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Research on the Utilization and Safety Guarantee System of Virtual Reality Technology in University English Contextual Teaching

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Abstract The emergence of virtual reality technology provides great convenience for English teaching work and greatly promotes the reform and innovation of English education. In order to effectively integrate virtual reality technology with English contextual teaching, this paper constructs an English teaching context based on virtual reality panoramic video. Paired-sample t-test and social network analysis are chosen as the data processing methods to carry out a college English contextual teaching experiment in two parallel classes in the second year of non-English majors in D colleges and universities in Xi'an City, Shaanxi Province, China, to explore the effect of the application of the English contextual teaching model based on VR panoramic video proposed in this paper on the students' English learning. The posttest score of the experimental class is 68.69, which is 6.8 points higher than that of the control class, and presents a significant difference with a significance probability of 0.012<0.05 in the t-test result. The clustering coefficient of the community network of English translation activities in the experimental class is as high as 0.85, the social network connection is dense, and the students are all able to actively participate in English learning activities.

Index Terms sample t-test, social network analysis, virtual reality technology, contextualized English language teaching

I. Introduction

The core of college English teaching is to improve students' language use ability, and language use can only be really practiced and improved in the actual language environment. For a long time, contextual learning has been recognized as a very effective learning mode for English teaching [1]. The most direct method is to bring students into real sites for teaching, but constrained by time, space, cost, feasibility and other practical factors, it is difficult to find suitable sites that can support teaching, and even if there are such sites, they can only be used mainly for observational teaching, and it is difficult to support the practice and use of the site by the students, especially by more than one person [2-4]. In this case, the use of computer technology to build teaching practice scenes of information technology has become the main technical way of contextual teaching [5-6]. The application of virtual reality (VR) technology in the teaching of English, the use of VR can be done to make students immersive, thus enhancing the learning experience of students, not only to bring a refreshing sense of novelty to the students, but also to stimulate the interest of students in independent learning, so that learning becomes more efficient [7-9].

In recent years, with the improvement of the performance of computing and display devices, it has become possible to use virtual reality technology to support the teaching of ordinary context. Literature [10] developed a VR teaching system for situational teaching based on the needs of English learners, and by constructing a virtual simulation system containing multiple sensory interaction forms such as visual, auditory, and tactile senses, it can provide students with a realistic English language environment, which plays an important role in improving the learners' English application skills. Literature [11] shows that the development of 5G communication technology and VR technology provides strong support for situated English teaching, and the teaching framework and interactive programs designed on this basis significantly improve the English learning effect of learners. Literature [12] describes the application of virtual reality technology based on artificial intelligence and machine learning in the English teaching classroom, which promotes students' participation in the classroom by creating an immersive virtual context suitable for English teaching, effectively solving the problem of passive acceptance of students in the traditional classroom. Literature [13] uses three-dimensional modeling technology to design relevant three-dimensional elements so as to establish the virtual reality scene required for English teaching, which provides technical support for the design of English situational teaching and promotes the high-quality development of English teaching. Literature [14] examined the impact of the situational teaching framework in the VR environment

on students' English learning effect, and found that the teaching mode can effectively improve students' knowledge of vocabulary, pronunciation and grammar, and at the same time bring them a new interactive experience. It can be seen that, compared with the simple text-based teaching mode, the use of virtual reality technology to build an immersive virtual scene of English teaching from various aspects, through the appropriate means of interaction to make students actively participate in the English classroom learning, and better enable students to appreciate the value and meaning of the use of English, while at the same time, it is also necessary to establish the relevant security system to prevent the possible information security and other issues.

This paper integrates virtual reality technology with university English contextual teaching, constructs an English teaching context based on virtual reality panoramic video, utilizes a multi-camera combination of panoramic camera to shoot the real scene, watches 3D panoramic content through a virtual reality helmet display, and utilizes gesture interaction to control the watched content and participates in the experience through voice and gesture. Three English contextualized teaching modes based on VR panoramic video are proposed: student immersion autonomous experience learning mode, teacher immersion guided learning, and role replacement voice-over learning, which provide effective solutions for English virtual contextualized teaching. Using the proposed to reach the VR panoramic video-based English contextual teaching model, two parallel classes of the second year of non-English majors in D colleges in Xi'an City, Shaanxi Province, China, were used as the research objects to carry out university English contextual teaching experiments, and the paired-sample t-test method was utilized in the hypothesis testing to test the effects of the VR panoramic video-based English contextual teaching model on the English proficiency of the students and the ability of English independent learning, and to use the social network analysis to explore its role on students' participation in English translation learning activities.

II. Situational Teaching Mode of College English Based on VR Technology

With the rapid development of science and technology, the application of virtual reality technology (VR technology for short) in the field of university English teaching is gradually increasing, providing students with a new way of immersive English learning experience [15]. In this chapter, we will construct an English teaching context based on virtual reality panoramic video from the perspective of operability and feasibility in actual teaching.

II. A. Virtual context construction based on VR panoramic video technology

Panoramic video, also known as interactive video, it can be based on the user's needs, in the horizontal 360 degrees, even including the pitch 180 degrees range, free to choose the viewing angle [16]. Virtual reality panoramic video, referred to as VR panoramic video, is a product of the combination of binocular display panoramic video and VR glasses, with the help of VR glasses three-dimensional display and position tracking capabilities, which allows users to see a three-dimensional scene like a real shooting scene, through the turn around, look up, head down to focus on the area of concern, watch different viewpoints, different viewpoints of the video, to experience the sound from different directions, and Interact with the panoramic video through gestures and gazing, so as to obtain an immersive sense of immersion.

The process of constructing a virtual English situation based on VR panoramic video is shown in Figure 1. First of all, a multi-camera panoramic camera is used to shoot the real scene, and then the multi-camera video is spliced and fused into a complete panoramic video for post-editing, which is then transmitted to the Internet video server through efficient video compression, and finally distributed and decoded to users. Users watch the 3D panoramic content through the virtual reality helmet display, control the viewed content through gesture interaction, and participate in the experience through voice and gesture.

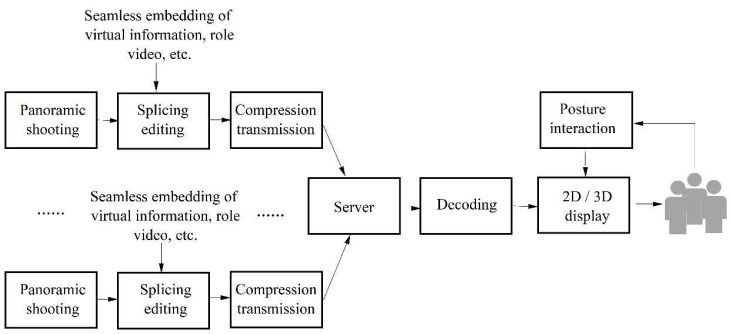


Figure 1: The construction process of VR panoramic video scene

Compared with the time-consuming and laborious production of 3D graphic scenes, panoramic video shooting and production does not require too much specialized knowledge, you can use panoramic cameras to efficiently and effectively get the virtual reality scene content.

After using panoramic camera to shoot multi-view video, it is necessary to splice and correct the multi-channel video to synthesize a complete panoramic video. Splicing technology needs to deal with multiple lens picture seams, lighting consistency and other issues, which directly determines the quality of the final video.

Unlike ordinary panoramic videos, panoramic videos used for teaching purposes should be able to support the embedding of virtual objects such as learning tasks and labeling information, as well as real-world objects such as the teacher's explanation video, so as to facilitate the teacher's purposeful guidance of students' learning. The key to seamless embedding is to obtain the positional parameters of the live camera according to the feature matching between multi-viewpoint images, and adjust the embedded view according to the relative positions of the live camera and the embedded objects to maintain the consistency between the embedded view and the live space. In order to reduce the complexity of the production and ensure the embedding effect, the teacher's explanation video should be shot in a fixed position with a fixed point-of-view camera with fixed focus. After the production of the VR panoramic video is completed, it can be distributed to the users through the media platform server. Users watching VR panoramic video need to use virtual reality display equipment to produce a sense of complete immersion. Finally, in order to allow users to actively participate in the virtual situation, natural human-computer interaction is indispensable, VR glasses are usually equipped with positional gesture sensing components, which can track the head movement parameters in real time, so that the user can naturally realize the free roaming in the virtual scene through the rotation of the head and the body to move, and choose to watch the area of interest.

II. B.English Contextual Teaching Model Based on VR Panoramic Video

Compared with traditional VR contextual teaching, VR panoramic video has better operability. According to the characteristics of English teaching, English contextual teaching based on VR panoramic video can adopt the following three application modes.

II. B. 1) Student immersion self-directed experiential learning model

According to the teaching content, the teacher selects and pushes the VR panoramic video that takes place in a real-life situation in the native-speaking country, and sets up reminder messages for the events and episodes in the scene, assigns learning tasks and problems, and embeds them in the panoramic video in the form of a “bulletin board” or a pop-up window with a link. Students watch online through VR boxes and smartphones, immersing themselves in the scene as if they were observing and learning in the field. According to the learning task, they can choose the appropriate perspective to focus on the learning content through natural interaction such as body rotation, control the progress of learning through gestures or joystick interaction, select the labeled objects to view the prompt information, and complete the learning task.

II. B. 2) Teacher immersion guided learning

Teachers for the VR panoramic video environment, characters, plot, etc., using a fixed-point-of-view camera fixed-focus shooting the corresponding explanatory video, seamlessly embedded in the panoramic video, and guide the students to watch the panoramic video of the different areas. What students see is that the teacher is in a real scene, explaining real events, and obtaining a better sensory experience, so that they can better understand the use of language in real situations.

II. B. 3) Role-replacement voice-over learning

By controlling the audio track in the VR panoramic video, the voice of a character in the scene can be weakened or turned off, allowing students to replace the character and complete the character's dialogues in the video in a way similar to dubbing, so as to achieve the purpose of practice. You can also turn off all the voices and let multiple students participate in dubbing at the same time with the help of the plot of the scene video, so as to give full play to students' creativity, let them express their ideas boldly, show multiple versions of expression, and improve students' participation.

The above three modes of learning have good operability, which not only allow students to experience the diversity of communication in a culturally diverse environment, but also help to stimulate students' interest in learning by enriching and expanding interactive learning, avoiding the psychological barriers that may be brought about by face-to-face convective communication, and improving students' motivation to participate in learning, and at the same time, teachers have a stronger control over the content of the study, the progress of the study, and the learning effect. At the same time, teachers have stronger control over the content, progress and effect of learning.

III. Experimental research design for contextualized teaching of college English

This paper will carry out a university English contextual teaching experiment to test the utility of the university English contextual teaching model based on VR technology proposed in this paper in real-life English teaching. This chapter will focus on the specific experimental research design, which mainly includes the following four aspects: research question, research object, research instrument and research steps.

III. A. Research hypotheses

This study focuses on the effect of the utilization of virtual reality technology in the contextual teaching of college English, and investigates the impact of the English contextual teaching mode based on VR panoramic video proposed in this paper on students' English learning, with the following research questions and research hypotheses:

Hypothesis 1: The English contextual teaching mode based on VR panoramic video can improve students' English proficiency.

Hypothesis 2: The English contextual teaching mode based on VR panoramic video can enhance students' English independent learning ability.

Hypothesis 3: The English contextual teaching mode based on VR panoramic video can promote students' active participation in English translation learning activities.

III. B. Subjects of the study

In this study, two parallel classes of non-English majors in the second year of College D in Xi'an City, Shaanxi Province, China, were selected as the subjects of the study, and both natural classes adopted the traditional English contextual teaching method before the experiment. Based on the final grades, the two natural classes with the closest levels were initially selected as the experimental subjects, and the experimental class and the control class were set up respectively, with the number of students in both classes being 48. The experimental class and the control class have the same English teacher, and the two classes are basically the same in terms of class style, learning style and class management. The duration of the experiment is one semester (5 months).

III. C. Research tools

III. C. 1) English test questionnaire

This study is an attempt to improve the method of English learning of the students in the experimental class by conducting an intervention of English contextualized teaching mode based on VR panoramic video in the experimental class. The English test questionnaires used in this study are the English Application Ability Test for Higher Education of the Unified Examination. The questionnaire focuses on assessing the candidates' English application skills, emphasizes the applicability and practicability of the test content, which is widely recognized by the society and has high reliability and validity at the same time.

III. C. 2) Questionnaire on English independent learning skills

In order to better understand the impact of the implementation of the qin contextual block teaching method on students' English independent learning ability, this paper uses a questionnaire specially designed for the study of Chinese college students' English independent learning ability in the pre- and post-tests of the experiment. The questionnaire has five dimensions and 32 items. Dimensions 1 to 5 correspond to the teachers' teaching objectives and requirements, the setting of learning objectives and the formulation of learning plans, the use of English learning strategies, the monitoring of the use of English strategies, and the monitoring and evaluation of the English learning process.

Likert's five-level quantitative method was used to assign scores (A=1, B=2, C=2, D=3, E=5) according to the five-level scale of “A→E”, which means “not at all in line with my situation→completely in line with my situation”. The questionnaire data were then statistically analyzed using SPSS 21.0, and the higher the scores obtained, the stronger the students' independent English learning ability.

III. D. Research methodology

III. D. 1) Paired samples t-test

The t statistic is utilized in hypothesis testing and hence called paired samples t test. The paired samples t test is a parametric test [17].

Let $x_1, X_{12}, \cdots\cdots, X_{1n}$ and $x_2, x_{22}, \cdots\cdots, x_{2n}$ be random samples from 2 independent distributions x_1, x_2 respectively. Let $d = X_1 - X_2$, which corresponds to a sample difference of $d_i = X_{1i} - X_{2i} (i = 1, 2, \ldots, n)$, be considered $d_1, d_2, \cdots\cdots, d_n$ to follow a normal distribution $N(\mu_d, \sigma^2)$ with mean 0 if the difference between the x_1, x_2 samples is small.

Original hypothesis: $H_0 : \mu_d = 0$ (i.e., the data between the two samples are considered not significantly different).

Alternative hypothesis: $H_0 : \mu_d \neq 0$ (i.e., the data between the two samples are considered significantly different).

The formula for the test statistic is as follows:

$$t = \frac{\bar{d}}{\sqrt{\frac{S_n}{\sqrt{n}}}} \tag{1}$$

In formula (1), $\bar{d}$ is the mean of $d_1, d_2 \cdots\cdots d_i$, n is the sample size, and S_n is the standard deviation of $d_1, d_2, \cdots\cdots d_i$. $\bar{d}, S_n$ calculated according to equations (2) and (3):

$$\bar{d} = \frac{\sum_{i}^{n} = t^{di}}{n} \tag{2}$$

$$S_n = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(d_i - \bar{d})^2} \tag{3}$$

When hypothesis H_0 holds, the t statistic conforms to a t distribution with $(n-1)$ degrees of freedom.

For a given level of significance $\alpha(0 < \alpha < 1)$, the critical value of the test $t_{\alpha/2}(n-1)$ can be obtained by looking up the t distribution table, such that $P\{|t| \geq t_{\alpha/2}(n-1)\} = \alpha$, if $|t| \geq t_{\alpha/2}(n-1)$, it is rejected H_0 and a significant difference is considered to exist between the two samples. Otherwise, it is considered that there is no significant difference between the two samples.

In the statistical analysis software currently in use, the difference between the two sets of samples is usually calculated and the corresponding data are substituted into formula (1) to calculate the test statistic and the corresponding probability P value, and the original hypothesis is rejected if the P value is less than the given significance level, otherwise the original hypothesis is accepted.

III. D. 2) Social network analysis

Social networks have received increasing attention over the past decade or so. In social networks, the connections between entities are represented by links in a graph. From a data mining perspective, social network analysis (SNA) is also known as link analysis or link mining [18]. Link mining brings together research in several areas, including social networks, hypertext and Web mining, graph mining, inductive logic planning, and relational learning. Currently, social network analysis techniques have penetrated a variety of pedagogical applications.

The following concepts are required to utilize social network analysis techniques:

1) Center node

A node with greater degree of centrality in the network, i.e., such nodes are connected to many other nodes and have a high degree of centrality.

2) Critical nodes

A node in the network with high traffic, through which many inter-node communications have to pass. This type of node plays a key role in the network and has a vital role in the connectivity of the entire network.

3) Centrality

Centrality is used to evaluate the importance of nodes in the network. Centrality can be used to measure which nodes are the primary nodes in the network. In a social network, centrality is the sum of the number of connections a node has with other nodes. Given that there is n node in the network and the connections between nodes are stored in a matrix $X(n \times n)$, the following formula is used to calculate the centrality of a node:

$$D(N_i) = \sum_{j=0}^{n} X_{ij} \tag{4}$$

where, X_{ij} is taken as 0 or 1, 1 means there is a connection between node i and node j, otherwise it means there is no connection. In order to compare with different networks, the centrality value calculated in equation (1) is normalized and the average connection value with other nodes is calculated as shown in equation (5):

$$D'(N_i) = \frac{D(N_i)}{n-1} \tag{5}$$

where n is the number of nodes in the network.

IV. Analysis of the results of the university English contextual teaching experiment

At the end of the English contextual teaching experiment, the recovered pre-test and post-test vocabulary learning method questionnaires and vocabulary scores data were entered into SPSS20.0, and the data were analyzed in two aspects: independent samples t-test, and paired samples t-test according to the two main lines of between-groups and within-groups. At the same time, the interaction behavior of students in this experiment was analyzed and processed by combining the social network analysis method.

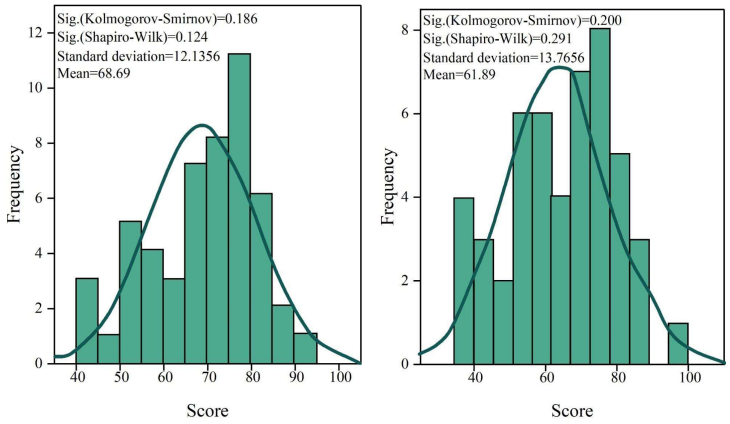
IV. A. Independent samples t-test analysis

Before the beginning of the experiment, the students in the experimental class and the control class were tested, and there was no significant difference between the two classes in terms of English scores (P<0.05), and the English learning level was comparable enough to be used as a teaching experiment.

IV. A. 1) Statistics and Analysis of English Performance

After one semester of English contextual teaching practice, the students were tested in English, the corresponding experimental data were collected and the SPSS software was used to test the data for normality, and then the independent samples t-test was conducted to determine whether the performance of these two classes showed significant differences, in order to understand the effect of the English contextual teaching mode based on VR panoramic video proposed in this paper in improving the English performance of college students. The effect of

The histograms of the distribution of the posttest scores of the experimental and control classes are specifically shown in Fig. 2, Figs. (a) and (b) show the experimental and control classes, respectively. It can be seen that by Kolmogorov-Smirnov and Shapiro-Wilk tests, the significant levels of the experimental class are 0.186 and 0.124 respectively, both higher than 0.05, while the significant levels of the control class are 0.200 and 0.291 respectively, both higher than 0.05. In addition, the histograms of the scores of the two classes also show a more normal overall In addition, the histograms of the two classes also showed a normal distribution. Therefore, it can be concluded that the scores of both classes are normally distributed and can be used for parametric tests.



(a)Experimental class (b)Control class

Figure 2: Score distribution histogram

The statistical results of the posttest scores of the experimental and control classes are specifically shown in Table 1. As can be seen from the table: the mean value of the post-test scores of the experimental class is 68.69, while that of the control class is 61.89, which is 6.8 points higher, indicating that the overall English proficiency of the students in the experimental class has improved more significantly through the English contextualized teaching mode based on VR panoramic video.

Table 1: The post-test scores of the experimental class and the control class

	Class	Mean value	Standard deviation	Standard error of mean
Post-test scores	Experimental class	68.69	12.1352	1.7458
	Control class	61.89	13.7656	1.9538

The results of the independent samples t-test for the posttest scores are specifically shown in Table 2.The Sig value of Levene's test of chi-squaredness is 0.306>0.05, indicating that the variance of the posttest scores of the two classes is the same for the variable of achievement, which fulfills the assumption of chi-squaredness of parametric test. According to the t-test of the mean equation, the probability of significance is 0.012<0.05, indicating that there is a significant difference between the experimental and control classes on the post-test scores.

Table 2: Results of the Independent Sample T Test

	Levene test of variance equation			T test of mean equation					
						Sig. (bilateral)	Mean difference	Standard deviarian	95 % confidence interval of the difference	
Post-test scores	-	F	Sig.	T	Df				Lower limit	Upper limit
	Suppose the variance is equal.	1.012	0.306	2.584	98	0.012	6.7252	2.5912	1.5808	11.8715
	Suppose the variance is not equal	-	-	2.577	95.428	0.012	6.7262	2.5977	1.5662	11.8841

The above analysis shows that there is a significant difference between the two classes in the variable of post-test scores, which means that there is a significant difference in the overall English proficiency of the students in the two classes. It can be concluded that after one semester of practicing the English contextual teaching mode based on VR panoramic video, the experimental class's performance is better than that of the control class, and the progress is greater, and the hypothesis one proposed in this paper is valid, i.e., “the English contextual teaching mode based on VR panoramic video can improve the English proficiency of the students”.

IV. A. 2) Statistics and analysis of the results of each question type

In order to further understand the differences of contextual teaching methods in improving students' English language application skills, the author also conducted statistics and analysis on the scores of the post-test scores of the experimental and control classes to understand the different effects of contextual teaching methods on improving students' English language application skills in listening, vocabulary and grammatical structures, reading, translation and writing.

The statistical results of the posttest scores of the experimental and control classes for each question type are specifically shown in Table 3. In listening, vocabulary and grammar, reading, translation and writing, the mean differences between the post-test scores of the experimental and control classes were 0.42, 2.65, 1.23, 1.07, 1.34. Among them, the differences were smaller in listening and larger in the scores of the other question types.

Table 3: Post-test scores of each question type

Question type	Class	Mean	Standard deviation	Standard error of mean
Listening	Experimental class	15.83	3.611	0.518
	Control class	15.41	3.429	0.538
Vocabulary and Grammar	Experimental class	9.48	2.655	0.353
	Control class	6.83	2.52	0.281
Reading	Experimental class	25.05	4.752	0.712
	Control class	23.82	5.127	0.725
Translation	Experimental class	10.86	2.691	0.414
	Control class	9.79	2.838	0.43
Writing	Experimental class	7.47	2.757	0.413
	Control class	6.13	2.993	0.475

The results of the independent samples t-test for the subtest scores of the posttest are specifically shown in Table 4. It can be seen that the significance of the difference between the scores of the experimental class and the control class in each of the English questions is not the same.The Sig values of Levene's chi-square test for each of the questions are 0.811, 0.305, 0.588, 0.257 and 0.82 respectively, which are greater than 0.05, reflecting the fact that in the five questions the variances of the achievement variables are equal, and that the data are normally distributed as a whole. However, the t-test of the mean equation for each achievement showed that there was no significant difference in the achievement of listening and reading questions with p-values of 0.678>0.05 and 0.222>0.05 respectively; in vocabulary and grammatical structures, translation and writing, there was a significant difference in the achievement with p-values of all less than 0.05 respectively.

Table 4: Independent sample T test of the scores of each item type

Question type	Levene test of variance equation			T test of mean equation					
						Sig. (bilateral)	Mean difference	Standard deviarian	95 % confidence interval of the difference	
	-	F	Sig.	T	Df				Lower limit	Upper limit
Listening	Assume that the variances are equal	0.052	0.811	0.403	98	0.678	0.284	0.712	-1.119	1.709
	Suppose the variance is not equal	-	-	0.416	98	0.678	0.284	0.712	-1.118	1.708
Vocabulary and Grammar	Assume that the variances are equal	1.016	0.305	5.352	98	0.000	2.705	0.505	1.71	3.719
	Suppose the variance is not equal	-	-	5.38	97.983	0.000	2.705	0.505	1.711	3.718
Reading	Assume that the variances are equal	0.267	0.588	1.24	98	0.221	1.2316	1.0011	-0.7562	3.2215
	Suppose the variance is not equal	-	-	1.217	96.538	0.221	1.2316	1.0028	-0.7599	3.2252
Translation	Assume that the variances are equal	1.285	0.257	2.092	98	0.038	1.148	0.545	0.059	2.259
	Suppose the variance is not equal	-	-	2.085	95.506	0.04	1.148	0.545	0.056	2.262
Writing	Assume that the variances are equal	0.048	0.82	2.337	98	0.022	1.314	0.556	0.205	2.444
	Suppose the variance is not equal	-	-	2.324	97.047	0.022	1.314	0.556	0.204	2.445

IV. A. 3) Statistics and analysis of quantitative data from questionnaires

In order to better understand the impact of the implementation of the English contextual teaching model based on VR panoramic video on the students' English independent learning ability, the questionnaires on English independent learning ability were distributed to the students of the experimental class before and after the experiment, and all of them were collected and valid. According to Likert's five-level quantitative method of scoring, “A→E” means “not at all in line with my situation→fully in line with my situation” for the five-level scoring (A=1, B=2, C=2, D=3, E=5). The questionnaire data were then statistically analyzed using SPSS 21.0, and the higher the scores obtained, the better the students' ability to learn English independently. The data description and results obtained after quantitative statistics are specifically shown in Table 5. From the table, it can be seen that the mean value of students' questionnaire scores before the experiment was 81.48, while the mean value of questionnaire scores after the experiment was 110.88, which was 36.08% higher. In terms of sub-dimensions, the mean values of post-test scores for dimensions 1 to 5 are 31.78%, 44.95%, 33.23%, 30.89% and 40.01% higher than those of the pre-test respectively, reflecting that after the experiment, students can more consciously and actively utilize extracurricular time to learn and apply English, utilize the existing learning resources, more flexibly combine new knowledge with practice, and pragmatically go for the selection of an effective learning path.

Table 5: Paired sample T test results of questionnaire data

Dimensions	test	Mean	standard deviation	Standard error of mean
Dimension 1	Before experiment	13.91	2.66	0.421
	After experiment	18.33	2.779	0.335
Dimension 2	Before experiment	11.39	2.808	0.393
	After experiment	16.51	3.068	0.39
Dimension 3	Before experiment	13.12	2.564	0.429
	After experiment	17.48	2.589	0.426
Dimension 4	Before experiment	18.94	3.584	0.44
	After experiment	24.79	3.327	0.443
Dimension 5	Before experiment	24.12	5.697	0.822
	After experiment	33.77	5.916	0.861
Total score	Before experiment	81.48	16.202	2.27
	After experiment	110.88	15.968	2.292

The results of the paired samples t-test for the data from the pre-test and post-test questionnaires are shown in Table 6. The test results show that not only on the total score of the questionnaire, but also on the five dimensions, the lower and upper 95% confidence intervals of the difference in means are all negative and do not contain zero, indicating that there is a significant difference between the two variables of each paired group. The t-value of -19.228 and Sig. (two-sided) probability of significance of 0.000<0.05 for the pre-test total score and post-test total score indicate that there is a significant difference between the two variables of the pre-test total score and post-test total score. On the other five dimensions, the probability of significance of the two-tailed test for each of the paired variables is less than 0.05, and all of them show significant differences.

Table 6: Paired sample T test results of questionnaire data

Dimension	-	Mean value	Standard deviation	Standard error of mean	95 % confidence interval of the difference		T	Df	Sig. (bilateral)
					Lower limit	Upper limit			
Dimension 1	Pretest-posttest	-4.42	2.221	0.311	-5.076	-3.826	14.312	50	0.000
Dimension 2	Pretest-posttest	-5.12	2.222	0.311	-5.566	-4.316	15.882	50	0.000
Dimension 3	Pretest-posttest	-4.36	1.61	0.225	-4.806	-3.9	19.305	50	0.000
Dimension 4	Pretest-posttest	-5.85	2.555	0.358	-6.621	-5.183	16.494	50	0.000
Dimension 5	Pretest-posttest	9.65	4.16	0.583	-10.837	-8.497	16.594	50	0.000
Total score	Pretest-posttest	29.4	10.888	1.525	-32.376	-26.252	19.228	50	0.000

The results of the above tests show that after the implementation of the English contextual teaching mode based on VR panoramic video, students have a better understanding of the teacher's teaching objectives and requirements, and many of them are able to set up their own learning goals, make learning plans, use more English learning strategies, adjust their learning strategies in time, and monitor and evaluate their own English learning process. Students' independent learning ability in English has been significantly enhanced, which proves the hypothesis that “VR-based English contextualized teaching mode can enhance students' independent learning ability in English”.

IV. B. Social network analysis

In this section, social network analysis will be applied to analyze and process the interaction data of the students in the experimental class as a group using Excel, Ucinet and NetDraw to explore the changes in the students' English translation level. This study adopts two most commonly used indicators of social network analysis-cohesion analysis and role power analysis-to analyze the dynamic and directed network formed by English translation activities.

The community graph is a diagram that reflects the whole situation of a network, the nodes in the community graph represent each group, the lines between the nodes represent the relationship between nodes and nodes, and the arrows represent the flow of information. The cohesion of the network is mainly expressed through the indicators of density, clustering coefficient and average degree. The community graph of students' English translation activities during the experiment is shown in Figure 3.

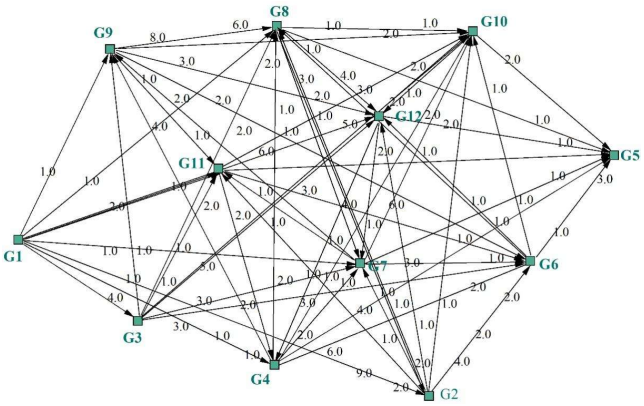


Figure 3: Translation activity community map

Combined with the above English translation activity community diagram, the basic attributes of the English translation social network are specifically shown in Table 7. It can be seen that the density of the social network formed by the 12 groups of the 48 students in the experimental class is 0.65, indicating that the network has 65% of the network connections, which is a relatively dense network, indicating that there is basically interaction among the groups. Each node in the social network has an average of 7.17 connections, indicating that each group basically interacts with other groups. The clustering coefficient of the network is 0.85, which indicates that the groups are very closely connected, forming a dense social network. The average distance between two points in the network is 1.3, indicating that each group in the network can reach another group through 1.3 groups, which is also a reflection of the network's close connectivity.

Table 7: The basic attributes of translation social network

Number	Attribute name	Attribute value
1	Density	0.65
2	Average degree	7.17
3	Reciprocity	0.87
4	Clustering coefficient	0.85
5	Average distance	1.3

Role rights in a network are primarily expressed through centrality. Centrality is a measure of the extent to which a node seeks to interact in a social network, i.e., the ability of a node to reach out to others in the network, and is generally expressed in terms of a node's point-degree centrality, mediated centrality, and proximity centrality. Among them, point degree includes point out degree and point in degree. Point out degree refers to the total number of other points to which the point directly points, and point in degree refers to the total number of points that directly point to the point. A node with high point centrality will have many direct connections to other nodes in the network and thus have greater power. In contrast, a node residing at the edge of the network is inactive in the relationship formation process. Both intermediate centrality and proximity centrality are concerned with controllability between nodes; the greater the intermediate centrality, the more important position the node occupies, and the greater its ability to control the spread of information; whereas the smaller the proximity centrality, the more the node resides at the core, and thus the more uncontrolled it is.

The table of centrality indicators for each group of English translation activities in the experimental class is specifically shown in Table 8. G1~G11 in the table represent each English translation activity group in the experimental class. The point-in and point-out degrees of all groups are relatively large, indicating that each group is more actively involved in the activity. Among them, G4 has the largest point-out, indicating that G4 outputs the most information and actively makes suggestions and comments to other groups; G2 has the largest point-in,

indicating that G2's translations are generally noticed by other groups. Overall, the point-in and point-out of each group is almost greater than the total number of groups except G2, indicating that each group is actively involved in the activity. The mediated centrality of G11 is the greatest, indicating that G11 is in a position of controlling the information in the English translation activity, and that the whole flow of information in the English translation activity is unlikely to be controlled by an individual group (the value of 3.43% is so small that it can be ignored).

Table 8: Centrality index table of each group in English translation activities

-	Degree				Intermediacy		Compactness			
	Point out degree	Point-in degree	The normal point out degree	Normal point indegree	Interme diateity	Non-intermedi acy	Depth of penetratio n	Point out the depth	Point-in tightness	Point out the tightness
G 1	12	16	11.11	14.82	0.62	0.56	15	18	73.33	61.11
G 2	7	29	6.48	26.85	2.86	2.6	12	16	91.67	68.75
G 3	17	21	15.74	19.44	2.64	2.4	13	16	84.62	68.75
G 4	30	14	27.78	12.96	6.1	5.54	15	12	73.33	91.67
G 5	12	11	11.11	10.19	0.6	0.54	17	16	64.71	68.75
G 6	23	10	21.3	9.26	3.06	2.78	14	13	78.57	84.62
G 7	19	18	17.59	16.67	4.45	4.05	14	12	78.57	91.67
G 8	25	19	23.15	17.59	4.74	4.31	14	11	78.57	100
G 9	13	20	12.04	18.52	0.76	0.69	16	16	68.75	68.75
G 10	12	12	11.11	11.11	2.39	2.18	15	15	73.33	73.33
G 11	14	22	12.96	20.37	6.71	6.1	11	14	100	78.57

Overall, after applying the English contextual teaching model based on VR panoramic video proposed in this paper in the experimental class, each English translation group interacted to form a reciprocal social network with no significant difference between the groups, and students were able to actively participate in English translation learning activities, which fostered the students' cooperation ability and promoted the optimization of students' learning performance. Hypothesis three was verified.

V. Conclusion

This paper combines virtual reality technology with university English contextual teaching, proposes an English contextual teaching model based on VR panoramic video, and applies it to real university English teaching to carry out university English contextual teaching experiments. Paired-sample t-test and social network analysis are used to analyze the results of the university English contextual teaching experiment.

Paired samples t-test was applied to explore the changes in the English scores of the experimental and control classes after the experiment with the quantitative data of the questionnaire. In terms of English scores, the post-test scores of the experimental and control classes have a mean value of 68.69 and 61.89 respectively, which is 6.8 points higher than the latter, and the overall English proficiency of the students in the experimental class has improved more significantly. The independent samples t-test of the post-test scores of the experimental and control classes shows that the probability of significance is 0.012<0.05, and there is a significant difference. In listening, vocabulary and grammar, reading, translation and writing of different English test questions, the mean values of the experimental class's scores were higher than those of the control class by 0.42, 2.65, 1.23, 1.07, 1.34, respectively, and there was a significant difference between the experimental class and the control class in the scores of

vocabulary and grammatical structures, translation and writing questions, with the P-values of 0.000, 0.038, 0.022, respectively, which were all lower than 0.05. The post-test scores of the experimental class and the control class were tested by independent samples t-test, and there was a significant difference. 0.05. Analyzing the results of the questionnaire on English independent learning ability of the experimental class, the mean values of the post-test scores of the experimental class in dimensions 1~5 are higher than those of the pre-test by 31.78%, 44.95%, 33.23%, 30.89%, and 40.01%, respectively, and the probability of significance of Sig. (two-sided) in the results of the paired samples t-test for each dimension and the total score of the questionnaire are all 0.000< 0.05, all showing significant differences.

The changes in the English translation level of the students in the experimental class were analyzed by social network analysis. The clustering coefficient of the English translation social network of the students in the experimental class is 0.85, and each node has an average of 7.17 connections, and the average distance between two points is 1.3, which proves that the formed social network is closely connected. The average distance between two points of the network is 1.3,which means that each group in the network can reach another group through 1.3 groups,which also reflects that the network is closely connected from the side. Among the English translation groups in the experimental class, except for G2, the point-in and point-out degrees of each group are almost greater than the total number of groups, which means that each group can actively participate in English translation activities.

To summarize, the English contextual teaching mode based on VR panoramic video proposed in this paper can effectively improve students' English proficiency and English independent learning ability, promote students' active participation in English translation learning activities, and virtual reality technology can play an active and positive role in university English contextual teaching.

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