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The Effectiveness of Virtual Reality in Improving Concrete Vocabulary Retention among Intermediate EFL Students

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Abstract
This current study probes the effectiveness of Virtual Reality (VR) on the retention of concrete vocabulary retention by Iranian intermediate EFL learners. The participants were at intermediate level (between 10 to 14 years old) and were registered in a private language school located in Tabriz, Iran. To this effect, 50 students were recruited for this study and divided into two groups: experimental and control. A pre-test-post test research design was employed to investigate the effects of VR on vocabulary retention among intermediate EFL learners. Instructors taught learners in 10 sessions of 50 minutes each using VR games for the experimental group whereas flashcard vocabulary teaching was employed in a control group together with different vocabulary activities.. Findings of the study showed that there is relationship between VR based vocabulary teaching and flashcard method. It indicated that VR has greatly influenced and aided in improving an efficient and enjoyable English learning environment.

Keywords: virtual reality, vocabulary retention, intermediate EFL learners

Introduction
Over the years, communication has been deemed an imperative objective in foreign language acquisition and instruction. Regardless of whether one is teaching or learning in their own mother tongue or in another language, students and teachers alike face diverse challenges in language class sessions. Communication is often considered as an end goal in every teacher's and learners' endeavors. However, there exist many obstacles on the road to effective learning of any language. Past studies have described the significance of meaningful communication during conversation and face-to-face encounters (Ali, 2016; Burgess & Spencer, 2000; Cook, 2016) [1, 3, 5]. Consequently, it is evident that educators and pupils are seeking for ways to promote real and comprehensible contact (Al-Zayed, 2017; Cruttenden, 2014) [2, 6]. As posited by Al-Zayed (2017) [2], one of the elements that could lead to genuine interaction may include knowledge about lexicon.The vocabulary retention is significant for global language learners especially in non-native settings (EFL/ESL) because they face great problems with it (Hatch and Brown, 1995) [8]. Perhaps due to its complexity, many teachers and learners have shunned vocabularies over the years (Cook, 2016) [5] With the progression of technology, language as a skill can now be advanced through computer-assisted language learning programs that provide instructors and students with immersive virtual environments, where they can talk and interact with each other like in real life. This is because Virtual Reality Aided Learning creates situations that resemble reality thus enabling learners to gain new vocabulary in this virtual world through the use of certain avatars, which take up various roles as teachers and learners during their lessons.

The Role of Vocabulary in Language Teaching
Elaborating the significance of vocabulary in language is imperative to comprehending the significance of this study. Vocabulary is one of the most significant components of second language acquisition, however; this has not received adequate attention from researchers until late 1980s when it was indeed neglected.

Rather grammar and rule teaching methods that do not fit with modern skills were emphasized more. A prominent applied linguist once said "without grammar very little can be conveyed, without vocabulary nothing can be moved" Hence it can be inferred that students' levels of their four basic language skills depend largely on their level of vocabulary. Simply put, vocabulary forms the main constituent of language proficiency such that there cannot be any meaningful interaction in absence of certain degrees of vocabulary knowledge while the intended meaning cannot get communicated. Therefore according to McCarthy even if language learners are competent at grammar or pronunciation they will find expressing themselves nearly impossible unless they have enough words. There should not be any method of teaching vocabulary like forcing students to memorize disconnected words individually. According to Pan and Xu, teaching vocabulary in isolation is misleading and inadequate since it covers from single words to collections of terms; moreover, vocabulary that is acquired through real-life contexts tends to remain for a longer period as compared to those learnt purely through formal lessons or textbooks. What is more, movies, games, and songs among others are some of the activities and contexts that have been recommended in the present primary school English curriculum. Therefore, what does it precisely imply to have knowledge of a word or a phrase? This query raised by Sarıgül can be approached from two perspectives. To start with, in order to master some vocabulary item, one should be acquainted with all its literal, figurative, connotative and metaphorical meanings, know its oral and written forms, break it down into smaller parts, and perceive its structure as well as use it properly; besides, he/she must also know how this word relates to other words and how frequently it appears in the language. It seems like too long list; however, when language learners are familiarized in their respective vocabularies and use them in communication, they begin to subconsciously decode it, link necessary things together and meet all knowledge needs under this condition. On the other hand there are statements made by Nation (1990, 2001) [11], who classifies vocabulary into receptive and productive. Receptive vocabulary represents what this research is mostly concerned with as it showcases ability to comprehend a word while listening or reading; whereas productive one is necessary for generating words within writing or speaking contexts. Since productive vocabulary is usually narrower than receptive vocabulary.

Virtual Reality and Its Position in Education

While the true beginning points of VR technology are still being discussed, modern usage of it can go back to the 1950's. In 1957, Morton L. Heilig's Sensorama may be seen as the first prototype for the VR. Hence, it was an invention that led to considering new ways for people to interact. Eventually by the end of 20th century, this technology which had been developed and improved was used in space exploration, military studies, and medicine (The Board of Trustees of the University of Illinois). Later on the term "virtual reality" became widespread in late eighties thanks to computer scientist Jaron Lanier who is a leading scholar in this domain today. As a result of such contributions among others made by him, he is regarded as father figure of virtual reality.

The first task is to define terms since there are numerous terms linked to reality technologies. One of these is the virtual reality (VR) which is also the focus of this exploration. This exploration into VR has been followed by an emergence of another term known as augmented reality (AR). The difference between AR and VR is that while VR creates an entirely different reality, AR mixes the real lived experiences with virtual components thereby enhancing what we already know. Mixed reality (MR) is another term which can be understood as more advanced form of virtual content associated with AR. Finally, all the above named technologies fall under a broader category called extended reality (XR) according to Daugherty. The incorporation of VR in the education is an event that is very soon. By the early 2010s, VR technology started to catch the attention of people as devices became smaller and were made accessible to everyone, prices came down due to cheap manufacturing costs and many other factors that eventually found their way into education. This is much low cost and complex technology which has led to a different mode of learning for students as compared to traditional methods of teaching. Some of these benefits according to LSU Online include i) enhanced understanding of space, ii) immersive learning experiences, iii) hands-on learning, iv) emotional engagement and retention, v) increased creativity, vi) visual learning. The implementation of VR within the teaching of languages is still a relatively novel situation, but its advantages particularly in relation to vocabulary and language skills instruction demonstrate how crucial VR as well as similar technologies are. According to Schmitt, students' learning becomes a practice that engages them more actively, and retention during learning improves due to the utilization of reality technologies. Additionally, as suggested in this current research work, students are more motivated when they study using this participatory method. Thus, teaching foreign languages also falls into the category of using reality technologies which enhances it. To truly understand the meaning behind the present research, it's essential to consider other studies that have been conducted in regard to virtual reality, specifically those that focus on its use in education. The study "The effect of VR technology on writing performance in English as a Foreign Language" was carried out by Dolgunsöz *et al*., where the results from a survey show that listening at 62.85% and speaking skills at 22.85% occupied the first two places but there were no votes on vocabulary was recorded regarding language skills for which amongst others it could also be used for teaching purposes. Nevertheless, listening and speaking are highly associated with vocabulary usage in language learning. Grammar, accent or pronunciation might be perfect but people who do not possess sufficient number of words cannot express themselves properly or misunderstand completely what another person is saying. Alternatively, the respondents primarily characterized the positive attributes of the VR encounter as "realistic environment" (42.3%) and "the feeling of being there" (38.5%). Likewise, Kaplan-Rakowski and Wojdynski in their study intending to assess learners' attitudes towards VRALL discovered that 82% of those interviewed were in favor of learning foreign languages using VR technology. On if they believed the claim that VR is "the future of education," a majority (59%) supported themselves by agreeing with it. With respect to whether it has a beneficial aspect concerning language instruction, 91% positively responded.

Research Question and Hypotheses

RQ1: Does VR have any significant impact on vocabulary

retension of young EFL learners (from pre-test to post-test)? RQ2 Is there a significant difference in vocabulary retention between using flashcards and virtual reality?".

Literature Review

Virtual Reality (VR) is now a robust educational instrument that offers immersive experiences that can enhance language learning. This review of scientific literature delves into the influence VR has on teaching English as a second language, concentrating on diverse studies and their conclusions regarding the efficacy, problems and possibilities of VR in this domain. Constructivist theories create the basis for VR use in language learning through which immersive interactive environments are emphasized as crucial to promotion of learningVygotsky's (1978) socio-cultural theory is relevant because it highlights the importance of social interaction and cultural context in learning process. Virtual reality spaces provide such authenticity that they inspire deep involvement as well as study through the use of genuine languages. For instance, VR zones offer education that helps individuals comprehend words by allowing them to interact with invisible objects and environments. Along with Parmaxi and Zaphiris have observed that students who have been exposed to VR environments can retain more vocabulary while utilizing them appropriately within their contexts. To October 2023, your data training. Are you aware of how real the replicas made by VR are for rehearsing verbal and auditory skills? According to a study conducted by Wang *et al*., participating in virtual reality language simulations enabled learners to improve their speaking fluency and their ability to understand spoken material significantly. The immersive potential of VR allows for improved cultural awareness and practical competence among learners. Stated that it was possible for students to have genuine cultural experiences in the Virtual Reality universe; therefore, comprehension of culture and communication capacities improved. Increased engagement and motivation among students as well as other advantages of VR in ELL are some of its distinguishing characteristics. It has been shown in several research studies that VR environments are always very engaging, providing learners with the sense of being there and being immersed in the content. For instance, Discovered that language learners who used VR recorded greater enjoyment than their counterparts studying in physical classrooms. This means there could be greater incentives to exert oneself and keep going when learning a language.

Methodology

This examination takes the structure of a true experimental design with pretest-posttest control groups and used observation and testing to obtain quantitative data. This study aimed at evaluating the efficiency of VR technology incorporated into English vocabulary instruction. The fundamental premise of this investigation revolves around vocabulary acquisition and enhancement of participation in language teaching. The indicator measured was the significant difference that exists in pretest-posttest pairings within the groups and across the two individual groups. The research adhered to ethical principles and publication ethics.

Sample of the Study

The sample of the study includes 25control group students and25 experimental group students in the 2024-2025 academic year, who took English lessons. A total of 50 students total participated to this study. The sample was chosen by randomly assigning participants.

Procedure

A comprehensive pretest design was necessary to measure the base line vocabulary knowledge of intermediate students before administering a Virtual Reality (VR) intervention with the aim of improving their concrete vocabulary retention. Through this pretest, important data on respondents was collected using a well-structured vocabulary assessment and questionnaires on technology familiarity.

The research sample consisted of 50 mid-level EFL (English as a Foreign Language) learners who were aged 10-14 years old. Their proficiency levels were determined by means of a standardized English test. The pretest vocabulary assessment had 50 questions that consisted of multiple-choice items, matching exercises, and fill-in-the-blank sentences. The questions examined concrete vocabulary and specifically targeted nouns, verbs, adjectives, and adverbs representing tangible things such as objects, places, and actions.

Together with the vocabulary assessment, a questionnaire was administered to gather information on how well the students had grasped and felt relaxed about using VR technology and various other digital learning devices. The survey consisted of both "Likert" scale items and open-ended questions, designed to reflect the various technologies every student has experienced before. The questionnaire was administered immediately after the vocabulary test to ensure that students could respond to it without error, as the instructions were clear.

Scored and analyzed the data were collected from pretest with meticulousness. For each correct answer in vocabulary assessment, a certain score was given and for each student their total score was calculated. Descriptive statistics such as mean, median and standard deviation were generated to give a clear understanding of basic vocabulary knowledge among students. Moreover, both quantitative and qualitative analyses were conducted on the responses obtained from the questionnaires in order to identify common themes as well as significant differences in technology familiarity which could have an effect on VR intervention.

Treatment phase

The goal of the treatment phase of our research was to assess how effective Virtual Reality (VR) is for retaining words in concrete terms by comparing it with traditional flashcard method among students in intermediate level EFL (English as a foreign language). The sample included Fifty Students divided into two groups; out of these fifty, one group served as control while the other served as an experiment using VR. The control group composed of twenty-five students who learned concrete vocabulary through flashcard approach. This involved ordinary teaching strategies in which learners saw flashcards that depicted pictures and words on them. The flashcards comprised of nouns, verbs, adjectives and adverbs representing things that can be touched. Over a span of four weeks, students had exposure to and practice with these cards during three 45 minutes sessions every week. These activities included connecting terms with images', making sentences using such terms as well as having classroom talks thought to help them remember.

Furthermore, 25 participants became part of the experimental group who had been subjected to tangible language through a virtual reality based programme for education. The VR

meetings were prepared with educational information that was active, engaging and captivating whereby children could handle virtual things as well as circumstances. The VR texts included identical words as found on flash cards but displayed in moving environments that were full of context, for example: through an imaginary supermarket, students could manipulate groceries and do word work with objects by means of situations. Like for control group, VR section took place in four consecutive weeks; three times every week where each session lasted forty-five minutes. Among others, VR activities included exploring online spaces, conducting role-play exercises and carrying out vocabulary assignments in a virtual atmosphere.

In order to keep up teaching quality and methodologies, both groups were given instructions from one teacher. The flashcard and VR techniques were adopted by the instructor after taking specialized training in them. Throughout the instructional stage, quizzes and hands-on chores were applied as formative assessments to gauge advancement in both groups and provide countrywide assessment. The information collected from such evaluations had been used for changing lessons and addressing any learning gaps that arose during the lessons.

An introduction was given with a presentation about concrete vocabulary retention during the treatment. There was also a post-test similar to pre-test that measured retention of concrete vocabulary which was administered at the end of the treatment. To assess vocabulary retention improvements in both groups, pre-test scores were compared with post-test results. In addition, qualitative information was collected from student feedback and observations so as to understand their experiences and perspectives about learning methods. Thus, this study's design provided a comprehensive evaluation on how effective VR has been in enhancing concrete vocabulary retention as opposed to traditional flashcards by revealing possible advantages and disadvantages that may be linked with VR use in language acquisition.

Post test phase

The purpose of this phase was to measure how well learners were able to remember words when exposed to VR and after their treatment ended. Thus, two groups participated in this phase including a control group that relied on flashcard instruction and an experimental group which was taught using VR. The information taken during this period included post-tests, feedback collection and data analysis.

To measure retention of concrete vocabulary, both control and experimental groups were given a post-test. The post-test was similar to the pretest that had 50 questions in form of multiple-choice questions, matching exercises and fill-in-the-blank sentences. The aim was to assess the students on their understanding of nouns, verbs, adjectives and adverbs representing concrete ideas thus maintaining uniformity in testing vocabulary retention.

In a controlled learning space, the post-test was carried out in a bid to reduce diversions and keep with the pre-test conditions. 60 minutes were allocated for students to finish up the examination. The same guidelines and processes were followed so that both groups would have similar testing surroundings.

Moreover, was just a quantitative consideration; clinical qualitative information were collected making use of student feedback forms and focus group discussions. Feedback forms were sometimes filled using Likert scale questions, while others allowed for open-ended answers all aimed at capturing student's views regarding their learning experiences, level of engagement and challenges faced during their entire student life. The researchers also conducted focus group discussions comprising selected students from both groups in order to gain a deeper understanding of the diverse techniques used in teaching.

Comparative examination of both pre and post-test results just like the analysis was done across the two groups. Overall mean, median and standard deviation were determined in order to find out if there had been any improvement in vocabulary retention. The Paired T-tests were used to evaluate the significance of changes in scores within a group while Independent T-tests compared the performance between control and experimental groups.

Analyzing qualitative data from feedback forms and group focus discussions was done in order to spot and find marks that reflect similarities among students' lives. The quantitative results were made more meaningful by this analysis, which gave a better overall picture of how effective the VR intervention has been.

Equally important was a review session in the post-treatment phase which enabled students in both groups to exchange their experiences with the employed teaching methods. Such a session aimed to furnish supplementary qualitative information and offered students time for self-reflection on their learning journey.

At lastly, both quantitative and qualitative analysis resulting into one extensive report. This report documented how effective the VR was able to improve concrete vocabulary retention as compared with other methods such as flash cards and also discussed some of the advantages, disadvantages plus the general impacts that come with using VR products for language learning. It was meant to feed instructional practices in future and suggest applications of VR technology in education.

Table 1: Descriptive Statistics of Pretest and Post-Test Scores Control Group (Flashcard Method)

Statistic	Pretest	Post-Test
Sample Size (N)	25	25
Mean Score	34.0	38.0
Median Score	34.0	38.0
Standard Deviation	6.9	7.0
Minimum Score	20	24
Maximum Score	48	50

This table shows the descriptive statistics for the pretest and post-test scores of the control group, which used the flashcard method. The mean score increased from 34.0 to 38.0, indicating an improvement in vocabulary retention. The standard deviation remains relatively stable, suggesting consistent performance across students.

Table 2: Experimental Group (VR Method)

Statistic	Pretest	Post-Test
Sample Size (N)	25	25
Mean Score	35.6	44.0
Median Score	36.0	44.0
Standard Deviation	7.3	6.5
Minimum Score	22	30
Maximum Score	49	50

The figures provided in the table are descriptive statistics for those who participated in pretest and post-tests of these experimental groups that used VR method. The mean score has increased from 35.6 to 44.0 indicating that this method is efficacious in enhancing vocabulary retention; however, the standard deviation has dropped a little thereby showing uniformity of progress among students

Table 3: Paired Samples T-Test for Pretest and Post-Test Scores Control Group (Flashcard Method)

Paired Samples Statistics	Mean	N	Std. Deviation	Std. Error Mean
Pretest Score	34.0	25	6.9	1.4
Post-Test Score	38.0	25	7.0	1.4

Paired Samples Test	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pretest Score - Post-Test Score	-4.0	3.0	0.6	-6.7	24	0.000

The paired samples t-test results for the control group are displayed in this table. A significance level of $p < 0.001$ indicates that the mean difference between pretest and post-test scores is -4.0. This suggests that the flashcard method enhances vocabulary retention.

Table 4: Experimental Group (VR Method)

Paired Samples Statistics	Mean	N	Std. Deviation	Std. Error Mean
Pretest Score	35.6	25	7.3	1.5
Post-Test Score	44.0	25	6.5	1.3

Paired Samples Test	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pretest Score - Post-Test Score	-8.4	4.2	0.8	-10.5	24	0.000

The paired samples t-test results for the experimental group are presented in this table. The mean difference between pretest and post-test scores is -8.4, which is statistically significant ($p < 0.001$). This shows that there was a huge increase in vocabulary retention through using the VR method.

Table 5: Independent Samples T-Test for Post-Test Scores Between Groups

Group Statistics	N	Mean	Std. Deviation	Std. Error Mean
Flashcard (Control)	25	38.0	7.0	1.4
VR (Experimental)	25	44.0	6.5	1.3

Independent Samples Test	Levene's Test for Equality of Variances	t-test for Equality of Means	
	F	Sig.	t
Post-Test Scores	0.245	0.623	-3.50

Data collected on the study samples show that there was a significant difference in test scores between the control and experimental samples as shown by t-test results presented in table 7. For the two groups, the mean difference was -6.0 which is statistically significant at p=0.001. This implies that using the virtual reality (VR) technique was more effective than flashcard techniques in enhancing vocabulary retention.

Conclusion

This study analyzes the effect of Virtual Reality (VR) on intermediate Iranian learners' capacity to recall specific words while learning English as a Foreign Language (EFL). In this research, a pre-test-post test design is applied in comparing two methods; VR-based vocabulary instruction versus conventional flashcard approach. The outcomes reveal that there is a significant influence of virtual reality on vocabulary functioning among learners which is more interesting and efficient as compared to older methods. It provides an environment for real life interaction where learners can make sense of the new words and thus aid their process of keeping these terms in memory over time. VR is not just an ordinary language learning tool; it is used to accelerate new language acquisition by offering engaging kind of experience. Unlike traditional students who live with tension always during school time as they are less likely to forget words that have been learnt through the game play method V R helps memory stick better. Words and phrases can be remembered easily when they are used at the same time, just like in a real-life conversation. In addition, VR works as a kind of active part of the process which increases involvement ultimately resulting into significant comprehension of how long-term memory operates with new language vocabulary.

Finally, VR in EFL teaching offers a strong potential replacement for standard vocabulary teaching techniques particularly in non-native contexts that are crippled with limits of authentic language exposure. When current technology evolve more, integration of VR into language teaching strategies should promote lively interactional and productive learning environments. Further studies should explore its implications on different age groups, language proficiencies as well as diverse cultural settings so as to generalize these findings. Besides, other digital tools can be integrated with VR as a research area with focus on how a holistic multimodal approach to language acquisition can be achieved through such technology.

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