

Application of Virtual Reality Technology in College English Course Design and Development

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Abstract: The formation and popularization of virtual reality technology has a subversive impact on the educational ideas, educational methods and educational achievements of colleges and universities, especially with a high degree of compatibility with college English teaching. Therefore, many colleges and universities have begun to try to apply virtual reality technology to the course design and development of college English in order to further improve the quality of college English teaching. Based on this, this paper analyzes the concept and characteristics of virtual reality, and analyzes the value of virtual reality technology in college English curriculum design and development. It also introduces the specific application of virtual reality technology from two aspects, such as VR video development process and VR English course learning resource design, in order to provide help and reference for college English course design and development.

Keywords: virtual reality; college English; course design; course development

1 Introduction

College English curriculum reform puts forward new requirements for English teaching, which requires students to communicate freely in English. College English educators have innovated many teaching methods, such as interactive teaching method and interest teaching method, to make students become the dominant in the classroom. However, due to the lack of language environment, the final effect is not ideal. In recent years, many scholars have discussed the application of situational teaching method in classroom teaching, and guided students' emotional activities to participate in cognitive activities by simulating the real environment, so as to stimulate students' situational thinking, so that they can acquire knowledge from situational thinking, improve their ability and achieve their learning goals. [1] Therefore, scholars began to discuss the possibility of introducing VR technology into English teaching, and how to reasonably apply VR technology to English course teaching became the focus of their attention.

2 The concept, value and characteristics of virtual reality

Virtual technology refers to the computer technology as the core, using relevant science and technology to form a digital environment that is highly similar to the real environment in a specific range in terms of sight, hearing and touch. Users need to rely on special equipment

and targets in the digital environment to complete the interaction and influence, and then form the feeling of being in the real environment.

Virtual reality has three basic characteristics, namely 3I characteristics, including Imagination, Interaction and Immersion. The details are as follows: First, immersion. Immersion refers to the degree of real feelings that users can get in the virtual environment as the protagonist of the environment. Immersion can make users feel that they are part of the virtual environment made by computer system to the greatest extent, and transform people from observers to participants, and then immerse themselves in the computer environment. It enables users to feel that vision, hearing, smell and even touch are close to reality, even without any difference from reality. [2]

Second, interaction. The interaction of virtual reality technology refers to the participants' being in the virtual environment, the maneuverability of objects and the natural degree of users' getting feedback in the virtual environment. The formation of this interaction needs to rely on different types of special three-dimensional interactive systems. Users can interact with users to the greatest extent in the whole virtual environment, and the virtual environment can interact with users to the greatest extent according to users' instructions, so as to improve users' real feelings.

Third, imagination. Imagination means that virtual reality technology can provide users with a very broad imagination space, further expand people's perception range, and then establish a non-existent or even impossible environment that users can't establish in real life. Taking the movie *Avatar* as an example, Cameron used virtual reality technology to create an unrealistic planet, namely Pandora planet, according to his personal imagination, which provided a very real feeling for the audience. [3]

3 The application value of virtual reality technology in college English course design and development

3.1 Meet the learning characteristics of students

First, compared with primary and secondary school students, college students' own learning ability and self-analysis ability are better. They have stronger adaptability to modern new learning methods and environment, and can operate various virtual reality learning facilities more freely, and at the same time, develop their own learning characteristics and learning needs in depth. Second, college English courses in many colleges and universities in China are still taught in large classes. Teachers must carry out teaching work according to the learning progress of most students within a limited time, and cannot provide targeted and one-on-one teaching guidance for all students. However, in the virtual reality learning environment, students can receive one-on-one teaching services provided by virtual facilities, and such excellent personal emotional experience can further improve students' learning motivation. Third, learning motivation includes internal learning motivation and external learning motivation. The former mainly comes from students' sense of pleasure and satisfaction during their learning activities. Virtual reality technology can provide customized or diversified multimedia stimulation, so that students who lack learning motivation can form more relaxed and happy emotions, thus stimulating their learning enthusiasm and forming students' internal

learning motivation. In addition, the immersion and interactivity of virtual reality technology itself can create authentic scenes, set up various interactive activities, put students in a learning scene close to reality, think and imagine during the realization of teaching objectives, and then stimulate students' external learning motivation. Fourth, students learn in the learning world, which is beneficial to reduce their learning tension and anxiety. For most students, especially those who are introverted or lack self-confidence, their unwillingness to talk and show has become the main obstacle to their study. In the virtual reality environment, students can practice repeatedly in their favorite learning scenes until they master relevant knowledge and dare to communicate in English.

3.2 It is conducive to promoting English ubiquitous learning

The Outline of the National Medium-and Long-Term Education Reform and Development Plan clearly states that China will basically form a learning society of "everyone can learn, everywhere can learn, and always can learn" in 2020. In 2007, China's Ministry of Education also demanded that English teaching should develop in the direction of personalized learning, and it will not be interfered by time and place, and guide students to develop in the direction of active learning. But at present, the teaching of college English courses in most colleges and universities is generally concentrated in the two academic years of freshman and sophomore. The total course time is very limited, and neither the learning frequency nor the course content can meet the actual needs of language learning. After entering the junior and senior school year, the English course is over, and many students are unwilling to continue learning English, which leads to the gradual forgetting of the English knowledge they have learned. The integration of virtual reality and reality enables students to realize one-to-one learning and distance learning at any time and any place depending on different types, forms and functions of learning hardware devices. Moreover, students can adopt different learning methods such as the integration of formal learning and informal learning, personalized learning and collaborative learning. Diversified learning methods have changed the traditional teaching design of college English courses, making English learning not only in freshmen and sophomores, but also covering students' whole college study career and even extending to students' life. It makes English practical activities and learning activities spread from course learning to all places, and then promotes students to realize the sustainable development of English learning. [4]

4 The application of virtual reality technology in college English course design and development

4.1 VR video development process

In general, the VR/AR development process includes selecting equipment and platforms, selecting interactive methods and tools, selecting development platforms and engines, selecting third-party plug-ins and tools, and selecting product release platforms. The details are as follows:

First, choose the right equipment and platform. Before developing VR and AR applications, it is necessary to select suitable devices and platforms according to the actual application scenarios of the final products. For example, if CR application is developed on PC platform,

HTC Vive and Oculus Rift should be preferred. If it is developed on VR devices supported by PS4, PSVR should be preferred. It can be seen that with the passage of time, the equipment and platforms on the market will be constantly updated, and designers and developers need to select suitable equipment and platforms according to the actual situation.

Second, choose appropriate interaction methods and third-party tools. For the development of VR, the traditional keyboard, mouse and handle are not suitable interactive choices. Mainstream VR devices generally have corresponding interactive devices, such as Nine Controller corresponding to HTC Vive and PS Move corresponding to PS VR. Specifically, human-computer interaction based on virtual hand can be adopted. First, the depth camera and color camera are used to shoot human motion images, which are recorded as I_p and I_c . Because they are taken from the same frame, they are aligned. At the same time, remove the data whose depth value is outside $MinDep$ and $MaxDep$, record it as I_d , and clear the relevant areas in the color image, as follows:

$$\begin{aligned} ID &= \{x_1, x_2, \dots, x_n\}; \\ I'd &= \{x_i | MinDep \leq x_i \leq MaxDep, 1 \leq i \leq n\} \\ Id &= I - I'd \end{aligned}$$

After that, the interference items in the scene can be removed by color recognition, and the RGB color space information data can be transformed into YCbCr color space. After comparing the tone information in the color image, the hand contour information can be extracted, and then the algorithm skeleton information can be obtained by using the hand skeleton. [5] Heat stroke transformation algorithm can be used to refine, and the distance on the edge of a point on the outline of a human hand is used as a radius to make a circle, which shows that more than two points with the shortest distance from the point are found at the edge position, that is, points that are considered to be bones, otherwise, the points are removed. The formula of axis transformation algorithm is as follows:

$$SKele = \{q \subseteq A, \exists c_1 \neq c_2 \subset C, d(q, c_1) = ds(q, C)\} \quad (1)$$

In the formula, A represents the set of pixel points in the hand range, C represents the edge of the hand range, and $d(q, c)$ represents the distance from point q to point c on the edge. After obtaining the hand skeleton, the motion data of joint points are confirmed by Kalman method. At the same time, the constraint information is set for the propagation angle of hand movement, and the perfect budget of mean-shift algorithm is used to finally recognize the user's posture and complete the interactive action.

Third, choose a suitable product release platform. Like the mobile phone platform, you can also choose specific publishing platforms and channels, such as Vive Port Mall designed by HTC Vive, or AppStore App Mall, which can provide different types of functions such as screenshot display, purchase and download, so as to facilitate users and developers to complete seamless connection.

4.2 Matching and interactive design of three-dimensional skeleton

Teachers can get frame pictures by using the Stacked Hourglass Networks model, and get 2D joint heat map information by preprocessing the frame pictures. All heat maps contain the probability value of the current pixel belonging to the joint point, and finally take the pixel

position with the highest probability as the position of the joint point in the image. It is suggested to use nonparametric model matching algorithm for 3D pose derivation. The specific process is as follows:

Firstly, a basic posture sample library Q is established, in which 2D posture data $P_{2D}=\{(x,y)\}$ and corresponding 3D posture data $P_{3D}=\{(x,y,z)\}$ are stored, that is, $Q=\{P_{2D},P_{3D}\}$, and they must satisfy the following relationship:

$$P_{2D_i}(x,y)=W_i P_{3D_i}(x,y,z) \quad (2)$$

That is, for any 2D joint information, it is because its corresponding 3D joint point is transformed by the operation with the camera model, where W_i represents the camera parameters for the current 3D pose to be transformed into the corresponding 2D pose. Based on this, for any 2D gesture to be recognized, $P'_{2D}=(x',y')$ has the following relationship:

$$P(P_{3D_i}|P'_{2D}) \propto \exp\left(-\frac{\|W_i P_{3D_i} - P'_{2d}\|^2}{\sigma^2}\right) \quad (3)$$

Secondly, combined with the above formula, it means that for any 2D joint pose with matching, the 2D pose with as little distance as possible is retrieved in the sample, and then the 3D pose corresponding to this pose is the approximate pose that needs to be found at present. [6] For the matching process, the nearest neighbor algorithm ($K=1$) can be used. Specifically, the algorithm retrieves all 2D gestures in the sample set, and operates with the 2D gestures to be recognized at present to obtain the Euclidean distance ρ of two sample points:

$$\rho_j = \sum_{j=1}^{16} \sqrt{(P'_{2d_j} \cdot x - P_{2D_j} \cdot x)^2 + (P'_{2d_j} \cdot y - P_{2D_j} \cdot y)^2} \quad (4)$$

Thirdly, the distance ρ from all the samples is obtained by matching with all the samples. Then select the sample with the smallest distance, confirm the corresponding 3D pose, and include the similar 3D pose of the pose to be recognized. The method does not need to directly match the x,y,z Y and Z coordinates of the position information of the value, but approximate the Z coordinates of the value, and X and Y still use the position information obtained by the 2D gesture. The details are as follows:

$$P'_{3d}=(P'_{3d \cdot X}, P'_{3d \cdot Y}, P'_{3d \cdot Z}) \quad (5)$$

In the above formula, k represents the subscript closest to the 2D sample. In this way, P'_{3d} is the final 3D skeleton data information.

VR video can be designed interactively based on the direction of hand movement. The hand is the most flexible part of the human body. In the process of designing VR video, we can use the direction of hand movement to realize the interaction with the virtual environment, such as controlling the movement of objects in the virtual environment and changing the perspective. The specific process is as follows: First, get the direction of hand movement. The motion direction of the hand can be obtained by acquiring the hand motion vectors of two adjacent picture frames. Vector information v_h of hand and elbow can be obtained in all frames, and

$v_h = P_{hand} - P_{elbow}$. [7] In two adjacent frames, the specific direction V of the user's hand movement can be obtained by using the difference between the two vectors. In order to ensure the stability of the algorithm, another threshold can be defined to limit the hand movement. Only the movement beyond the current threshold can be regarded as the deviation of hand movement, and the formula is as follows:

$$V = \begin{cases} v_{cur} - v_{pre} & \text{if } (v_{cur} - v_{pre}) > \tau \\ 0 & \text{if } (v_{cur} - v_{pre}) \leq \tau \end{cases} \quad (6)$$

4.3 Design of VR English course learning resources

As far as the classification of learning resources is concerned, the learning resources that can be displayed in the virtual learning environment created by VR technology include text resources, image resources and multimedia resources, as well as external web resources and special model resources. From this, the learning resources in the virtual environment can be subdivided into two points. One is the video model resources in VR environment, which generally use static text, graphic images and video transmission to show learning resources to students. The second is the web page resources outside the platform, which are learning websites and new learning resource pools related to the subject of the course for students. The presentation of external web resources needs to build communication between virtual reality and the Internet by creating functional scripts, and present the existing learning resources in the network in the built-in browser of virtual reality or in the three-dimensional objects created by students by using technical processing and functional scripts. Therefore, in the process of learning in virtual reality, students can upload the finished third-party video to the video playing platform, and call English learning resources in the network by establishing a three-dimensional display board and writing functional scripts, and display the preset learning materials in the display board. [8] This diversified media element and multi-dimensional resource presentation mode further enriches the network resources in virtual reality and meets the actual needs of various learners in the learning process. The design of learning resources is shown in Figure 1.

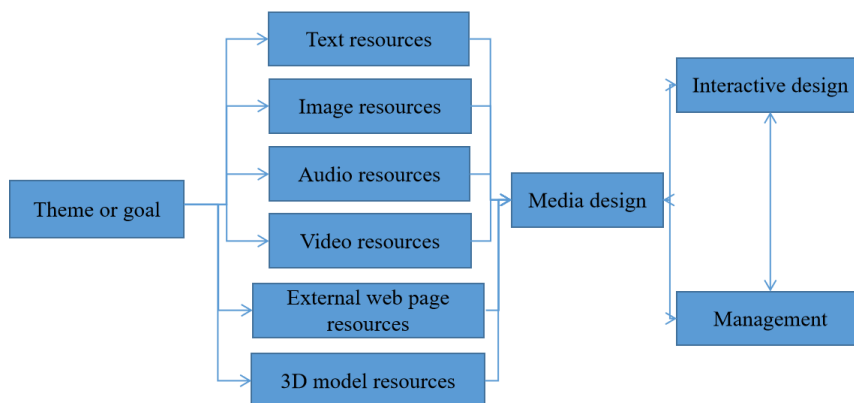


Figure 1 Flow chart of virtual reality resource design and development

The design of English learning resources in virtual reality can be divided into the following three parts:

First, learning material design. English learning materials are the basic content of students' learning, and they are also the foundation of carrying out learning work. At the same time, we need to fully understand the subject of the course and the purpose of learning, and carefully design and develop learning content according to the specific learning environment, including text, images, audio and video and other diverse learning materials. In addition, in the process of designing course materials, it is necessary to emphasize its rationality and forms of expression, so that students can gain learning experience and knowledge more efficiently and complete the transfer of virtual reality learning and real life learning ability. [9]

Second, the design of media tools. It is mainly used to show different types of materials needed by course teaching in virtual environment, which is the category of learning materials display. Diversified resources correspond to different forms of media tools. For example, the text resource media tool only needs to create a virtual model in virtual reality as a trigger condition, and students can open the preset learning resources. If it is a graphic resource, it is necessary to present the model surface created for students. Therefore, in the process of designing media tools, teachers need to emphasize the design of attribute specifications to facilitate the display of corresponding image resources.

Third, interaction design. The interactive design of English learning resources in virtual reality belongs to the high-level total of resources, which needs to be completed by writing functional scripts in order to help students get a more real English learning experience. For example, in the design of multimedia PPT, based on the existing learning materials and media equipment, it is necessary to write functional scripts for playing PPT and give them to media tools, so that students can freely choose the PPT pages they study on the media tools and get feelings similar to real study life. In addition, a virtual library can be established in the virtual world, which is convenient for students to consult English learning materials and realize internal resource sharing. Students can share high-quality learning resources by giving or buying and selling, which changes the disadvantages of limited teaching resources in traditional English courses. [10]

5 Conclusions

With the development and popularization of information technology, college English teaching methods will inevitably change. The application of VR technology in college English teaching can not only break the constraints of time and space on classroom teaching, but also provide students with massive teaching resources. This requires teachers to make full use of VR technology, change the traditional teaching methods, clarify the development process of VR video, and design the learning resources of VR English courses reasonably, so as to improve the English learning efficiency of college students.

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