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A Study on the Application of Virtual Reality Technology in English Learning

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Abstract

With the advent of Virtual Reality (VR) technology, educators have begun exploring its application in English language teaching to enrich students' learning experiences and enhance English language skills. This study adopts a quantitative approach to obtain statistical evidence for the effectiveness of integrating VR technology with vocabulary teaching. The empirical study results revealed that students who experienced VR technology prior to standard vocabulary instruction performed significantly better in vocabulary retention and use, compared to students who did not experience VR technology. These outcomes indicate the establishment of a positive feedback loop in vocabulary learning through the integration of virtual reality technology.

Keywords

Virtual reality, technological tool, English learning.

1. Introduction

In today's digital era, the field of education has been constantly exploring innovative teaching methods and technological tools to improve students' learning effectiveness and engagement. Virtual Reality (VR) technology, as an emerging educational tool, is gradually attracting widespread attention and interest. VR technology brings unprecedented opportunities to the field of education by simulating virtual environments and providing students with an immersive learning experience.

As an important language for international exchange and communication, the education of English has always been highly emphasized. Traditional English teaching methods have to a certain extent limited the development of students' language acquisition and communication skills. However, with the emergence of VR technology, educators have begun to explore how VR can be applied to English language teaching in order to enhance students' learning experience and the development of English skills. The purpose of this paper is to explore the application of virtual reality technology in English language teaching and to analyze in depth its potential for language acquisition, cultural exchange and communication skill development.

2. Literature Review

2.1. Current Status of Domestic Research

The Studies related to the application of virtual reality technology to language teaching by domestic scholars are relatively limited, mostly focusing on analyzing overall language proficiency rather than more specifically on the improvement of individual English skills or knowledge. Although we advocate the development of overall language proficiency from a macro perspective, we cannot cover everything in one class. In this case, it is indeed important to focus on specific English knowledge or skills from a micro perspective.

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Qiu (2006) envisioned a practice of using virtual reality-assisted modeling to teach Chinese to non-native speakers, arguing that it helps to enhance participation, facilitate communication, avoid excessive anxiety, and enhance comprehension input through an adjunctive pedagogical approach, which helps to integrate classroom instruction, individual instruction, and virtual reality learning. Wei (2009) further developed his proposal and extended it to the teaching of spoken English, stating that students can benefit from customized virtual contexts, natural interactions, shared learning spaces, and various experiential models. In addition, Zhu and Zhang (2011) have attempted to integrate virtual reality technology with business English programs. However, all of these have not yet been put into practice and are merely theoretical ideas. Zhang, Luo, Liu, and Shen (2015) attempted to develop a model for teaching marine engineering English based on virtual reality technology, aiming to create a sense of entertainment and immersion, reduce cognitive load, and ultimately improve the efficiency of marine engineering English learning. Wang (2018) explored the use of virtual reality technology in teaching English in elementary school. While recognizing the advantages of this cutting-edge technology, she pointed out existing problems related to teaching, technology, and administration.

Until 2017, more empirical studies were conducted, most of which were related to foreign language education. Shao and Wang (2017) applied virtual reality technology to Russian language teaching with the aim of integrating information technology with foreign language teaching. The results showed that immersed in the context of the source language, students were more willing to practice, more interested in learning, and showed better academic performance in Russian language learning. Li (2017) verified the possibility of using a virtual reality-based flipped classroom to improve students' English listening skills in journalism and then received positive feedback from students. There are also some advanced applications in English language teaching. Li (2018) demonstrated the effectiveness of using virtual reality technology in professional training for public speaking. It helps to train speakers to respond promptly to artificially simulated speech sounds, to build up linguistic knowledge and skills, and to deal with emotional experiences, psychological stress, perception and non-verbal expressions including gestures and eye contact. May (2019) explains how virtual reality can be used to enable interaction between learners and immersive business interpreting systems, ultimately ensuring more focused and improved fluency and accuracy performance in business interpreting. Considering the commonalities between interpreting and public speaking, Zhai (2019) combines them in virtual reality teaching and analyzes how the practice reduces feelings of unfamiliarity and anxiety, as well as stimulates student motivation and autonomous learning through the creation of a multimodal environment.

As can be seen, research related to the application of virtual reality technology to language teaching is relatively limited, mostly focusing on analyzing overall language proficiency rather than looking more specifically at the improvement of individual English skills or knowledge. Although we advocate developing overall language proficiency from a macro perspective, we cannot cover everything in one lesson. In this case, it is indeed important to focus on specific English knowledge or skills from a micro perspective.

2.2. Status of Research Abroad

Do In the United States, programs like Languagelab and, in the European Union, Virtual Language Learning through Entertainment Activities (VLL@GE) and Interpreting in Virtual Reality (IVY) have been Programs such as VLL@GE and Interpreting in Virtual Reality (IVY) were initiated under the Second Life framework to promote language acquisition for second language learners. Through games and multimedia dictionaries, second language learners can meet and communicate in virtual worlds (Ma & Chen, 2013; Liu, 2018). In France, UFR Lansad at the University of Lorraine also opened a virtual reality space to teach languages to non-

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specialized students (Chateau, Ciekanski, Molle, Paris & Privasbreaute, 2019). In addition, Spain developed SLRoute, a Massive Multi-User Online Learning (MMOL) platform, to help students have a better learning experience when learning Spanish (Lorenzo, Lezcano, Sánchez-Alonso, 2013).Bonner & Reinders (2018) provide some examples of how to integrate virtual reality technology to be integrated with language courses, such as using 360-degree videos in virtual reality to obtain more realistic presentations, setting the context of role-playing activities and introducing new topics through 360-degree videos in virtual reality.

In addition, there are some relevant specific and empirical studies. The use of virtual reality-assisted games to test students' performance in spoken English training. Simulating real-life situations makes the learning experience more realistic and more comfortable for students, which all contribute to increased learning confidence, rich communication (quantity), and high-quality language output (Reitz, Sohny, and Lochmann, 2016).Lee (2019) put forward the idea of using virtual reality to test the academic listening level of students, and found that there was no significant difference in the academic listening level of the control group and the virtual reality group there was no significant difference in terms of total scores, but students in the virtual reality group showed an advantage in terms of finding detailed information.Chen, Smith, York, and Mayall (2020) applied Google Earth virtual reality to expository writing and concluded that with the help of this technology, writing such as descriptive, compare and contrast, cause and effect, and enumeration writing Skills. Undoubtedly, this helped them to be more engaged in the writing course, and thus they had a positive attitude towards the virtual reality-based approach to teaching writing.

Compared with the development of applying virtual reality to language teaching in China, research in the Western world is more diverse in terms of language skills, covering speaking, listening and writing. However, reading remains a blind spot. In addition to language skills, more research could be conducted on language knowledge, such as the use of virtual reality technology to promote vocabulary building, the appropriate use of grammar, and the development of good pronunciation.

3. Methodology

3.1. Research Design

This study was conducted to obtain statistical evidence of the effectiveness of combining VR technology with vocabulary teaching in a quantitative way. A questionnaire was used to find out students' English vocabulary learning and their views on the application of VR technology to vocabulary teaching. It was ensured that the questions in the questionnaire were clear, concise and relevant to the purpose of the survey. The questionnaire was distributed electronically after identifying the group of students who needed to participate in the survey. Regarding the test, determine the specifics of the pre-test and post-test, including the content of the test, the type of questions, and the level of difficulty. Ensure that the two tests are similar in order to compare the progress of the students. During the implementation process, one group used VR technology to assist teaching and the other group used traditional teaching methods. Ensure that other variables, such as textbook, teaching time, etc., are controlled during the experiment.

3.2. Research Tools

3.2.1 Questionnaire survey

Questionnaires are suitable for situations where a large number of individual opinions need to be collected. In this study, all students operating virtual reality were required to fill out a questionnaire designed to find out about their current English vocabulary learning and their views on applying VR technology to English vocabulary teaching. The questionnaire included

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questions about current English proficiency, vocabulary learning habits, and the experience of applying virtual reality.

3.2.2 Testing

Tests were conducted before and after the experiment to obtain statistical evidence of the effectiveness of combining VR technology with vocabulary teaching in a quantitative way. There were two tests in total, i.e., one test before the experiment and one test after the experiment. The same English vocabulary test was administered to both groups of students before the start of the experiment in order to obtain baseline data on the initial level of the students. At the end of the experiment, the same English vocabulary test was administered to both groups of students to compare their progress.

4. Research results and analysis

Data from the pre-test and post-test of the experiment were analyzed through statistical methods (e.g., t-test) to determine whether vocabulary instruction incorporating VR technology statistically significantly improved students' English proficiency.

4.1. Analysis of the VR Student Questionnaire

The questionnaire distributed to the students was set according to the principles of Likert scale, which included a total of 20 questions, the first 7 questions were about the students' learning of English vocabulary now. From the 8th question to the 20th question is about students' perception of VR technology. The questionnaire was tested for reliability before it was distributed to more VR students, and the value of Cronbach's alpha was 0.804, which indicates that the questionnaire has good pairwise reliability.

Table1 Descriptive Analysis of Questionnaire

	Mean	Std. Deviation	N
Question1	4.0000	1.0465	50
Question2	4.7907	0.5588	50
Question3	2.2791	0.9341	50
Question4	3.3023	1.2447	50
Question5	3.0465	1.0224	50
Question6	3.4419	0.9587	50
Question7	3.4651	1.008	50
Question8	3.8372	1.3439	50
Question9	3.4651	1.3156	50
Question10	4.4651	0.5915	50
Question11	3.0930	1.4771	50
Question12	3.0233	1.4391	50
Question13	4.1628	0.9494	50
Question14	3.6297	1.2728	50
Question15	4.0465	1.1329	50
Question16	3.8372	1.3261	50
Question17	3.5116	1.2026	50
Question18	3.7907	1.2641	50

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Question19	4.0001	1.1547	50
Question20	4.0233	1.2628	50

According to Table 1, the average score (or mean) and standard deviation of each question can be seen. The researcher divides the mean of each question into 4 groups. The mean of Questions in Group 1 is more than or equal to 4; that in Group 2 is more than or equal to 3.5 but less than 4; that in Group 3 is more than or equal to 3 but less than 3.5; that in Group 4 is less than 3.

Questions in Group 1 (mean > = 4) show that most of students agree with the statement, referring to Question 1, 2, 10, 13, 15, 19 and 20. To be more specific, they believe that learning English is interesting (Question 1); vocabulary plays a crucial role in English learning (Question 2); the sound of Cardio VR is clear (Question 10); the language level of Cardio VR is appropriate (Question 13); Cardio VR provides the context (situation) to learn English vocabulary (Question 15); they are willing to use other VR applications except for Cardio VR (Question 19); they hope teachers can introduce such VR applications as Cardio VR in future English vocabulary teaching (Question 20).

Questions in Group 2 (4 > mean > = 3.5) show that most of students give more than a neutral point of view, including Question 8, 14, 16, 17 and 18, which focus on the scene design (Question 8), the general feeling (Question 14), raised interest (Question 16) and boosted efficiency (Question 17) in learning English vocabulary after using Cardio VR, and willingness to recommend Cardio VR to other students (Question 18).

Questions in Group 3 (3.5 > mean > = 3) show that most of students give the generally neutral but still a little bit favorable standpoint, referring to Question 4, 5, 6, 7, 9, 11 and 12. Specifically, they are about the attitude whether they always know the

pronunciation of the words learnt before (Question 4); whether they always make mistakes concerning spelling of the words learnt before (Question 5); whether they always know the meaning of the words learnt before (Question 6); whether they always know how to use the words learnt before correctly (Question 7); whether Cardio VR has an attractive user interface (Question 9); whether Cardio VR is easy to operate (Question 11); and whether they feel dizzy (Question 12).

Only Question 3 is included in Group 4 (mean < 3), which convincingly demonstrates a majority of students think that they have problems when learning English vocabulary.

From these 20 questions, it is manifest to draw the conclusion that most of students realize that there are some challenges in daily vocabulary learning and their general attitude towards the application of VR technology to vocabulary teaching is positive.

4.2. Analysis of the test

In this study, independent t-tests were conducted by comparing the means and standard deviations of the experimental and control groups to determine if there was a significant difference between the virtual reality group and the control group.

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Table 2 Independent Samples t-test of Pre-test Results

Group	Mean	Std. Deviation	95% confidence interval of the difference	*t*	*df*	*P*
Control group	16.77	**2.04**	**-0.971 ~ 1.031**	**0.117**	**68**	**0.907**
Experimental group	16.71	**2.01**				

* p<0.05 ** p<0.01

Table 3 Independent Samples t-test of Post-test Results

Group	Mean	Std. Deviation	95% confidence interval of the difference	*t*	*df*	*P*
Control group	17.03	**1.93**	**-3.326 ~ -1.359**	**-4.75**	**68**	**0.000****
Experimental group	22.37	**2.18**				

* p<0.05 ** p<0.01

The result of Pre-test (refer to Table 2) shows that the standard deviations of the control and experimental groups are statistically near to each other (2.04 and 2.01), indicating that the internal dispersions of the English scores of the students in the two groups are also approximately the same. Additionally, the value of p is 0.907, much larger than 0.05, which shows that there is no significant difference between the control and experimental group in the pre-test scores, and the average English competence of the two groups before the experiment is very close.

The results of this pre-test highlight that both the experimental group and the control group exhibited relatively low scores with no significant discrepancy. This implies that students' English proficiency was comparatively inadequate at the outset of the study. These preliminary findings serve as a crucial baseline for our subsequent experiments, where we will investigate whether the implementation of VR technology can lead to a noticeable improvement in students' English language abilities, particularly in the context of translation skills. This study aims to evaluate the effectiveness of VR technology in enhancing English vocabulary learning and translation abilities, offering valuable insights and data support for educational practices.

The results of the Pre-test (refer to Table 3) indicate notable distinctions between the control and experimental groups in terms of standard deviations, with values of 1.93 and 2.18, respectively. This suggests that there are indeed variations in the English scores of the two groups of students following the experiment. Furthermore, the p-value is calculated to be 0.000 ($p<0.05$, $t=-4.753$), signifying a statistically significant difference.

This significant difference in the post-test scores between the control group and the experimental group underscores that the VR teaching intervention had a substantial impact. Specifically, the post-test scores of the experimental group, which received VR-enhanced

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instruction, were found to be significantly higher than those of the control group, which underwent traditional teaching methods.

These results provide strong evidence supporting the effectiveness of VR technology in enhancing English language learning outcomes, particularly when compared to conventional teaching methods. The statistically significant difference highlights the potential of VR as a valuable tool in educational practices, emphasizing its ability to improve students' English language proficiency.

5. Conclusion

In order to understand students' and teachers' perceptions of integrating virtual reality technology with English vocabulary teaching and the statistical evidence for this practice, the researchers conducted a substantial amount of work, including a literature review on vocabulary mastery, virtual reality technology, technology acceptance model, multimodality, cognitive load theory, and national and international literature review on integrating virtual reality technology and language teaching and learning, as well as an empirical study. Eventually, some major findings are summarized.

First, the practice of integrating virtual reality technology with English vocabulary teaching was supported by teachers with different work experiences. Teachers understand the importance of English vocabulary in learning and spare no effort to use various ways to improve the efficiency of vocabulary teaching. They preferred to apply virtual reality technology for vocabulary teaching not only because VR technology provided a context-based teaching environment, but also because of the positive effects of multimodal VR applications, such as more engagement and improved learning efficiency.

Second, students widely accepted this practice. Although some students felt a bit dizzy, most of them acknowledged that this innovative teaching method stimulated their curiosity while helping them become more enthusiastic about learning vocabulary. In addition, the multimodal approach to vocabulary learning mobilized different sensory organs, increased the associated cognitive load, and ultimately left a lasting impression.

In addition, the results of the empirical study showed that students who operated the virtual reality technology prior to regular vocabulary instruction performed better in terms of vocabulary retention and use in both short-term and long-term memory than students who did not operate the virtual reality technology. According to the SPSS analysis, there was a significant difference between the scores obtained by the virtual reality group and the control group on the three posttests. Thus, when virtual reality technology is applied to teachers' English vocabulary instruction, a virtuous cycle is created. In conclusion, it is feasible and beneficial to apply virtual reality technology in teaching English vocabulary in junior high schools.

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