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Virtual Reality in Language Learning: A Literature Review of Empirical Studies in Recent Ten Years

Meng-Ya GAO & Chun-Ping ZHENG*
School of Humanities, Beijing University of Posts and Telecommunications, China
*zhengchunping@bput.edu.cn

Abstract: In the past decade, the application of virtual reality (VR) in language learning has attracted increasing attentions in the field of computer-assisted language learning (CALL). This research systematically reviewed 55 empirical studies focusing on the application of VR in language learning published by 11 high impact journals in and beyond China over the past decade (2010-2019). A coding scheme and analytic framework was defined to systematically analyze the general publication trends, including publication numbers, target languages, and research methods. Moreover, we summarized seven main research themes and analyzed the affordances and challenges of the VR applications in language learning. This systematic literature review fulfilled the need to map the current research status, and it also provided some insights for future research and development of VR in the field of CALL.

Keywords: Virtual reality, language learning, systematic literature review

1. Introduction

The application of emerging technologies for educational purposes has brought profound changes in the way students learn languages. Among them, the virtual reality (VR) technology has shown great potential in language education. It overcame the limitations of physical classrooms and provided immersive and simulated contexts for language learners, giving them an authentic environment to communicate in foreign language and experience diverse cultures in the virtual world (Shih, 2015). Besides, it integrated multiple interaction channels, such as video-based synchronous online communication, with simulated avatars and virtual reality systems (Shih, 2014). Due to the unique features of immersive contexts, multimode communication channels, and synchronous interactions (Lan et al., 2016), VR had attracted considerable attention in the field of computer-assisted language learning (CALL). In the past decade, several studies were conducted to explore the effect of the application of VR in language learning (e.g., Melchor-Coutor, 2018; Xie, Chan, & Ryder, 2019), but there are still few systematic literature reviews on the use of VR for language learning. Using the similar research method with previous study (Zheng et al., 2019), the current research kept track on the development of the application of VR in language learning and selected the latest studies from 2010-2019. Out of the need to map the current research status, 55 empirical studies focusing on the application of VR in language learning published by 11 high impact journals in and beyond China over the past decade were finally reviewed.

1. Research Design

1.1 Research Questions

Employing the systematic content analysis, the current research reviewed 55 empirical studies focusing on the application of VR in language learning published by 11 high impact journals in and beyond China from

2010 to 2019. It aimed to analyze the current status and future development of the application of VR in language learning by addressing the following research questions:

- What are the general publication trends of the reviewed empirical studies about the application of VR in language learning from 2010 to 2019?
- What are the research foci of the reviewed empirical studies about the application of VR in language learning from 2010 to 2019?
- What are the affordances and challenges of VR for language learning according to these empirical studies?

1.2 Data Collection and Analysis

Since the application of VR in language learning is still an emerging research topic with focused research groups, we mainly selected research articles published by the leading journals in the field of CALL. Based on previous studies (e.g., Hsu, Hung, & Ching, 2013; Shih, Feng, & Tsai, 2008), six high impact journals in the field of CALL beyond China were selected for this research. Five of them are Social Science Citation Index (SSCI) source journals, including: *Computer Assisted Language Learning* (CALL), *ReCALL*, *Computers & Education* (C&E), *Language Learning & Technology* (LLT), and *System*. Besides, *CALICO Journal* is also included as a very important and representative journal in the field of CALL. Then, "VR" and "language learning" were used as keywords to search relative publications in the China National Knowledge Infrastructure (CNKI) from 2010 to 2019. According to the research results, five Chinese Social Science Citation Index (CSSCI) source journals with relatively larger number of studies and high impact were selected, including: *Modern Educational Technology* (MET), *China Educational Technology* (CET), *Technology Enhanced Foreign Language Education* (TEFLE), *Open Education Research* (OER), and *Distance Education in China* (DEC). Researchers browsed the titles, abstracts, and keywords of all articles published in the 11 journals over the past decade (2010-2019), and finally selected 55 empirical studies focusing on the application of VR in language learning.

Following the coding system in previous research (Chai, Koh, & Tsai, 2013; Zheng et al., 2019), a coding scheme and analytic framework was defined to systematically analyze the general publication trends, including publication numbers, target languages, and research methods. Moreover, we summarized seven main research themes and analyzed the affordances and challenges of the VR applications in language learning.

2. Results and Discussion

2.1 General Publication Trends

Publication Numbers

As shown in Figure 1, the number of empirical studies published in 11 journals per year is between three to nine, which is still quite small, indicating that the relevant research is still in the initial stage. If looking at the change over the past ten years, the overall trend is to increase in the twists and turns, and 2019 witnessed the largest number of empirical research publications. We also counted the numbers of empirical studies published by each journal from 2010 to 2019, as indicated in Figure 2. Three journals, including CALL, ReCALL, and C&E, published relatively more empirical studies (not less than ten) concerning the applications of VR to language learning. Besides, it's obvious that the number of empirical studies published in domestic journals is far less than that of international journals. Therefore, we expect that more related empirical studies could be conducted in China in the next few years.

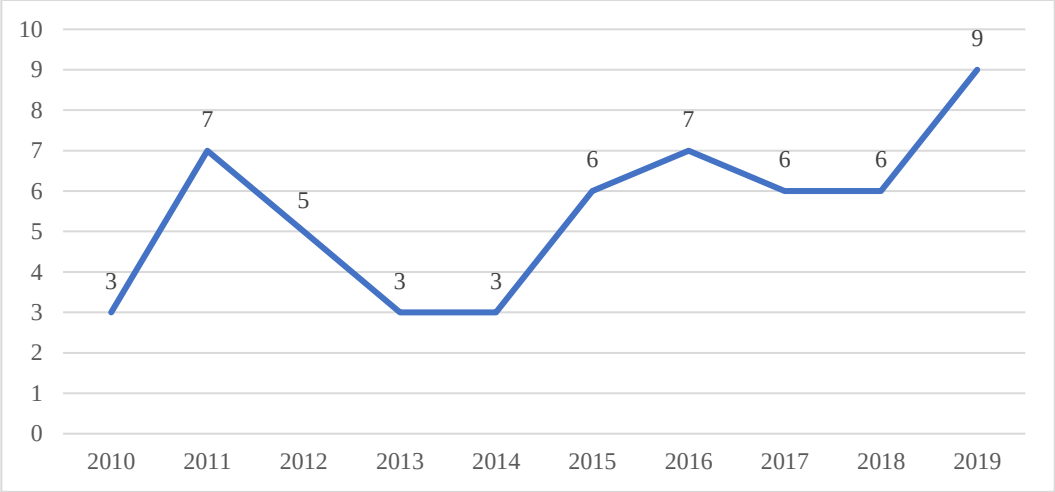

Figure 1. Numbers of empirical studies published by 11 journals (2010-2019)

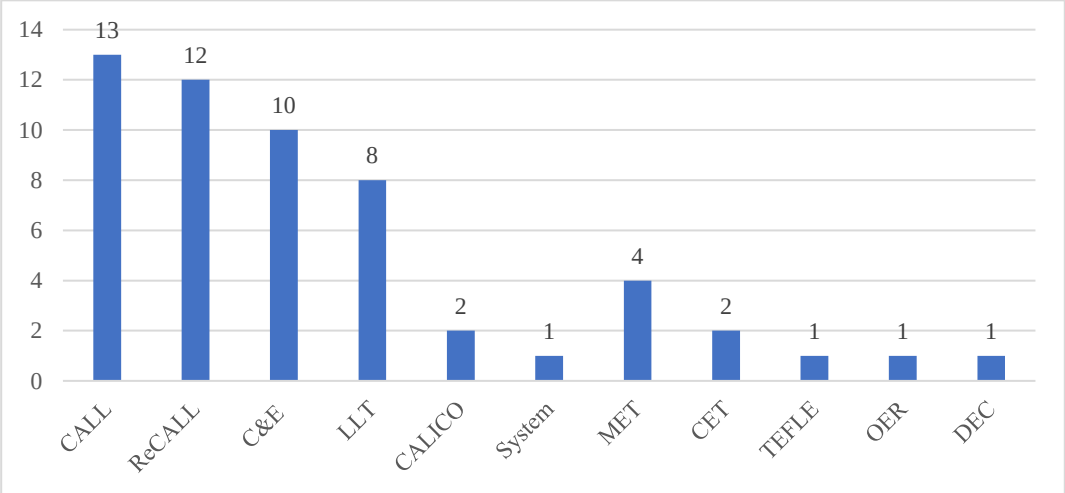

Figure 2. Numbers of empirical studies published by each journal (2010-2019)

Target Languages

In terms of the target languages, English is certainly the dominant language of the reviewed 55 studies. More than sixty percent of the reviewed articles (35 studies) targeted at the English language teaching and learning, in which, 31 studies focused on English only, while the other four studies focused on English and other languages at the same time. No one would deny that English has already become the lingua franca of the world (e.g., Lan, 2015). In addition, as illustrated by Figure 3, a few articles concerned the applications of VR in Chinese and Spanish language learning, with eight studies and seven studies respectively. Apart from that, very little research put attention on the less commonly taught languages learning with VR applications. However, we need to realize that in this globalization era, it is also crucial to preserve the cultural and linguistic diversity. VR could create authentic environment for language learners who lack context for language communication, and therefore be used for reviving languages in crisis (Dalton & Devitt, 2016).

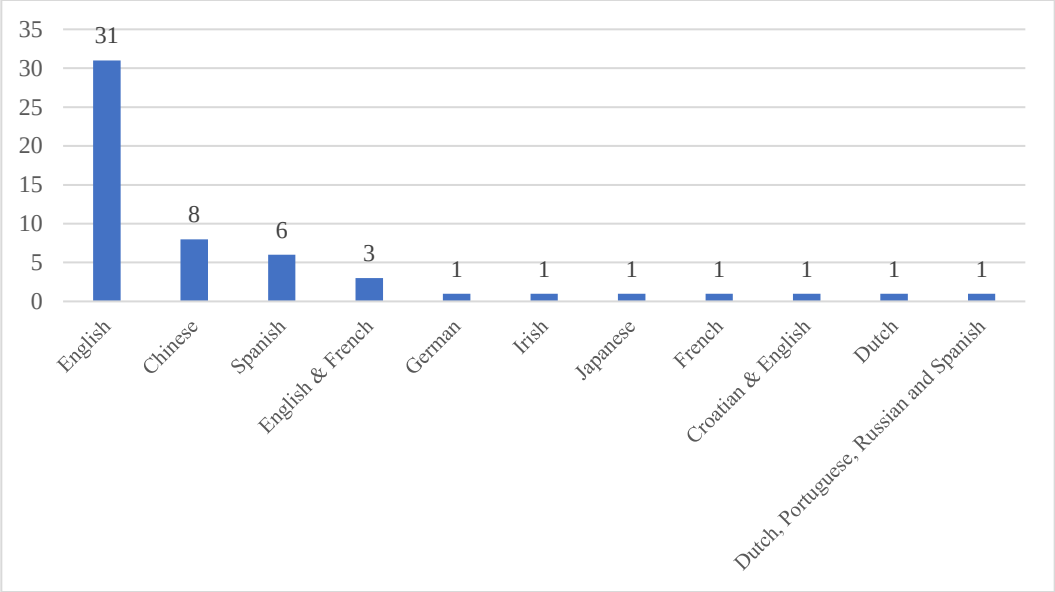

Figure 3. The target languages of the reviewed empirical studies

Research Methods

Among the empirical studies we reviewed, 29 studies (more than half of the total) employed the mixed research method, 18 studies and 8 studies employed quantitative method and qualitative method respectively, as indicated in Figure 5. It's not hard to understand the popularity of the mix methods in these studies. VR based virtual environment provided authentic contexts for language learners, and complicated interactions and multimodal communications happened in the language learning process (e.g., Mroz, 2015). In this situation, mixed method is a good choice to amend the inherent flaws of pure qualitative or quantitative method (Creswell et al., 2003). Both qualitative and quantitative data could be collected and analyzed, which enables researchers to have a more comprehensive understand of the issues.

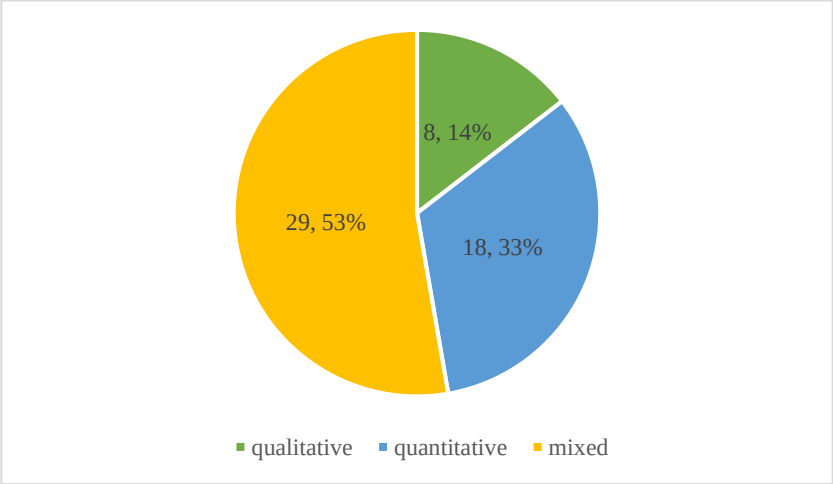

Figure 4. The research methods of the reviewed empirical studies

2.2 Research Foci

Based on content analysis, this research summarized seven main research themes, including language learner characteristics, affordances of VR for improving learners' linguistic knowledge and non-linguistic

skills, design features of language-learning tasks, the nature of interactions, design and development of VR platforms, and teachers' role and teacher development, as indicated in Table 1. Among the reviewed studies, several studies concerned more than one research theme. For instance, Mei and Zhu (2019) designed immersive embodied teaching environment and took the project-based teaching of business English, finding that the environment could improve students' learning efficiency and interpreting ability. In general, the most popular topic was language learner characteristics, such as learning engagement, learning efficiency, learning anxiety, etc. Besides, the affordances of VR for improving learners' linguistic knowledge and non-linguistic skills also attracted much attention. However, only three studies focusing on language teachers' role and development. There is no doubt that teachers play an important guiding role in the process of language learning, especially in the complicated virtual environments (Wang, 2015). Therefore, more empirical studies concerning language teachers' role should be conducted in the future.

Table 1. *Main Research Themes*

Main research themes	Number of empirical studies
Language learner characteristics	32
Affordances for improving learners' linguistic knowledge	31
Affordances for improving learners' non-linguistic skills	25
Design features of language-learning tasks	15
The nature of interactions	11
Design and development of VR platforms	8
Language teachers' role and teacher development	3

2.3 Affordances and Challenges of the VR Applications in Language Learning

The immersive and simulated contexts supported by VR made it possible for language learners to overcome the limitations of physical classrooms and freely wander in the virtual world to experience diverse cultures, and being fully engaged in the language learning activities (Peterson, 2012; Shih, 2015). Besides, some multi-user virtual environments (MUVEs) characterized by the avatar showed great potential to decrease learners' anxiety and improve their self-confidence for its anonymity (Melchor-Couto, 2018). In addition, these MUVEs offered multimodal interaction channels for language learners from different cultural backgrounds to interact with each other through texts, voice, and videos synchronously or asynchronously (Wigham & Chanier, 2015). However, there are still some challenges for the effective use of the VR application in language learning. On one hand, the limitation of the internet bandwidth (Levak & Son, 2017) and the cost of related high-quality computer devices (Chen, 2016) pose challenges in the accessibility. On the other hand, the cognitive load caused by the complicated operation of the virtual environment systems and the complexity of learning tasks design (Lan, 2014) present new challenges for its future applications.

3. Conclusion

Employing the content analysis method, this study systematically reviewed 55 empirical studies focusing on the application of VR in language learning published by 11 high impact journals in and beyond China from 2010 to 2019. A coding scheme and analytic framework was postulated to analyze the general publication trends, including publication numbers, target languages, and research methods. Besides, we summarized seven main research themes and analyzed the affordances and challenges of the VR applications in language learning. The results showed that the relevant research is still in the initial stage with relatively less studies. However, although the VR technologies were not mature enough and encountered several challenges, it showed great potential in promoting students' linguistic knowledge and non-linguistic skills, decreasing learners' anxiety, and improving learning efficacy. In addition, more empirical studies could be conducted to explore the potential effectiveness of applying VR technologies in special education and reviving languages in crisis.

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References

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2013). A review of technological pedagogical content knowledge. Journal of Educational Technology & Society, 16(2), 31-51.

Chen, J. C. (2016). The crossroads of English language learners, task-based instruction, and 3D multi-user virtual learning in Second Life. Computers & Education, 102, 152-171.

Chen, J., Zhao, J., Wang, G., & Zhang, K. (2019). The application research of augmented reality technology in the intervention of children with autism. Modern Educational Technology, 29(08), 86-92.

Creswell, J. W., Plano Clark, V. L., Gutmann M. L., & Hanson W. E. (2003). Advances in mixed methods design. In Tashakkori A. & Teddlie C. (eds.). Handbook of Mixed Methods in the Social and Behavioral Sciences. Thousand Oaks, CA: Sage, 209-240.

Dalton, G., & Devitt, A. (2016). Irish in a 3D World: Engaging primary school children. Language Learning & Technology, 20(1), 21-33.

Hsu, Y.-C., Hung, J.-L., & Ching, Y.-H. (2013). Trends of educational technology research: more than a decade of international research in six SSCI-indexed refereed journals. Etr&D-Educational Technology Research and Development, 61(4), 685-705.

Lan, Y. J. (2014). Does second life improve mandarin learning by overseas chinese students? Language Learning & Technology, 18(2), 36-56.

Lan, Y. J. (2015). Contextual EFL learning in a 3d virtual environment. Language Learning & Technology, 19(192), 16-31.

Lan, Y. J., Kan, Y. H., Sung, Y. T., & Chang, K. E. (2016). Oral-Performance Language Tasks for CSL Beginners in Second Life. Language Learning & Technology, 20(3), 60-79.

Levak, N. & Son, J. B. (2017). Facilitating second language learners' listening comprehension with Second Life and Skype. ReCALL, 29(2), 200-218.

Melchor-Couto, S. (2018). Virtual world anonymity and foreign language oral interaction. ReCALL, 30(2), 232-249.

Mroz, A. (2015). The development of second language critical thinking in a virtual language learning environment: a process-oriented mixed-method study. CALICO Journal, 32(3), 528-553.

Peterson, M. (2012). EFL learner collaborative interaction in Second Life. ReCALL, 24(1), 20-39.

Shih, M. L., Feng, J., & Tsai, C. C. (2008). Research and trends in the field of e-learning from 2001 to 2005: A content analysis of cognitive studies in selected journals. Computers & Education, 51(2), 955-967.

Shih, Y. C. (2014). Communication strategies in a multimodal virtual communication context. System, 42, 34-47.

Shih, Y. C. (2015). A virtual walk through London: culture learning through a cultural immersion experience. Computer Assisted Language Learning, 28(5), 407-428.

Wang, A. (2015). Facilitating participation: Teacher roles in a multiuser virtual learning environment. Language Learning & Technology, 19(2), 156-176.

Wigham, C. R., & Chanier, T. (2015). Interactions between text chat and audio modalities for l2 communication and feedback in the synthetic world Second Life. Computer Assisted Language Learning, 28(3), 260-283.

Xie, Y., Chen, Y., & Ryder, L. H. (2019). Effects of using mobile-based virtual reality on chinese l2 students' oral proficiency. Computer Assisted Language Learning, 1, 1-21.

Zheng, C., Xu, L., Gao, M., Lu, Z., Cheng, Q., & Yang, Z. (2019). A systematic literature review of virtual reality in language teaching (2009-2018). Technology Enhanced Foreign Language Education, 4, 39-47.