Virtual Reality-Assisted Language Learning

Subjects: Education & Educational Research

Contributor: Lianghui Wang

Virtual Reality (VR) refers to a three-dimensional (3D) environment generated by computer technology, which can provide a context similar to visual simulation and other senses. It allows users to communicate with people, machines, and other entities in the virtual environment by using computers and various devices. The dramatic reduction in the cost of devices and technology has driven a rapid growth of VR applications in educational fields such as medicine, science, and mathematics in recent years that has been proven to be positive. Learners feel the actual situation through sensory organs, which can help them improve their motivation, participation, and learning ability. Moreover, VR has also been applied to language learning and has shown the importance and potential of applications to support language learning.

meta-analysis virtual reality language learning VR-assisted language learning

1. Introduction

Language serves as a bridge between humans and society to communicate. With the growing trend of globalization, language education has also developed rapidly. For example, the recognized international language, English, has become a compulsory subject in many countries and regions [1]. However, language learning is a time-consuming and challenging process for many students as far as the current situation is concerned. The main reason for language learning difficulties is the lack of an authentic language environment, and learners cannot personally contact relevant contexts to use the target language to achieve learning goals [2]. That is, it is essential that language learners are provided an authentic learning environment and meaningful tasks [3]. The advancement of computer technology as a learning tool has provided new methods and created real-world environments to improve language learning [4]. As a novel technology, virtual reality (VR) has provided numerous alternative learning opportunities to language learners in the past decade [5].

2. Current Insights

Many studies have suggested the potential of VR-assisted language learning. However, there is little consensus on whether it can help improve language learning. Through integrating the finding of published empirical studies of VR-assisted language learning, the research provided concrete evidence on the overall effect sizes of VR-assisted language learning on students' linguistic and affective gain and how moderator variables influenced its effectiveness.

2.1. The Effectiveness of VR-Assisted Language Learning

Based on the results of 21 articles (N = 1144) in this meta-analysis, the researchers find evidence for the overall effectiveness of VR applications on students' language learning achievement, and the researchers also find an overall positive effect size of 0.662 and 0.570 on students' linguistic and affective gain, respectively, suggesting that VR can enhance students' language learning achievement compared to non-VR conditions. The overall effect size can be considered a medium effect [6], which is consistent with the findings of Wang et al. [7] that VR-assisted language learning can facilitate language knowledge acquisition and enhance affection. The positive findings related to VR-assisted language learning may be attributed to several features of virtual reality: (1) immersive learning can effectively promote language learning [8]; (2) improve language skills through interaction between VR and learners [5][9]; (3) effectively filter by authentic language learning settings (e.g., learning anxiety) [10][8]. The meta-analysis reveals the potential of using VR applications in language learning and provides teachers with options to support their teaching.

2.2. The Moderator Analyses of VR-Assisted Language Learning

In this research, the researchers identify six moderator variables and investigate how the design of the intervention influenced the effectiveness of VR-supported language learning. Although the overall results are positive, it should be considered that individual studies' results may vary by factors, such as control treatment, education level, hardware type, target language, language skill, L1/L2. However, the findings of this moderator analysis indicate that only one moderator (hardware type) is significant at $p < 0.01$. Compared to immersive devices, non-immersive devices have the most significant effect on linguistic gains. The reason for this is that long-term use of immersive devices affects learners' senses, such as dizziness [11]. Furthermore, students might only focus on the interesting content rather than the learning content, failing to achieve learning goals [7]. It also shows that the effect of immersive and non-immersive devices on learners' language learning can be compared in future research.

Regarding the control treatment, the researchers compared VR applications as a teaching resource with other types of teaching resources, including multimedia and traditional resources. The researchers do not find significant differences among the control treatment in this research and suggest that VR applications promote language learners' linguistic and affective gain compared to multimedia and traditional resources. Moreover, higher-education students are the main research subjects, consistent with some research on VR-assisted language learning [11][7]. The reason for this may be that most of the researchers who support language learning with VR come from colleges and may find college students easier than collecting relevant data in K-12 schools. While VR has a large effect on the linguistic gains of middle education and a medium-to-large effect on the affective gains of higher education students, these differences were not statistically significant in the different educational levels. Overall, the language learning of the different educational levels was positively influenced by VR applications, which is consistent with previous research results [7].

The findings of the moderator analysis indicated a large effect size for speaking than other language skills in terms of language domains. However, these differences were not statistically significant for different language skills. It should be noted that research on reading is lacking, which should be addressed in future research. At the same time, the result related to the target language and L1/L2 revealed that most studies on VR-assisted language

learning have focused on English as an L2. This may be because learning an L2 is far more challenging than learning L1 [12]. The results regarding this moderator suggest that VR technology could be used in both L1 and L2 learning, indicating that these have a good potential as an educational resource.

3. Conclusions

Based on the above analysis, several suggestions for VR-assisted language learning are put forward as follows:

First, future research should enrich the diversity of applications of VR-assisted language learning. The essence of VR-assisted language learning is VR technology designed to improve the effectiveness of language teaching/learning methods. Existing research should not be limited to higher education but should focus more on kindergarten and K-12 education. For example, Cerezo, Calderón, and Romero [13] adopted VR-assist language learning to help preschool children practice the pronunciation of basic English vocabulary. The results showed that VR-assisted language learning significantly impacted the children's motivation and improved their performance compared to traditional methods. Furthermore, most of the studies focused on vocabulary-related knowledge (e.g., vocabulary and writing) and a lack of grammar knowledge and reading skills. Language learning programs mainly involve English as a foreign language, with few studies having focused on learning other languages as a second or foreign language, and there has been little research related to native language teaching. Thus, future research should consider different languages with different skills to expand the diversity of VR-assisted language learning.

Second, future research should examine the effects of different VR devices on language learning. The results of the moderator analysis show that only the different device types had significant differences in this meta-analysis. Non-immersive devices performed better for students' linguistic gain than immersive devices. The existing studies have mainly compared VR with traditional teaching on language learning, and there is a lack of research on the effect of different VR devices in language learning. Therefore, it is worthwhile to examine the effects of different VR devices on language learning in future research.

Third, future research should not only focus on language knowledge acquisition and affective enhancement, but also focus on the development of higher-order thinking in the process of language acquisition. From these studies included in the meta-analysis, it can be found that the results of language gains are mainly obtained through post-intervention tests, and the analysis of emotional gain is mainly obtained through questionnaires. However, there is a lack of a deeper mechanism exploration of VR-assisted language learning, such as higher-order cognition or behavior evaluation. With the development of emerging technologies such as artificial intelligence and big data, more innovative approaches, such as learning behavior analysis, should be used to understand the nature of VR-supported language learning. For example, there has been evidence from neuroscience research to support immersion learning for L2 acquisition [14]. Future research should not only consider learning benefits, but also examine the development or changes in higher-order thinking or abilities.

References

1. McKay, S.L. English as an international language: What it is and what it means for pedagogy. RELC J. 2018, 49, 9–23.
2. Moeller, A.J.; Catalano, T. Foreign Language Teaching and Learning. International Encyclopedia of the Social & Behavioral Sciences, 2nd ed.; Pergamon Press: Oxford, UK, 2015.
3. Golonka, E.M.; Bowles, A.R.; Frank, V.M.; Richardson, D.L.; Freynik, S. Technologies for foreign language learning: A review of technology types and their effectiveness. Comput. Assist. Lang. Learn. 2014, 27, 70–105.
4. Hwang, G.J.; Fu, Q.K. Trends in the research design and application of mobile language learning: A review of 2007–2016 publications in selected SSCI journals. Interact. Learn. Environ. 2018, 27, 567–581.
5. Chen, Y.L. The effects of virtual reality learning environment on student cognitive and linguistic development. Asia-Pac. Educ. Res. 2016, 25, 637–646.
6. Cohen, J. Statistical Power Analysis for the Behavioral Sciences, 2nd ed.; Erlbaum: Hillsdale, NJ, USA, 1988.
7. Wang, C.P.; Lan, Y.J.; Tseng, W.T.; Lin, Y.T.R.; Gupta, C.L. On the effects of 3d virtual worlds in language learning—A meta-analysis. Comput. Assist. Lang. Learn. 2020, 33, 891–915.
8. Xie, Y.; Chen, Y.; Ryder, L.H. Effects of using mobile-based virtual reality on Chinese L2 students' oral proficiency. Comput. Assist. Lang. Learn. 2019, 34, 225–245.
9. Liaw, M.L. EFL learners' intercultural communication in an open social virtual environment. J. Educ. Technol. Soc. 2019, 22, 38–55.
10. Huang, H.L.; Hwang, G.J.; Chang, C.Y. Learning to be a writer: A spherical video-based virtual reality approach to supporting descriptive article writing in high school chinese courses. Br. J. Educ. Technol. 2020, 51, 1386–1405.
11. Qiu, X.Y.; Chiu, C.K.; Zhao, L.L.; Sun, C.F.; Chen, S.J. Trends in VR/AR technology-supporting language learning from 2008 to 2019: A research perspective. Interact. Learn. Environ. 2021, 1–24.
12. Lin, T.J.; Lan, Y.J. Language Learning in Virtual Reality Environments: Past, Present, and Future. Educ. Technol. Soc. 2015, 18, 486–497.
13. Cerezo, R.; Calderón, V.; Romero, C. A holographic mobile-based application for practicing pronunciation of basic english vocabulary for spanish speaking children. Int. J. Hum.-Comput. Stud. 2019, 124, 13–25.

14. Linck, J.A.; Kroll, J.F.; Sunderman, G. Losing access to the native language while immersed in a second language: Evidence for the role of inhibition in second-language learning. Psychol. Sci. 2009, 20, 1507–1515.