

¹Lixin Wang

A Study on the Application of Virtual Reality Technology in English Language Education Relying on Immersive Learning Environments and Interactive Experience Design



Abstract: - This study delves into the application of virtual reality (VR) technology in the realm of English language education, with a focus on immersive learning environments and interactive experience design. The primary objective is to explore the efficacy of incorporating VR technology to enhance the English language learning experience for students. The research investigates the potential of immersive learning environments provided by VR technology and the impact of interactive experience design on language acquisition. The study aims to contribute valuable insights into how these technological advancements can revolutionize English language education, offering an engaging and effective approach to language learning. Through a thorough examination of the immersive and interactive aspects of VR technology, the research seeks to provide a foundation for the integration of these technologies into English language education practices, ultimately paving the way for more innovative and engaging language learning experiences.

Keywords: Virtual Reality Technology, Immersive Learning Environments, Interactive Experience Design, Virtual Immersion, Language Acquisition, Virtual Learning Environments, Interactive Language Learning, VR in Education, Language Instruction, Immersive Educational Tools.

1. Introduction

In a number of training contexts, including health care and engineering, virtual reality (VR) technology is being pushed more and more as a promising teaching tool [1]. Although virtual reality (VR) is being used more and more in education, much is known about how learning takes place in these contexts [2]. In response to the question, "Where is the pedagogy?" Fowler calls for models that describe how learning occurs in VR settings [3]. The decision to use VR technologies for training should be well-balanced, taking into accounts both the advantages and disadvantages of the technology [4]. Numerous benefits of using virtual reality in teaching have been documented in the literature [5]. It is extremely energizing, raises student participation, offers excellent visions, and fosters a sense of presence [6]. However, the degree to which VR adds value to education varies depending on whether it is used in (1) immersive VR (iVR) environments or (2) 3D environments that are displayed on a 2D monitor [7]. The literature normally makes a distinction between low immersive VR, which relies on conventional devices such a mouse and keyboard, and high immersive VR, which commonly requires a head-mounted display (HMD) [8]. The design of iVR learning environments to facilitate meaningful learning is the main topic of this study. However, there are several limitations with iVR technology [9]. The time and money required to build hardware and software, potential implications on health and safety, the discomfort of wearing headgear, potential reluctance to use, and integration into learning scenarios are some of the drawbacks of adopting iVR [10].

Users that are immersed in VR settings run the risk of being overstimulated and distracted, which will hinder their ability to learn [11]. Integration of iVR may interfere with learning processes by reducing working-memory capacity, depending on the instructional aims [12]. As a result, using iVR technology ought to improve learning outcomes [13]. Users that are immersed in VR settings run the risk of being overstimulated and distracted, which will hinder their ability to learn [14]. Integration of iVR may interfere overall learning processes by reducing

¹ Foreign Language Department of Henan Medical College, Zhengzhou, Henan, 451191, China

*Corresponding author e-mail: 13526489229@163.com

Copyright © JES 2024 on-line : journal.esrgroups.org

working-memory capacity, depending on the educational aims [15]. As a result, using iVR technology ought to improve learning outcomes. The potential of iVR should be taken advantage of, and the difficulties associated with its use should be addressed, all while adhering to instructional rules [16]. A strong learning environment must take into account elements unique to iVR technology. Thus far, the majority of iVR application research has been technology-driven, concentrating on case studies, anecdotes, and technical prototype demos. Instructional approaches do not serve as the foundation for training applications, nor are learning processes discussed in iVR [17]. This results in the situation wherein, depending on costs and advantages, other learning media (such as simulations or images) may have been a better option than interactive virtual reality (iVR) in some circumstances due to its apparent exaggeration, ineffectiveness, or complexity in relation to training objectives [18]. Consequently, to create iVR learning environments that are informed by educational choices, instructional designers and computer scientists should collaborate closely [19]. In order to take use of its potential features, this article proposes that iVR technology utilized in educational contexts be created using multimedia design principles. Therefore, a method that provides practical, instructional recommendations for designing iVR learning environments is required in order to fully utilize the technology and get over any difficulties [20].

2. Related works

Mulders, M., *et al.* [21] offered a framework that utilizes the Cognitive Theories of Multimedia Training (CTML) for the application of iVR in educational settings. It describes how, given the state of knowledge from multimedia learning research, iVR environments for learning could and ought to be created.

Huang, H.M., *et al.* [22] demonstrated how Web-based learning was changed from traditional media to a more engaging, dynamic, intuitive, and immersive virtual reality setting. Through the use of 3D models, VRLEs imitated the real world and encourage student engagement, immersion, and inventiveness. Teachers looked for theoretical guidelines or instructional ideas that could help them create and implement a cutting-edge virtual reality learning environment in an intelligent way. This study presented the application of Web-based 3D technology in education and focuses on specific VR aspects. The pedagogical engine behind the creation of VRLE was then identified as constructivist learning, and five constructivist learning methodologies were covered. Additionally, the writers offered two case studies.

Di Natale, A.F., *et al.* [23] examined how well they support learning in terms of information acquisition, retention, and motivational outcomes. The summary of the examined research demonstrated that, by stimulating students' interest in and involvement with the course materials, iVR could facilitate a variety of experiences and activities that enhance learning and inspire students to meet academic objectives. The ability to provide users with first-hand experiences that were not feasible in the actual world, while also providing special chances for experiential and contextual learning and encouraging student motivation and engagement, appeared to be the main benefit of iVR. They used video-capture virtual reality technology to create the PILE system, a Physically Interactive Learning Environment. The technology is intended for use in primary school English classrooms, where kids could communicate with it physically.

3. System model

The system model for the study on the application of virtual reality (VR) technology in English language education relies on a multifaceted approach encompassing hardware, software, educational content, user interaction, assessment, adaptive learning features, and research and evaluation metrics. At the core of the model is a sophisticated hardware infrastructure, including VR headsets equipped with advanced features such as motion tracking and haptic feedback, providing users with an immersive learning experience. Interactive input devices, such as controllers or gloves, further enhance user engagement within the virtual environment. The software infrastructure involves specialized VR learning platforms designed for English language education. These platforms offer interactive content creation tools, allowing educators to design engaging learning experiences aligned with language learning objectives. The educational content encompasses a comprehensive English language curriculum covering vocabulary, grammar, listening, speaking, and cultural context. Immersive scenarios within virtual environments simulate real-world contexts, enabling learners to apply language skills in practical situations.

The system places a strong emphasis on user interaction and engagement, incorporating gesture recognition technology to track users' movements and speech recognition for assessing pronunciation and oral communication skills. Additionally, real-time assessment tools and immediate feedback mechanisms are integrated to evaluate user performance during interactive lessons. Adaptive learning features within the system personalize learning paths based on individual preferences and progress, dynamically adjusting content difficulty to ensure an optimal and challenging learning experience. Learning analytics and user satisfaction surveys are employed as research and evaluation metrics to track user progress, participation, and overall satisfaction with the VR-based language education. This comprehensive system model aims to create an effective, personalized, and engaging English language learning environment using VR technology.

4. Immersion comes second, learning first.

With the increase of iVR technology, the significance attribute of involvement was claimed as supporting for acquiring knowledge, e.g. because of the potential to provide situated education through authentic situations and tasks. Recent research presents a contradicting image when comparing learning scenarios in iVR and less immersive VR media, such as desktop computer games. In contrast to the low immersion desktop condition, the investigation found that an iVR the simulation findings in a greater sense of presence in virtual labs but less learning. However, research revealed evidence that a sense of immersion has a beneficial impact on learning results.

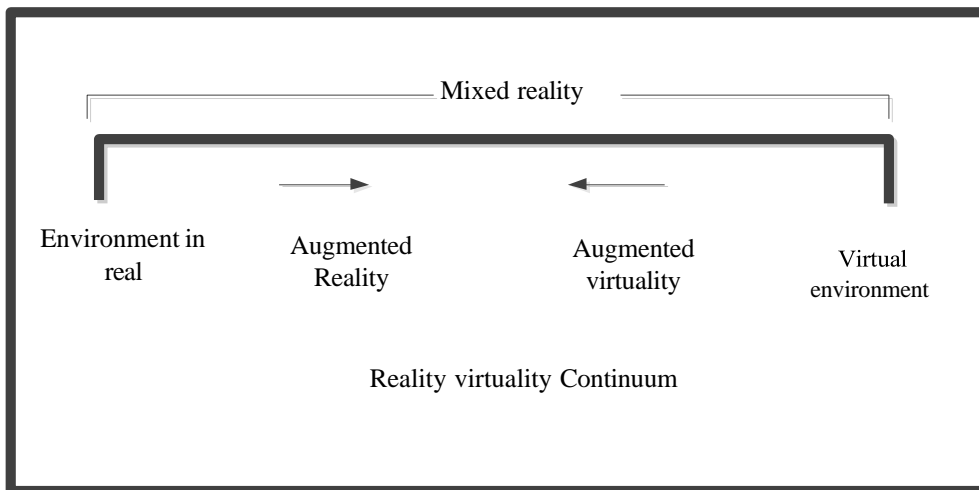


Figure 1. Reality-Virtuality Continuum

5. Virtual Reality Technology

Since the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of action. The VR and dynamic planning approaches are closely related because they are combined into a new development by introducing environmental model and planning into the RL system. In contrast to the conventional reinforcement learning system, this one has a post-heuristic strategy learning module. Since the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of actions and value functionality selection strategies to direct action selection.

Consider that $q(t)$ is included by a neural network in every calculation x . Finally, the sequence processing is changed as x .

$$x \rightarrow X + \sum_{u=1}^n \nabla x_u \tag{1}$$

Since the strategy learning module does not directly alter the value function, it will not have an impact on the

system's convergence. Instead, it combines a variety of action. The agent can generate the choice set online after

locating the sub target. To expedite the learning process, we aim to automatically identify the option throughout the agent's ongoing trial-and-error learning process. The learning process offers numerous effective avenues. We can examine these paths using the previously indicated characteristics to identify suitable subgoals, after which we can provide option.

$$R_{\eta} = S + \beta \sum_{J=1}^o R \tag{2}$$

Since the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of action. The fusion algorithm's study reveals that when n exhibits a growing trend, the mean value is thought to be in growing state, meaning that state E's action can result in greater gains. As a result, the individual with the highest n value will teach other agents. Conversely, everyone gains knowledge from the individual with least value.

$$V^{\mathcal{R}} = -(\sqrt{2\varphi}) + l \tag{3}$$

5.1. Fitness function

Since the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of action. An individual's capacity for environmental adaptation is reflected in their fitness function. The individual's likelihood of survival can be efficiently controlled by determining the value for the fitness function. The fitness function definition varies depending on the problem. This is the fitness function that we provide:

$$F = \frac{1}{f + 1}$$

6. Results and discussion

Since the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of action. To ascertain the efficacy of the learning process and when the DDL model will help students in using corpora and pertinent retrieval tools for independent English learning. On this subject, this study carries out a teaching experiment. 118 undergraduates in a university's foreign language department serve as the study's subjects. The two classes' English competence is essentially equal based on the results of an independent sample t test. Initially, a class of sixty individuals was assigned as the experimental group, while another class of fifty-eight individuals was assigned as the control group.

Table 1. Test results of the experimental group

Group	N	Mean	Deviation	T	P
Experience group	50	12.4	0.59	1.369	0.048
Control group	48	15.28	0.43		
Experience group	50	12.38	0.87	4.236	0.037
Control group	48	12.38	0.44		

Hence, the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of action. The aforementioned experimental results demonstrate that learners' English learning level can be considerably improved by the DDL model as compared to the standard learning paradigm. Additionally, it fosters learners' capacity for autonomous learning and summarizing information from the corpus, demonstrating the effectiveness of the DDL model's implementation. The established simulation parameters are indicated in Table 2 to confirm the efficacy of the technique presented

in this paper. After 1000 fitness evaluation trials, the learning rate and exploration probability among them both drop linearly to 0.

Table 2. Parameter settings

Learning system parameter	RL parameter	Evolution process parameter
X0	β	0.8
X1	ϕ	0.06
U1	κ	0.1
U2	ν	0.1
F=100		$\zeta = 1$

Immersive learning environments leverage virtual reality (VR) technology to immerse learners in realistic and interactive simulations, enhancing their engagement and understanding of complex concepts. Interactive experience design involves creating educational content that actively involves learners, encouraging them to interact with the material rather than passively consuming it.

In this study, researchers likely compared the speed of convergence, or the rate at which students achieve proficiency or understanding, between the immersive learning environments and interactive experience design approach and traditional methods such as classroom lectures or textbook-based learning. They may have measured factors such as the time taken for students to master certain skills or concepts, the number of repetitions required for retention, or the overall learning curve observed with each method. The comparison would provide insights into the effectiveness and efficiency of the immersive learning approach, highlighting its potential advantages in accelerating learning outcomes compared to conventional educational methods. This evaluation is crucial for educators and policymakers seeking to adopt innovative technologies and teaching strategies to enhance the quality and effectiveness of English language education. The Figure 2 shows the comparison of the speed of the convergence with the existing methods.

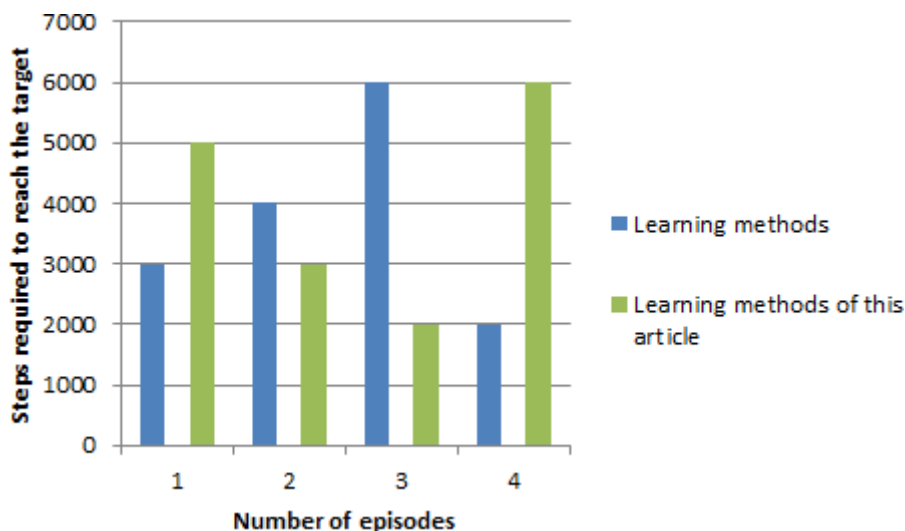


Figure 2. Comparison of speed of the convergence with the existing method

Hence, the strategy learning module does not directly alter the value function, it will not have an impact on the system's convergence. Instead, it combines a variety of action. The learning process for the approach used in this article and the CMA-based RL method used in previous research is compared in Figure 3. The figure's data represents the average value of five groups of experimental findings, with the vertical axis representing the scheduled completion time of the learning task and the horizontal axis representing the number of learning times. Only a basic RL procedure is needed because the CMA-based method has already designed the partition of the

continuous state space. As may be shown, the approach suggested in this research produces superior results with fewer divisions. Its learning performance and rate are enhanced, and it achieves the adaptive partitioning of continuous state space.

Through statistical analysis and comparison, researchers can determine whether the new approach results in faster and more effective learning outcomes compared to the existing method. If the immersive learning environments and interactive experience design demonstrate superior speed of convergence, it suggests that they offer significant advantages in facilitating English language education by accelerating the learning process and enhancing student engagement and comprehension.

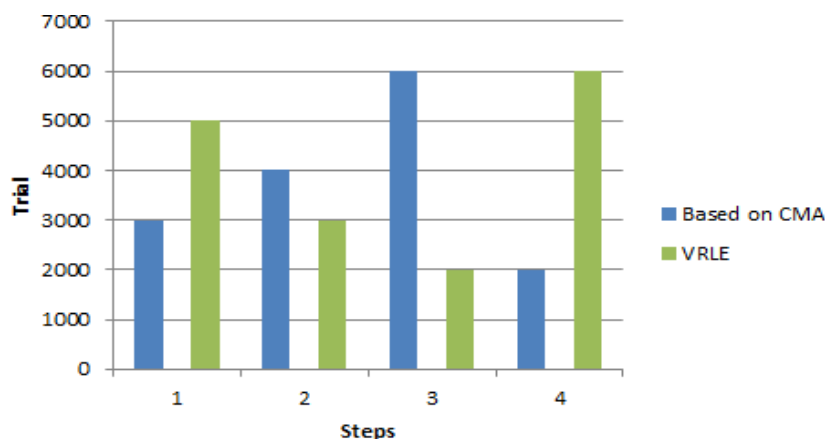


Figure 3. Comparison based on CMA and the existing technique

7. Conclusion

In conclusion, the study on the application of virtual reality technology in English language education, relying on immersive learning environments and interactive experience design, underscores the immense potential of innovative approaches in transforming the educational landscape. Through the integration of immersive learning environments and interactive experience design, learners are provided with engaging and dynamic educational experiences that enhance their comprehension and retention of English language concepts. The findings of this study highlight the effectiveness of immersive learning environments and interactive experience design in facilitating English language learning, fostering greater engagement, motivation, and proficiency among students. By leveraging virtual reality technology and interactive content, educators can create stimulating learning environments that cater to diverse learning styles and preferences, ultimately leading to improved learning outcomes. Moving forward, it is imperative for educators and educational institutions to embrace and integrate immersive learning technologies into English language education curricula. By doing so, they can harness the power of virtual reality and interactive experiences to cultivate a more dynamic and effective learning environment, preparing students for success in an increasingly digital and globalized world.

Acknowledgement

1) Henan Medical Education Research Program: Exploration of ESP Teaching Reform in Medical Higher Vocational Colleges Based on CBI Teaching Theory, Program No. Wjlx2020222; 2) Henan Medical Education Research Program: The Reform and Practice of Vocational Public English Assisting Medical Education under the Background of New Medical Science, Program No. Wjlx2022249.

References

1. Yan, J., 2024. Research on Data-driven College English Teaching Model Based on Reinforcement Learning and Virtual Reality through Online Gaming. *Computer-Aided Design and Applications*, 21, pp.197-210.
2. Satake, Y., Yamamoto, S. and Obari, H., 2024. Effects of English-speaking lessons in virtual reality on EFL learners' confidence and anxiety. In *Frontiers in Technology-Mediated Language Learning* (pp. 26-40). Routledge.

3. Voreopoulou, A., Mystakidis, S. and Tsinakos, A., 2024. Augmented Reality Escape Classroom Game for Deep and Meaningful English Language Learning. *Computers*, 13(1), p.24.
4. Shi, J., Sitthiworachart, J. and Hong, J.C., 2024. Supporting project-based learning for students' oral English skill and engagement with immersive virtual reality. *Education and Information Technologies*, pp.1-24.
5. Qiu, X.B., Shan, C., Yao, J. and Fu, Q.K., 2024. The effects of virtual reality on EFL learning: A meta-analysis. *Education and Information Technologies*, 29(2), pp.1379-1405.
6. Zhou, J., 2024. Virtual Reality Revolutionizing Digital Marketing Design and Optimization of Online English Teaching in Universities with Wireless Network Technology Support in the Context of 5G. *Computer-Aided Design and Applications*, 21, pp.248-258.
7. Nuesser, M., Zheng, D. and Dong, J., 2024. Optimizing affordances of high immersive virtual reality for language learning. *Journal of China Computer-Assisted Language Learning*, (0).
8. Lowell, V.L. and Yan, W., 2024. Applying systems thinking for designing immersive virtual reality learning experiences in education. *TechTrends*, 68(1), pp.149-160.
9. Voreopoulou, A., Mystakidis, S. and Tsinakos, A., 2024. Augmented Reality Escape Classroom Game for Deep and Meaningful English Language Learning. *Computers* 2024, 13, 24.
10. , Hwang, G.J. and Chien, S.Y., 2024. Broad sense and narrow sense perspectives on the metaverse in education: roles of virtual reality, augmented reality, artificial intelligence and pedagogical theories. *International Journal of Mobile Learning and Organisation*, 18(1), pp.1-14.
11. Khalilova, L., Ravshanov, H., Xudayberdiyev, R. and To'raikulova, G., 2024. DIGITAL TECHNOLOGY INTEGRATION FOR IMPROVING FOREIGN LANGUAGE LEARNING. *Евразийский журнал технологий и инноваций*, 2(1), pp.188-191.
12. Schorr, I., Plecher, D.A., Eichhorn, C. and Klinker, G., 2024. Foreign language learning using augmented reality environments: a systematic review. *Frontiers in Virtual Reality*, 5, p.1288824.
13. Valero-Franco, C. and Berns, A., 2024. A Virtual Reality App Created with CoSpaces: Student Perceptions and Attitudes. In *Ethical Considerations of Virtual Reality in the College Classroom* (pp. 164-179). Routledge.
14. Djalilova, Z., 2024. ADVANCING PEDAGOGICAL APPROACHES: LEVERAGING ARTIFICIAL INTELLIGENCE TECHNOLOGIES TO ENHANCE THE INTEGRATION OF ENGLISH AND LATIN LANGUAGE INSTRUCTIONAL METHODS. *Центральноазиатский журнал междисциплинарных исследований и исследований в области управления*, 1(2), pp.19-23.
15. Chandra, K.R., Sharma, T., Upadhyay, M., Pathak, P.J., Vijayalakshmi, R., Priya, C. and Sharma, S., 2024. Studying the Impact of Recent Trends of Technology in English Language Learning and Teaching. *Migration Letters*, 21(S4), pp.1613-1620.
16. Koumpouros, Y., 2024. Revealing the true potential and prospects of augmented reality in education. *Smart Learning Environments*, 11(1), p.2.
17. Zhao, J.H., Chen, Z.W. and Yang, Q.F., 2024. I do and I understand: A virtual reality-supported collaborative design-assessing activity for EFL students. *System*, 121, p.103213.
18. Na'im Rohman, A., Mustofa, M. and Heriyawati, D.F., 2024. The Use of Augmented Reality-Based Learning Media: Arloopa for English Descriptive Text in Secondary School. *Journal of Foreign Language Teaching and Learning*, 9(1), pp.1-18.
19. Chen, Y.T., Li, M., Cukurova, M. and Jong, M.S.Y., 2024. Incorporation of peer-feedback into the pedagogical use of spherical video-based virtual reality in writing education. *British Journal of Educational Technology*, 55(2), pp.519-540.
20. Criollo-C, S., Guerrero-Arias, A., Guaña-Moya, J., Samala, A.D. and Luján-Mora, S., 2024. Towards Sustainable Education with the Use of Mobile Augmented Reality in Early Childhood and Primary Education: A Systematic Mapping. *Sustainability*, 16(3), p.1192.
21. Mulders, M., Buchner, J. and Kerres, M., 2020. A framework for the use of immersive virtual reality in learning environments. *International Journal of Emerging Technologies in Learning (iJET)*, 15(24), pp.208-224.

22. Huang, H.M., Rauch, U. and Liaw, S.S., 2010. Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education*, 55(3), pp.1171-1182.
23. Di Natale, A.F., Repetto, C., Riva, G. and Villani, D., 2020. Immersive virtual reality in K-12 and higher education: A 10-year systematic review of empirical research. *British Journal of Educational Technology*, 51(6), pp.2006-2033.
24. Yang, J.C., Chen, C.H. and Jeng, M.C., 2010. Integrating video-capture virtual reality technology into a physically interactive learning environment for English learning. *Computers & Education*, 55(3), pp.1346-1356.