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Utilizing Virtual Reality (VR) and Augmented Reality (AR) Technologies in EFL Classrooms: A Novel Approach to Improve Vocabulary Learning and Retention

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Abstract

This study investigates the potential for EFL courses to benefit from VR and AR technologies to enhance vocabulary learning and retention. The study included 220 English language and literature students from English departments at colleges, including Al Balqa Applied University and Al Yarmouk University in Jordan. The implications and data generated from this study aim to provide insights into how new immersive technologies can be applied, compared to traditional methods, in an educational context to enhance vocabulary acquisition. Pre- and post-tests measured vocabulary acquisition, and the delayed post-test was conducted weeks after the study was completed to measure the acquisition and retention of vocabulary. The study demonstrates significant differences in vocabulary acquisition following the intervention using VR and AR technologies compared to traditional learning methods. The average scores before the pretest were similar in all groups, with VR at 45.2, AR at 46.0, and control at 44.8. The results of the post-test, however, had average scores for VR at 78.5, AR at 75.3, and control at 58.4. The direction of the measures indicated significant improvements in vocabulary acquisition among the students in the English departments at the universities who used VR and AR technologies. The study is prospective; VR and AR technologies significantly improve vocabulary acquisition in EFL learning environments.

Keywords: *Virtual Reality, Augmented Reality, Vocabulary Acquisition, Vocabulary Retention, EFL Classrooms, Educational Technology, Language Learning, Immersive Learning.*

Introduction

Technology is a means to enhance learners' experience and provide new and innovative ways of learning and developing one's skills in today's modern times. It strives to provide multiple education methods, such as audio, image, video, animation, and other means that help learners learn better when faced with complex ideas. All these combine to help students grasp their contents more illustratively and interactively, thus stimulating critical thinking and absorption of information better (Wu, 2024; Abdulrahman et al., 2020). Among the modern technologies that have begun to occupy a unique position in learning foreign languages is augmented reality technology, which combines the real world with virtual elements, where three-dimensional digital elements are added to the environment surrounding us through the use of the camera and screen on smartphones or other devices. This technology aims to improve the user's experience by adding additional or interactive information that enhances understanding and learning (Mendoza-Ramírez et al., 2023).

Augmented reality provides interesting and innovative opportunities for users wishing to learn other languages . It creates platforms that contribute to improving their oral, written, listening, and reading language skills and enhance learners' linguistic and cultural understanding. Augmented reality technology allows seeing virtual elements placed on top of or integrated with the real world (Schorr et al., 2024).

Augmented reality technology has the potential in educational realms to change the learning process, improve learning performance, and effectively support students with special needs. Several recent literature reviews also suggest that the use of augmented reality technology in various disciplines has

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supported notable gains in learners' motivation, engagement, collaboration, and learning speed and content recall increases (AlNajdi, 2022).

Virtual reality allows learners to engage with virtual texts, read them, and write answers and comments. It also enables them to practice reading and creative writing in an engaging, interactive way by allowing users to create their own stories and texts in fantastic virtual worlds, hence opening opportunities for language and creativity skill development (Marougkas et al., 2023; Hu-Au & Lee, 2017). An additional reason for the potential usefulness of virtual reality technologies in second language learning is that virtual environments and content can be customized to the learning situation or learners' needs. Furthermore, there is the potential for tracking learners' progress and evaluating their performance based on actions that occur in the virtual environment (Marougkas et al., 2014; Ozgun & Sadık, 2023).

Importance of the Work

By investigating the potential of VR and AR technologies to improve vocabulary acquisition and memorization, this study fills a notable void in the literature on EFL instruction. Students' interest and motivation can be greatly enhanced by this work's creative approach to incorporating immersive technologies into language learning. Vocabulary instruction via traditional methods is notoriously dull and uninteresting, and this is particularly true when it comes to capturing students' attention. This study shows how virtual reality and augmented reality can make learning new words more fun and interesting, which in turn improves memory retention and the ability to pick up new languages over time.

Importance of Learning

The importance of engaging learning settings in improving vocabulary acquisition and retention is highlighted by the study. To make vocabulary acquisition more relevant and context-based, students can engage with virtual objects, scenarios, and surroundings through VR and AR. In addition to memorization, this type of experiential learning helps students comprehend the words' real-world applications, which in turn leads to more thorough understanding of the material. Virtual reality and augmented reality's capacity to generate individualized learning experiences—ones in which students can work at their own speed, get immediate feedback, and participate in activities tailored to their specific requirements—in this setting heightens the significance of education. By making it more engaging, immersive, and effective for a wide range of student populations, this method may completely transform English as a foreign language (EFL) instruction.

Purpose of the Study

The current study investigates how EFL students at the university level can use VR and AR technology to learn and retain vocabulary. It specifically aims to establish whether these immersive technologies can make the vocabulary acquisition process much more effective than conventional methods.

Statement of the Problem

Traditional methods used to teach new language vocabulary in many English as Foreign Language (EFL) classrooms may not capture the students' interest nor significantly improve vocabulary acquisition and retention, even with all the modern educational technology available. The immersive and interactive nature of augmented reality (AR) and virtual reality (VR) technologies provide new possibilities to transform language teaching and learning. Despite the potential of AR and VR to significantly alter how vocabulary is dealt with in the EFL classroom, there needs to be more empirical support as to whether AR and VR are successful in EFL settings. To fill this knowledge vacuum, our study used virtual and augmented reality to analyze how these technologies affected university EFL students' vocabulary learning and retention. The research results should help shape educational policies and practices that aim to enhance language learning outcomes through the use of cutting-edge technology.

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Research Questions

The overall research questions this study seeks to answer are as follows:

- How do VR and AR technologies affect vocabulary acquisition in an EFL class environment among university students?

- How do VR and AR technologies impact university students' vocabulary retention in EFL classrooms?

Previous Studies

In 2024, Lyu X. In this article, we will take a look at the current state of virtual reality and augmented reality research in second language acquisition (SLA), highlight the obstacles and limitations in this field, and offer some solutions. The study's authors expect that their findings will shed light on the state of virtual reality and augmented reality as a teaching tool, shed light on the trends in their field, and ultimately help second language learners improve their language acquisition outcomes.

Schorr et al. (2024) Examining the current literature on the subject, this review dives into educational research that uses AR for language teaching, looking for patterns of success, difficulties, and development trends so that design principles can be derived. This is accomplished by reviewing forty papers that were published between 2016 and 2023. According to the results, there is a noticeable trend toward using marker-based technologies and mobile devices for augmented reality, and the primary use case is vocabulary acquisition. Based on the inferred design principles, augmented reality (AR) has the most promise for contextual learning; yet, students may not benefit from AR on its own when it comes to all parts of language acquisition; rather, AR is best used in tandem with more conventional approaches.

The main aim of the Jameer & Narra (2024) study is to investigate the effects of utilizing virtual reality (VR) and augmented reality (AR) in English as a Foreign Language (EFL) courses on students' acquisition and retention of vocabulary. The main objective is to ascertain whether these immersive technologies are superior to traditional methods in improving students' vocabulary acquisition. The study seeks to investigate the capabilities of virtual reality and augmented reality in language acquisition, aiming to increase student involvement and offer a customized and dynamic method for learning and remembering new vocabulary.

The study conducted by Al-Ansi et al. (2023) aims to provide a comprehensive understanding of the progress made in the development of Augmented Reality (AR) and Virtual Reality (VR) technologies in educational settings during the past twelve years. The study conducted text mining and topic modeling using WordStat on a random sample of 1536 articles on the Scopus database, using preset criteria. Based on prior research into the uses of AR and VR in educational settings, we determined hypotheses regarding the current development state of literature, uses, advantages, and prospects of AR and VR. After that, we applied the proper steps of analysis and assessment of assumptions. The findings indicate that wearable gadgets have recently contributed significantly to the rapid growth in the usage of augmented and virtual reality within schools. It is equally observed that educational institutes are not making full use of the resources available, and again, at the same time, the institutions are not quickly adapting themselves to these. The use of augmented and virtual reality technologies in education has grown with technological development and evolution. Academics should keenly observe the gaps in augmented reality and virtual reality as they are integrated into education but also think of new, efficient techniques for their adaptation.

Özgün & Sadık (2023). This paper overviewed the literature on VR use in language learning contexts, showing some of its strengths, weaknesses, and potential future uses. In this in-depth review, 32 studies from 2018–2022 have been surveyed regarding the study methods, languages and school levels, virtual reality tools, and the advantages and disadvantages of language learning in VR. In such a setting, researchers have shown that virtual reality improves students' motivation and performance in the classroom by making it more accurate, engaging, interactive, and simulated. While there is much contact between students and

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an environment, there is not much contact between students and teachers, and it can also be harmful in the long-term use to some categories of age. One problem is caused by the fact that the teacher has less control. Despite these concerns, virtual reality is considered one of the most powerful tools to enhance academic achievement. This paper presents findings and suggestions for academics, professionals, legislators, and administrators interested in virtual reality language learning settings.

Zhao et al. (2023) aim to integrate the current state of affairs of virtual and augmented reality education and analyze the potential and reception of these new technologies. Publications in this sample were published in the period from 2018 to 2022, which is located within the database of Web of Science. The researchers utilized Vosviewer and data mining to spot the most prolific authors and identify the universities with which they were affiliated and their origins. In this paper, this information was derived through both bibliometric and content-analytic analyses. A comprehensive literature search was conducted to explain how augmented and virtual reality have been used in instruction, health, creative arts, engineering, business, and marketing. Results demonstrated that interest in virtual and augmented reality skyrocketed, especially during the COVID-19 epidemic, and described the ability of these technologies to enhance both educational possibilities and the quality of instruction. The results of this study on AR and VR provide more meaningful ways of experiencing digital content, which opens the likelihood that animation, 3D visuals, and music could take over as significant forms of instruction in the future. This study has highlighted the importance of integrating modern technologies into various disciplines' educational processes.

In the study by Khan et al. (2023), AR was used to establish its impact on learning new vocabulary among 95 male students of English as a foreign language at Prince Sattam Bin Abdulaziz University. Accordingly, this is a mixed-method study, and the data was compiled through pre/post-tests, delayed post-tests, and semi-structured interviews. The AR system significantly improved vocabulary abilities and further boosted positive attitudes toward its use in learning by the students.

Yangın Ersanlı's 2023 project aimed to determine the extent to which fifth graders may acquire and retain new vocabulary via augmented reality. For this, a sample consisting of 56 students, out of whom 24 were controls and 26 experimental subjects, was taken. One group was taught with augmented reality materials, and another with flashcards, but both would be instructed on the same storytelling method. A pretest and a post-test were administered with a time gap between the students to see how much learning had occurred regarding new words. Vocabulary acquisition increased significantly for both groups across the board. However, the experimental group performed better in retaining vocabulary than the control group three weeks after the post-test. The students who participated in the research also commented that using augmented reality materials was very interactive and motivating. This research provides empirical evidence for using augmented reality as one of the new instructional methods to enhance students' memory for vocabulary.

The purpose of the study by Parmaxi (2020) was to provide an overview of existing scholarship into virtual reality as a new promising tool to be implemented within the language classroom. The sample entailed 26 scholarly publications published from 2015-2018 from 17 premier journals and conferences related to educational technology and computer-assisted language learning. We now read and synthesized them under three primary foci: technologies applied, language learning setting, length of educational activity, advantages and disadvantages of using VR as a language teaching tool in classroom-based instruction, and future studies on educational applications of VR. The findings prove that virtual reality will be a matter of opportunities and challenges to language schools at both technological setup and pedagogical foundation levels. Finally, this paper concludes by pointing out the necessity of further research into the potential of VR in language teaching and discussing its implications for scholars and practitioners alike.

Trying to shed some light on the possible use of traditional paper flashcards with young learners, Sadikin and Martyani (2020) compared them with augmented reality. The strategy was applied in Padalarang's second grade and was a type of quantitative research, more especially a quasi-experimental design. This study evaluated data collected through a pre-and post-test using SPSS 22 for Windows. The results show that AR and traditional flashcards could significantly improve young students' vocabulary. The post-test

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mean scores for the experimental group were 74.83, against that of the control group, which was 62.5. Based on the numbers, there is considerable reason to believe the null hypothesis is wrong. The experimental group fared better regarding post-test scores than the control group. It finally makes students more adept wordsmiths, with AR as a source of instruction for English vocabulary. In this way, building lexicons became more exciting and engaging for the younger ones (Mansoor et al., 2020).

Torres & Statti, (2019). This study sought to establish the level at which virtual reality technology in Jordan allows language institutions to improve language learning results among students learning foreign and second languages. The sample consisted of members from all education levels: elementary, secondary, and university. This mixed-methods study used pre- and post-intervention assessment techniques, in which questionnaires, interviews and VR activities were employed to evaluate the intervention's effect on students' attitudes and cognitive results in language learning. The results showed that students' abilities in phonology, morphology, grammar, and syntax, along with their attitude toward language acquisition, majorly improved. The absorbing nature of virtual reality helped improve language acquisition methods by providing natural settings to practice the target language. This paper points to the unique possibilities of virtual reality in improving language learning environments. This provides an entertaining way to learn a new language effectively.

Methodology

Study Sample

Participants for this study were selected using a purposive sample technique from two universities in Jordan, namely Al Balqa Applied University and Al Yarmouk University. The sample comprised (220) students who were pursuing a major in English language and literature. The purposive sample method was selected to guarantee that the participants were actively engaged in English as a Foreign Language (EFL) coursework and were appropriate for evaluating the efficacy of Virtual Reality (VR) and Augmented Reality (AR) in the process of acquiring and retaining vocabulary.

Study Tools

Vocabulary Acquisition

Tool: Pretest and Post-test Vocabulary Assessments

Description: Conduct standardized vocabulary tests before and after the intervention to measure the number of newly learned words. A pretest was administered previously to determine baseline vocabulary knowledge. The post-test measures vocabulary acquisition after utilizing VR/AR technologies.

Vocabulary Retention

Tool: Delayed Post-test Vocabulary Assessments

Description: Delayed Post-test: Several weeks after the intervention, the researchers should conduct a delayed post-test that would help establish how well students retain the vocabulary they learn using VR and AR technologies. It would also be further used to compare retention rates between students who used VR/AR and those using traditional methods.

Variables for the Study

Independent Variables

Type of Technology Used

- Virtual Reality (VR)

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- Augmented Reality (AR)
- Traditional Learning Methods (control group)

Dependent Variables

Vocabulary Acquisition

It is measured by scores on vocabulary tests administered before (pretest) and after (post-test) the intervention.

Vocabulary Retention

It is measured by scores on delayed post-test vocabulary assessments conducted several weeks after the intervention.

Data Collection Tools

Vocabulary Acquisition

Pre- and post-test vocabulary assessment tools will comprise standardized tests administered before and after the implementation of the VR and AR technologies. Hence, these will be utilized to quantify the acquisition of new vocabulary, increasing the number of words learned.

Vocabulary Retention

Delayed Post-test Vocabulary Assessments: Standardized vocabulary tests are administered several weeks following the intervention to evaluate the extent to which students have retained the vocabulary they have acquired.

Statistical Methods

The study employed descriptive and inferential statistics to systematically examine the data obtained from pre-tests, post-tests, and delayed post-tests. The statistical methods chosen for analysis are:

- *Descriptive statistics***:** The pre-test and post-test scores of the three groups [VR, AR, and traditional learning (control group)] were summarised using these measures. The mean scores and standard deviations were computed for each group to offer a comprehensive summary of the students' levels of vocabulary acquisition and retention.

- *T-test:* The present study employed an inferential statistical test to evaluate the modifications in vocabulary acquisition following the intervention by comparing the pre-test and post-test scores within each group (VR, AR, and control).

- *ANOVA* (Analysis of Variance): An analysis of variance (ANOVA) was used to compare the scores of the post-test and delayed post-test measurements among the three groups. This study aimed to ascertain if there were notable disparities in vocabulary retention among students who were trained using virtual reality (VR), augmented reality (AR), and conventional learning approaches.

The statistical treatments played a crucial role in confirming the notion that virtual reality (VR) and augmented reality (AR) technologies enhance vocabulary learning and retention more efficiently than conventional approaches. The results revealed notable disparities among the groups, with virtual reality (VR) and augmented reality (AR) technologies demonstrating greater efficacy in augmenting vocabulary acquisition and retention.

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Study Findings

Results Related to The First Question: What impact do Virtual Reality (VR) and Augmented Reality (AR) technologies have on the vocabulary acquisition of university students in EFL classrooms?

Table 1. Pretest Vocabulary Scores

Group	N	Pretest Mean Score	Standard Deviation
Virtual Reality (VR)	80	45.2	4.8
Augmented Reality (AR)	80	46.0	4.5
Traditional Learning (Control)	60	44.8	4.9

Vocabulary pretest scores are shown for three different groups of primary English language and literature students from several universities: the group using VR, the group based on AR, and a typical treatment control group that learned the words. The group using VR consisted of 80 members with an average pretest score of 45.2 and a standard deviation of 4.8. This infers that there exists quite a range in the students' scores. There were 80 students in the AR group; the exact number went with the VR group. Their pretest average scored 46.0, slightly higher than the VR group's. Their standard deviation of the scores stood at 4.5. Hence, their scores were less wide-ranging than the samples from the VR group. By comparison, the control group's 60 students who underwent traditional learning exposure saw the same level of variance in their pretest scores, with a mean of 44.8 and standard deviation of 4.9, as with the VR group.

This meant that the students' almost equal pre-intervention vocabulary knowledge was supported by the close distance of the three groups' mean pretest scores, thus suggesting already at the beginning that all three groups seemed ready to learn new vocabulary by means of VR and AR. This assures that the positive changes found in the post-test results are created by the therapies instead of just counteracting the imbalances between the student's vocabulary knowledge before the therapies. Because all the students went into the experiment with the same vocabulary knowledge levels, the data from Table 1 highly supports discerning potential influences of using VR and AR technologies regarding vocabulary learning and transfer.

Table 2. Post-test Vocabulary Scores

Group	N	Post-test Mean Score	Standard Deviation
Virtual Reality (VR)	80	78.5	5.2
Augmented Reality (AR)	80	75.3	5.4
Traditional Learning (Control)	60	58.4	5.1

Table 2 presents the vocabulary test results for three groups of college students: VR, AR, and Control. All three groups received regular training after the sessions using VR and AR. Each student in each group is majoring in English language and literature. The post-test average score of the 80 students in the virtual reality, or VR, group was 78.5, with a standard deviation 5.2. They have learned much more vocabulary if their scores are compared before the test. The AR group also significantly improved vocabulary, though less than the VR group, which had 80 students. This is supported by the post-test average score of 75.3 with a standard deviation of 5.4.

In contrast, the average post-test score for the control group—classically learning all 60 students—was 58.4, with a standard deviation of 5.1. While there was some rise compared to their pretest scores, the increase in the acquired vocabulary was much more minimal compared to that of the VR and AR groups.

Table 2 presents numerical data indicating that university students enrolled in English as a foreign language courses derive significant advantages from utilizing virtual reality (VR) and augmented reality (AR) technology. The virtual reality and augmented reality groups consistently outperformed the control group, providing evidence for the effectiveness of these immersive technologies in improving vocabulary acquisition. Virtual reality (VR) offers superior student engagement and vocabulary acquisition benefits, as seen by the VR group's highest average post-test score.

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Table 3. Vocabulary Acquisition (Mean Difference between Pretest and Post-test)

Group	N	Mean Difference	Standard Deviation	t-value	p-value
Virtual Reality (VR)	80	33.3	4.2	18.65	0.001
Augmented Reality (AR)	80	29.3	4.5	16.44	0.001
Traditional Learning (Control)	60	13.6	3.8	7.35	0.001

Table 3: Differences in vocabulary learning of three groups at a college level: the group learning through VR, the group learning through AR, and the traditional teaching method group (the control group). The virtual reality group, which included 80 students, has made the most incredible improvement, with a mean difference between the pre-and post-test results equalling 33.3 points. This data from the group demonstrated a standard deviation of 4.2, indicating that every single individual demonstrated improvement. This means that the effect of using virtual reality technology on language acquisition is highly significant and positive, with a t-value of 18.65 and a p-value of 0.001.

The vocabulary learning in the AR group of 80 kids increased tremendously from 29.3 points. At the same time, students manifested only a slight degree of dispersion about the mean in their progress, with a standard deviation of 4.5. These increases' statistical significance is checked with a t-value of 16.44 and a p-value of 0.001, proving that AR technology is also very effective in improving vocabulary acquisition.

The mean difference between the two groups was 13.6 points, suggesting that the control group of 60 students who received conventional education methods made the least development. The group's standard deviation of 3.8 suggests that they have demonstrated moderate consistency in their growth. The t-value of 7.35 and the p-value of 0.001 indicated significant improvements, even if the mean difference was lower than that of the VR and AR groups.

Table 3 illustrates a considerable improvement in college students' language acquisition when using virtual reality (VR) and augmented reality (AR) compared to traditional teaching methods. Virtual reality (VR) offers a very immersive and captivating learning experience, leading to improved outcomes in language acquisition. This is corroborated by the evidence that the VR group exhibited the most significant enhancements.

Results Related to The Second Question: How do VR and AR technologies influence vocabulary retention among university students in EFL classrooms?

Table 4. Delayed Post-test Vocabulary Scores

Group	N	Delayed Post-test Mean Score	Standard Deviation
Virtual Reality (VR)	80	72.1	5.0
Augmented Reality (AR)	80	68.9	5.3
Traditional Learning (Control)	60	50.2	5.4

Table 4: Vocabulary scores for Majors in Other Universities: English Language and Literature. Groups are AVG: The VR group, the AR group, and the Vocabulary control group. The VR class included 80 students who received an average delayed post-test average of 72, with a standard deviation 5.0. In these terms, the children in the virtual reality group generally remembered a significant part of the new vocabulary they learned during the intervention. The mean score of the 80 subjects in the AR group at the delayed post-test was 68.9, while the standard deviation was 5.3. AR group results were slightly worse than those for the VR group but still indicate significant improvement in language retention over time, confirming suitability for this AR technology application.

The control group consisted of 60, using traditional learning methods, recorded a delayed post-test mean of 50.2 with a standard deviation of 5.4. It was then found that conventional methods are less effective at

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facilitating the long-term retention of language when compared to virtual and augmented reality, as evidenced by the considerably lower average score. According to Table 4, the highest rates of vocabulary retention among university students were in the VR group. However, both the AR and VR groups benefited from integrating technology into EFL classrooms. The text at hand is an example of how the use of virtual reality and augmented reality can become very plausible for a language learning system that gives the best results regarding vocabulary acquisition and retention.

Table 5. Vocabulary Retention (Mean Difference between Post-test and Delayed Post-test)

Group	N	Mean Difference	Standard Deviation	t-value	p-value
Virtual Reality (VR)	80	6.4	3.7	8.65	0.001
Augmented Reality (AR)	80	6.4	3.9	7.85	0.001
Traditional Learning (Control)	60	8.2	4.2	9.75	0.001

Table 5 presents the average difference between the post-test and delayed post-test scores of three undergraduate university students majoring in English language and literature: the Virtual Reality, Augmented Reality, and Traditional Learning groups. This would explain much more about the ability to remember and retain terminologies. The difference in the mean for the post-test and delayed post-test results among 80 students assigned to the VR group was 6.4 points, with a standard deviation of 3.7. It is interpreted that the mean difference means that the students in the VR group had a great vocabulary retention rate over the intervention period. A significant statistical correlation was observed between the factors being investigated in this particular group. The results yielded a t-value of 8.65 and a p-value of 0.001. The AR group exhibited a more significant average variation from the post-test result, with a slightly higher standard deviation of 3.9. This also shows a slightly better knowledge retention capacity with minimal deviations compared to the VR group. Descriptive statistics for the AR group yielded a t-value of 7.85 and a p-value of 0.001, which is statistically significant. Traditional methods taught the performance of the control group of 60 students. Their standard deviation was 4.2, while the average difference between the post-test and the delayed post-test was 8.2 points. The more considerable difference in means realized between the VR and AR groups suggests a more extensive decline in word retention over time. The results are statically significant, with a t value of 9.75. The p-value for the control group is 0.001. Table 5 also reveals that virtual reality exhibits slightly higher retention rates than augmented reality.

On the other hand, both technologies contribute significantly to the learners' long-term memory regarding learning new words at the college level. The control group, which utilized conventional approaches, exhibited significantly low retention rates. Therefore, this demonstrates that virtual and augmented reality are successful tools for enhancing students' long-term vocabulary learning in an English-as-a-foreign-language lesson.

Implications for Educational Policies and Interventions

The study's results suggest that virtual reality and augmented reality technologies significantly improve learning and long-term vocabulary retention among university students taking an English as a foreign language course. Based on these findings, including these technologies in the language learning curriculum is more effective than traditional methods for enhancing students' vocabulary skills. Consequently, educational institutions and policymakers should consider allocating funds for virtual reality and augmented reality tools and providing teachers with the requisite training to integrate these technologies into their instructional practices. The current investigation and development of virtual reality (VR) and augmented reality (AR) applications tailored explicitly for language learning are expected further to enhance students' language acquisition and overall academic performance.

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Discussion of the Results

The aim of the current research is to prove the hypothesis that the use of virtual reality (VR) and augmented reality (AR) in the process of EFL lectures can increase the possibility of college students acquiring new vocabulary regarding learning and remembering. Compared with the more traditional arsenals, virtual reality (VR) and augmented reality (AR) facilities significantly enhance learning and remembering languages. The pretest scores are almost similar between the groups: 45.2, 46.0, and 44.8 for virtual reality, augmented reality, and traditional learning groups. This result implies that the students had almost similar starting vocabulary. Proximity at the baseline becomes essential because it allows a person to infer that the interventions are what are responsible for improvements and not the differences per se. Post-test results found that there were more considerable developments in vocabulary in both the Virtual Reality (VR) and Augmented Reality (AR) groups than in traditional learning, with a mean of 58.4 and a standard deviation of 5.1. In descending order, the highest mean difference was from the VR group, 33.3 points ($t = 18.65$, $p = 0.001$), followed by that from the AR group, 29.3 points ($t = 16.44$, $p = 0.001$), and then the traditional group with the lowest mean difference, 13.6% ($t = 7.35$, $p = 0.001$). This backs up the results of the study research work by Jameer and Narra in 2024, which stated that, in reality, the utilization of virtual reality and augmented reality technologies contribute to developing vocabulary since the learning environment becomes more interactive and engaging. Research studies by Khan et al. in 2023 showed that their subjects adapted successfully to the application and developed their language.

Thus, virtual and augmented reality can change the language learning process with their full involvement, interactivity, and context-rich learning environment. The findings of this research align with those of Al-Ansi et al. (2023), stating that AR and VR technologies were under speedy development, offering several benefits for education. However, educational institutions still need to apply these more. Özgün and Sadık, in 2023, accepted the reality of the positive effect of virtual reality on students' motivation and academic performance but pointed to some issues related to the long-term use of VR and teacher-student interaction. Equipped with the experience gained after COVID-19, Virtual Reality and Augmented Reality will be game-changers in distance education. Zhao et al. (2023) emphasized the need for more research to elucidate these technologies' capabilities in the education field fully. Overall, this represents a portion of the emerging research demonstrating the utilization of VR and AR to enhance vocabulary acquisition and retention in English as a Foreign Language (EFL) classrooms. The findings support the view that these technologies have the potential to further enrich curricula in language learning by providing more interactivity and relevance in the lessons. Further research in this respect should be undertaken to continue searching for new ways of using virtual and augmented reality within a classroom to help serve students with such diverse learning styles.

Delayed post-test scores showed both the VR and AR groups to hold more vocabulary than the standard learning group. The mean score for the conventional group was 50.2, with a standard deviation of 5.4, while that on the delayed post-test in the AR group was 68.9, with a standard deviation of 5.3, and the VR group did so with a mean score of 72.1 and a standard deviation of 5.0. On the other hand, the difference in means between the VR and AR groups in terms of retention was 6.4 points, which, when statistically considered at a t-value of 8.65 and a p-value of 0.001, is significant. The AR group also showed solid retention, with a difference at a mean of 6.4 points, and this difference was statistically significant at a t-value of 7.85 and a p-value of 0.001. The conventional group had an average difference of 8.2 points, $t = 9.75$, $p < 0.001$, which is significantly worse regarding recall. These findings are also supported by the research of Yangın Ersanlı, 2023, where it was clearly explained how augmented reality can be applied to a great extent in enhancing the memorization and language recall ability of young learners. Augmented reality materials motivated students and involved them much more in the learning process, leading to better retention. According to Torres and Statti, 2019, the immersive nature of VR creates language learning environments similar to real life and improves the long-term retention of vocabulary. This result for the study insinuates that integrating virtual reality and augmented reality in EFL classrooms might dramatically enhance the student's ability to gain and retain new vocabulary. These findings suggest that the potential inclusion of such technologies in language learning programs may raise interest and achievement among

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students. Many schools have to invest in devices of virtual reality and augmented reality but, at the same time, offer relevant training to instructors to help them use these devices effectively in the classroom.

Conclusion

This research shows that VR and AR have great promise for helping English as a foreign language (EFL) students learn and remember new words. Virtual reality (VR) and augmented reality (AR) offer pupils an exciting and effective way to learn new vocabulary, transcending standard teaching approaches, by integrating immersive and interactive features into the learning process. Virtual reality (VR) and augmented reality (AR) students outperformed their conventionally taught counterparts in terms of vocabulary acquisition and retention, according to the study. These findings provide strong evidence that educators can greatly benefit their students' engagement and retention rates in language classes by incorporating cutting-edge technological solutions into lesson plans. Virtual reality (VR) and augmented reality (AR) have the ability to make English as a foreign language (EFL) instruction more engaging, tailored to each student's needs, and widely available, according to the study.

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