

# Application and Exploration of New VR/AR Technologies in Second Language Acquisition

**Xin Lyu**

*Department of Scientific Research,  
Wuhan Business and Trade Vocational College, Wuhan,  
430205, P. R. China  
E-mail: xinlv819@163.com*

## **Abstract:**

*New educational technologies are particularly important for the research and development of second language acquisition (SLA). Applying new educational technologies to language learning is also one of the latest and most promising research areas in SLA research. Virtual reality (VR) and augmented reality (AR) are popular tools for applying new educational technologies to SLA research. This article summarizes the relevant progress of VR/AR technology in current SLA research, points out the limitations and challenges faced by current educational technology research, and puts forward its own suggestions for improvement. It is hoped that this study will help language teachers and educators better understand the effectiveness and development trends of current VR/AR technology teaching methods, and support second language learners to achieve better language acquisition results.*

## **Keywords:**

*second language acquisition, virtual reality/augmented reality technology, empirical research*

## **1. Introduction**

Second Language Acquisition (SLA) refers to the process by which an individual acquires a new language after having already learned their native language. The process involves learning the rules and structures of the new language and acquiring the ability to use the language effectively in the real world. There are many factors that influence the SLA process, including age, ability, motivation, and exposure to the language <sup>[1]</sup>. In addition, a key debate in SLA research is whether second language acquisition is primarily a conscious or unconscious process. Some researchers believe that language learning occurs primarily through conscious and explicit instruction, while others believe that language acquisition is a more subconscious and implicit process <sup>[2]</sup>. Another important factor in SLA is input, which refers to the language input that learners receive during the language acquisition process. Input can come from a variety of sources, including teachers, textbooks, and exposure to the language in the real world. For many years, teaching researchers have been studying SLA in order to better understand the process of language learning and develop strategies for effectively teaching second languages. One of the newest and most promising areas of current SLA research is the application of new educational technologies to language learning <sup>[3]</sup>.

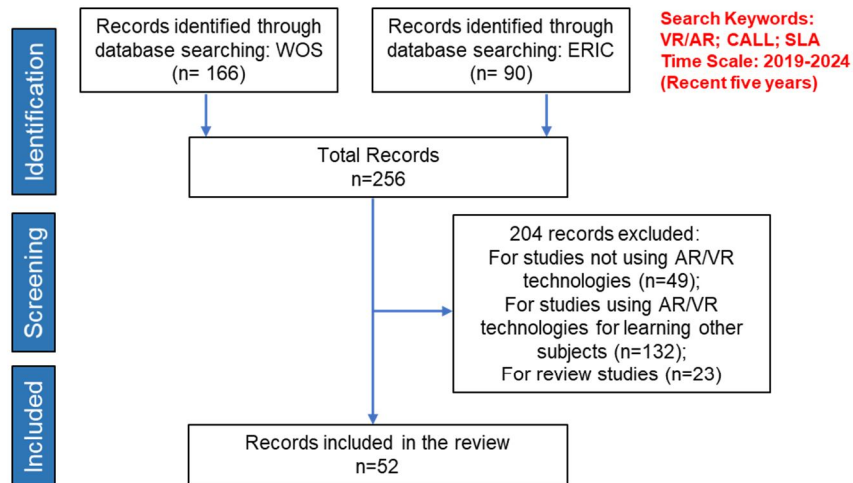
In recent years, a number of new educational technologies have emerged that have the potential to revolutionize the field of SLA. These technologies include Computer Assisted Language Learning (CALL), Virtual Reality (VR), Augmented Reality (AR), and Language-Learning Apps (LLApps). CALL involves the use of computers and technology to support language learning<sup>[4]</sup>. This can include software programs that provide learners with interactive practice and feedback, as well as online language courses and virtual classrooms. CALL can be used as a supplement to traditional classroom instruction or as the primary language learning method for students in remote or underserved areas<sup>[5]</sup>. VR is another technology that holds great promise for SLA. VR/AR technology offers a new approach to supporting the input hypothesis and information processing theory by creating immersive language learning environments<sup>[6]</sup>. These environments provide learners with visual and auditory stimulation and are enhanced by sensory feedback, making the learning process more engaging and efficient. The use of VR/AR technology has emerged as an innovative way to promote bilingualism by providing learners with a variety of opportunities to interact with a new language<sup>[7]</sup>. In addition, one aspect of VR/AR technology that makes it an attractive learning tool is the ability to create virtual environments that simulate real-world experiences. These environments can help learners practice their language skills in a low-stress and safe environment. VR/AR technology allows the creation of immersive experiences that replicate real-life scenarios, allowing learners to acquire language skills in context<sup>[8], [9]</sup>. Furthermore, VR/AR technology allows learners to gain multisensory and multimodal experiences. The use of visual, auditory, and tactile feedback can provide a variety of stimuli that engage learners in different ways. Visual feedback can provide representations of target language words and phrases, while auditory feedback provides the opportunity to listen to real conversations in the target language. On the other hand, tactile feedback can provide tactile sensations, such as vibrations, that can help learners internalize language patterns<sup>[10]</sup>. Virtual reality (VR) and augmented reality (AR) have become popular technological tools in education and language learning. As bilingual acquisition and second language learning become increasingly important, VR and AR have been considered as potentially effective ways to learn new languages<sup>[11]</sup>. However, although some studies have shown that they are promising tools, there are still many research gaps and limitations that need to be addressed. One of the main drawbacks of VR/AR for bilingual acquisition is the limited availability of high-quality software and content. Although there are a number of VR/AR language learning applications available, many of them lack sufficient depth and complexity to effectively teach a language. Some applications only provide basic vocabulary and grammar, while others focus on very specific topics or scenarios, making them less effective for broader language acquisition<sup>[12], [13]</sup>. Furthermore, the limited availability of quality VR/AR language learning applications often makes it difficult for teachers and learners to find the right resources. Another issue is the lack of standardization in VR/AR language learning research<sup>[14]</sup>. Studies examining the effectiveness of VR/AR for bilingual acquisition and evaluating different applications are often conducted in different settings, using different methodologies and with different learning measures. This lack of standardization makes it difficult to compare the results of different studies and to gain a clear understanding of the broader effectiveness of VR/AR. As a result, there is also limited research comparing the effectiveness of VR/AR language learning with traditional language learning methods<sup>[15]</sup>. While some studies have shown that VR/AR is effective

in teaching specific language skills, more research is needed to compare learning outcomes across different teaching methods [16]. Such comparisons can help identify specific strengths and weaknesses of VR/AR language learning and determine when it is best to use it.

This paper is to summarize the current applications of new educational technologies based on VR/AR in SLA. By comparing with traditional language learning methods, this study compares the relative advantages and limitations of different educational technology methods based on VR/AR technology in different countries and by different research teams. Finally, the current challenges and improvement strategies for second learners based on new VR/AR educational technologies are summarized. This research can help language teachers and educators create effective course materials, better understand the effectiveness of different technology-based teaching methods, and support learners to achieve better language learning outcomes.

## 2. Current research progress

The application of VR/AR technology in bilingual acquisition has now become a widely researched topic. Several studies have explored the effectiveness of these technologies in promoting second language acquisition. I screened 52 research papers (Figure 1) by searching the Web of Science (WOS) and Education Resources Information Center (ERIC) databases using a series of criteria (keywords: VR/AR technology, second language acquisition, empirical research in the past five years). The following sections provide a comprehensive overview of some of the important studies in this field.



\* Inclusion and exclusion criteria.

Inclusion Criteria	Exclusion Criteria
Must use AR/VR technologies.	AR/VR technologies were not used.
Must be about the use of AR/VR technologies for second language acquisition	AR/VR technologies were used for learning other subjects.
Must be empirical research.	Non-empirical research was excluded.

Figure 1. Screening procedure for research papers in related fields

## 2.1 VR/AR technology provides an immersive virtual reality environment

One of the main advantages of VR/AR technology in bilingual acquisition is the creation of an immersive virtual reality environment that simulates real language communication scenarios. Some studies have used VR/AR technology to create an immersive environment in which users can communicate more easily and freely in a foreign language by minimizing users' learning anxiety and providing a safe and comfortable learning space. Rahul et al <sup>[17]</sup> concluded through their research that VR and AR technology, as the construction of a cognitive immersive language learning environment, is an important component of foreign language education tools. Foreign language learning in this immersive environment can have a continuous improvement effect on the vocabulary, comprehension and drawing skills of the participants; Lai et al randomly assigned 30 12th grade high school students to a VR or PC group in order to explore the effects of virtual reality (VR) and personal computer (PC) games on language learners' vocabulary learning and their emotional perception <sup>[18]</sup>. The results showed that the average score of the VR group in the delayed post-test of vocabulary translation was significantly higher than that of the PC group. The questionnaire showed that both groups of learners liked playing visual novel games and were willing to use them as a tool for learning vocabulary. Meanwhile, Japanese researchers have investigated how three different computer-mediated communication methods affect foreign language anxiety among second language learners <sup>[19]</sup>. The study was conducted in three different oral synchronous computer-mediated communication modes: voice, video, and virtual reality (VR). The results of the learner perception questionnaire showed that VR was the easiest environment for communication, as well as the most interesting and effective language learning environment; Chen et al also pointed out that the study investigated the impact of technology-enhanced learning on reducing public speaking anxiety among English learners <sup>[20]</sup>. 33 college students were divided into three groups and received four weeks of assisted teaching using lectures, mobile assistance, or VR. The results showed that the teaching feedback generated by AI reduced the participants' public speaking anxiety, and the potential of using VR in public speaking teaching is obvious. These findings support the view that VR/AR technology can reduce the learning cycle of learning a second language and effectively alleviate learning anxiety.

## 2.2 Gameplay of VR/AR Technology

Many studies have used games as an effective means of learning a second language due to their fun and concentration properties. Lee et al used a murder mystery VR game to examine vocabulary-related (word level, frequency of exposure, salience) and learner-related (language ability, interest, watching subtitles) variables. The study adopted quantitative research methods and descriptive and inferential statistics (repeated measures analysis of variance and multiple linear regression) <sup>[21]</sup>. The results showed that games greatly promoted the acquisition and retention of second language vocabulary. Students' conscious attention and the salience of words were the main factors that promoted incidental vocabulary acquisition and retention in a game-enhanced language learning environment. Hao et al developed four AR games and investigated their impact on fifth-grade English course learning by integrating digital game-based learning theory, the attention-related confidence-satisfaction (ARCS) model, and different types of digital games. Students who received AR game learning showed significantly higher learning motivation than

those who received traditional learning <sup>[22]</sup>. Dr. Hsu and Dr. Chen used a newly created VR game-based English mobile learning application to investigate 274 students' English learning effects, student game engagement, and autonomous learning from cognitive and psychological perspectives <sup>[23]</sup>. The results showed that both game engagement and game experience were significantly affected by self-efficacy, intrinsic value and test anxiety. The interactive nature of the VR application and the game-based design challenges enabled students to easily enter a state of concentration and enhance their learning motivation.

### **2.3 VR/AR technology as a bilingual acquisition assessment tools**

VR/AR technology has also been used as an effective tool for bilingual acquisition assessment, and can also be used to provide learners with instant feedback to improve their language skills through effective learning mechanisms. For example, researchers at the Hong Kong Polytechnic University developed an AR application that enables learners to practice nominal post-modification in a virtual environment. The application provides real-time feedback on learners' performance and allows educators to diagnose students' learning difficulties, thereby improving the teaching process <sup>[24]</sup>. Taiwanese scholars pointed out through a survey that second language listening learning mediated by mobile VR is motivating, beneficial and convenient. They feel more focused on the listening task. Simulating real-life scenarios and interactivity, especially interactions with virtual characters, leads to a stronger sense of presence and a higher degree of immersion. Interacting in a truly fully immersive environment helps listening comprehension <sup>[25]</sup>. Chen et al explored the effectiveness of virtual reality (VR) in Chinese as a second language (CSL) vocabulary learning from the perspective of international students <sup>[26]</sup>. A new VR-based vocabulary learning theoretical framework was designed and validated to serve the investigation. The results showed that the VR method can effectively promote students' vocabulary learning and memory, and has a positive learning experience as a bilingual acquisition assessment tool. In 2021, Rozi et al conducted a study on vocabulary acquisition using AR technology. The researchers used an AR application to display 3D objects related to vocabulary. The study showed that learners who used AR technology performed better on vocabulary tests compared to learners who used traditional methods <sup>[27]</sup>. Lan et al. used action research to examine the effects of two different story reading language learning programs in a library environment <sup>[28]</sup>. The activities for the first group included picture book story reading and word games. The second group added 3D virtual construction tasks using the online VR construction tool Omni-immersion Vision to the reading activities. This allowed students to express their ideas through multimodal resources, including text and images in their stories and their 3D virtual environment. The results showed that the second study group not only made progress in English reading, but also showed lower anxiety levels than the first group in terms of their learning motivation. The combination of multimodal stories and context construction in the virtual world seems to benefit EFL learners. This fully demonstrates the superiority of VR/AR as an educational mechanism for assisted language learning.

### **3. Research Challenges**

However, many studies have also pointed out that VR/AR technology still has many limitations and defects in bilingual acquisition that need to be addressed. Most current learning

devices are desktop VR, which can only provide very limited interactive and immersive experiences. Without multiple sensory experiences and interactive channels, it is almost impossible to recreate real-life situations. At the same time, non-immersive AR technology, with its high portability, can support language learning in more scenarios. However, AR-related teaching resources are mainly focused on the training of single skills such as words, and cannot provide a resource-rich learning environment <sup>[29]</sup>. Moreover, there is no unified application standard for AR/AR in language learning, and there are obstacles to its application and promotion. Specific problems are: there is a lack of targeted research on the development of teaching materials and resources, no clear teaching plan has been formed, and no application specifications and educational standards have been established <sup>[30]</sup>, <sup>[31]</sup>. In addition, learners may easily become addicted to the virtual world and fail to form a serious learning attitude. If too much content unrelated to language learning is retained in the virtual environment, learners may deviate from their learning goals and fail to achieve the expected learning results. Therefore, researchers need to focus on the creation of virtual environments, reduce irrelevant interference, and adapt VR/AR technology to all aspects of language education <sup>[32]</sup>. Therefore, the development of second language acquisition methods that use VR/AR educational technology that is targeted, convenient, and efficient has great development potential. By focusing on more research issues, conducting various survey activities, and developing software systems and hardware facilities with different contents, VR/AR technology will provide us with more possibilities to promote language learning.

#### **4. Strategies for Improvements**

##### **4. 1 Design VR/AR environments that are accessible to multiple languages.**

Developing multilingual interfaces that meet the needs of bilingual learners is a major challenge. VR/AR applications should be designed with pedagogical principles in mind and should be aligned with language learning goals. In addition, there are technical and logistical issues that need to be addressed, such as the cost and accessibility of VR/AR devices and software. Designing VR/AR environments that consider multiple language nuances, including grammar, vocabulary, and pronunciation, can be complex.

##### **4. 2 Integrate cultural domain-specific aspects of language learning.**

Language learning is more than just grammar and vocabulary; ethical and cultural considerations need to be considered when using VR/AR in SLA. Using VR/AR may raise questions about privacy, security, and data protection. In addition, VR/AR content should be culturally appropriate and sensitive, given the different backgrounds and experiences of learners. Designing VR/AR environments that incorporate cultural aspects of bilingual learning is a challenge.

##### **4. 3 Designing assessment tools scientifically and rationally.**

Evaluating the effectiveness of VR/AR on bilingual acquisition is a challenge. Research needs to develop specialized evaluation tools to measure the effectiveness of VR/AR for language acquisition. Rigorous research using appropriate tools is needed to examine the learning outcomes and benefits of using VR/AR compared to traditional language learning methods. This requires the

use of appropriate research design, measurement, and analysis techniques.

#### **4.4 Reduce the complexity and cost of VR/AR development.**

Developing VR/AR environments for bilingual acquisition is expensive and time-consuming. VR/AR software development requires professional skills that are expensive to acquire; this makes it difficult for the research community to design and develop new VR/AR tools for bilingual learners. Therefore, it is very important to reduce the complexity and cost of technology development. By studying the use of multiple VR/AR educational tools and obtaining timely feedback, it also provides more reference value for technology development for educational technology researchers.

#### **5. Summary**

In summary, the application of VR/AR technology in bilingual acquisition has made significant progress in recent years, and a large number of studies have shown that VR/AR technology can enhance the language acquisition process. The technology has been adopted in various ways to provide immersive, interactive, and personalized learning experiences. Researchers continue to explore the many applications of VR/AR technology in education, and the potential for improving language acquisition through these technologies remains high. As these technologies continue to develop, it is expected that more effective application technologies will be introduced to enhance second language acquisition.

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