior layout design, and construction, and then combine them into the virtual reality system to build a three-dimensional virtual environment.

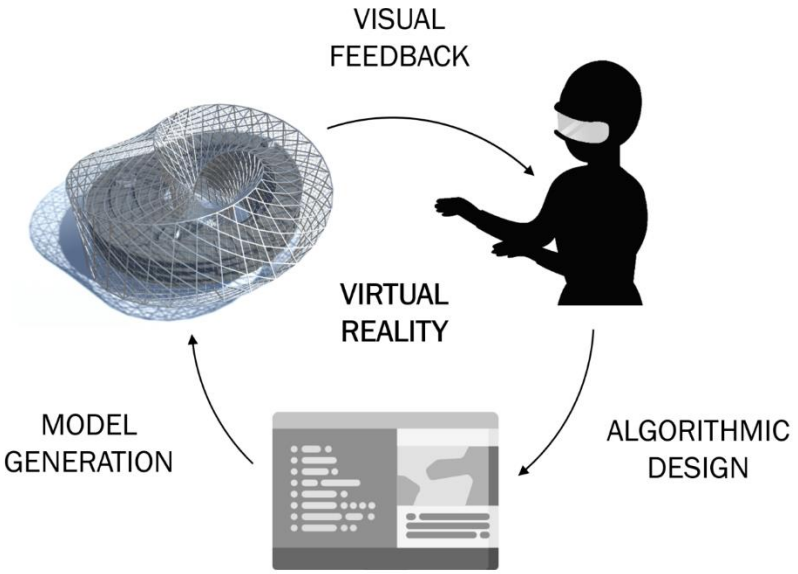

Figure 2 The process of virtual reality teaching

3.2 Technical Implementation

In the process of virtual reality technology teaching and implementation, the first step is to place the three-dimensional building model into the augmented reality scene. In order to form a clear visual mark, after the camera captures the image data, the augmented reality technology will use a unique algorithm to process and evaluate the captured image. The ORB (Oriented FAST and Rotated BRIEF) feature extraction algorithm is used. This method can accurately detect the feature points of the paired

image in real time, so as to accurately locate the image target and determine its direction. The formula is as follows:

$$R = \sum_{i=1}^{N} \mathrm{H}\left(I_i, T_i\right)$$

Among them, R represents the matching degree, N is the number of feature points, H is the feature matching function, I_i and T_i are the important feature points of the image captured by the camera and the target image respectively. The recognition stage is completed, and the 3D graphic blueprint embedded in advance by the intelligent mechanism is synchronized and integrated with the captured video content, and the improved 3D model is displayed on the display screen. Students can use portable electronic devices to view and communicate with digital examples.

4. Effect evaluation

In order to evaluate the actual effectiveness of virtual reality technology in architectural English teaching, a teaching effect evaluation was conducted on 120 students. The information is presented in the following table:

Table 1 Teaching effect evaluation results

project	Evaluation Metrics	Average value of previous period	The average value of the later period
Professional terminology mastery	Correct rate(%)	65	85
Practical operation ability	Task completion time (minutes)	30	20
English expression ability	Fluency score (out of 5 points)	2.5	4.0
Learning interest and engagement	Interest rating (out of 5 points)	3.0	4.5
Teamwork and communication skills	Cooperation score (out of 5 points)	3.0	4.2
Satisfaction with teaching methods	Satisfaction rating (out of 5 points)	3.2	4.6

Based on the existing data, the application of virtual reality technology in the teaching field has significantly improved learners' understanding of professional terms, with the accuracy rate increasing from 65% to 85%, an increase of 30%. In terms of operational skills, the time required for learners to complete tasks has been

shortened from an average of 30 minutes to only 20 minutes, and the efficiency has increased by 33.3%. In the field of English communication skills, learners' language fluency rating has increased from 2.5 points to 4.0 points, an increase of about 60%. In addition, the researchers' scores in the field of learning enthusiasm and participation evaluation increased from 3.0 points to 4.5 points, indicating that virtual reality technology has significantly improved learning interest and willingness to participate.

5 Conclusion

Research on the application of virtual reality technology in architectural English teaching shows that this innovative teaching model can significantly improve learners' professional technical vocabulary comprehension, practical application skills and English communication ability. Through an immersive and interactive learning environment, virtual reality technology effectively fills the gaps in traditional teaching and improves students' learning enthusiasm and their participation. In addition, virtual reality technology also promotes interactive communication and cooperation among students, and imitates the scenes of real project management, which is conducive to cultivating teamwork spirit. Virtual reality technology presents a new perspective and teaching method for architectural design education. It is predicted that in the future, the application of this technology in the education field will be more popular and deepened, promoting the improvement of the overall quality of education and shaping professional talents that are more in line with market demand.

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