

A Systematic Review of second language Learning Based on Metaverse

Yang Xiaodi^{1,2}, Melor Md Yunus², Karmila Rafiqah M. Rafiq³,
Wang Zheng^{2,4}

¹Guangzhou Xinhua University, Guangzhou, Guangdong Province, China, ²Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, 43600, Malaysia, ³Faculty of Education, Universiti Teknologi MARA Puncak Alam Campus, 42300, Malaysia, ⁴Zhejiang Guangsha Vocational and Technical University of construction, Jinhua, Zhejiang Province, China

To Link this Article: <http://dx.doi.org/10.6007/IJARPED/v13-i3/21843>

DOI:10.6007/IJARPED/v13-i3/21217

Published Online: 04 July 2024

Abstract

The metaverse represents an emerging technological frontier, and its integration with higher education is becoming increasingly close. By discussing second language learning in the context of the metaverse, this article helps to explore innovative educational paradigms and teaching methods for language acquisition using virtual environments. This article adopts the preferred reporting item of systematic evaluation and meta-analysis (PRISMA) to review current research by searching two major databases, Scopus and Web of Science. Through a systematic search of "Second language learning" or "Second language acquisition" or "L2 learning" or "ESL learning" or "ESL" or "Bilingual education" or "Language acquisition" or "Language learning" or "Multilingualism" or "Language immersion" or "Language education") and ("Metaverse" or "Virtual reality" or "VR" or "Augmented reality" or "AR" or "Extended reality" or "XR" or "Virtual world" or "Cyberspace" or "Digital realm" or "Online universe" or "Immersive digital environment" or "Synthetic reality" or "Virtual space", a total of 34 articles were found. Based on this, this study selected several possible factors to understand learners' learning performance and level of participation in second language learning based on virtual environments. In addition, this article also explores the current situation and development of virtual reality technology used in language teaching at home and abroad, as well as the urgent issues and specific challenges in metaverse technology. Summarized the inspiration and guiding significance of foreign language teaching based on virtual reality technology for China. Among the 34 articles, this study selected 12 empirical studies related to the metaverse, and elaborated on the research objectives and results of these articles, exploring the current situation and development of second language teaching based on virtual reality technology. In addition, this article also combines relevant research from a large number of Chinese literature to analyze the advantages and challenges of second language teaching based on virtual reality technology in China, and puts forward relevant suggestions. Research has found that domestic research is still in its infancy, with a focus on value exploration. Foreign studies have shown that language teaching based on virtual reality technology can improve students'

learning enthusiasm, alleviate classroom anxiety, and help students apply theoretical knowledge learned in the classroom to practice.

Keywords: Metaverse, Second Language Learning, Virtual Environment, Challenge

Introduction

In the past few years, the latest information technology on the Internet has emerged endlessly, and the metaverse has become a hot topic, considered a new direction for promoting second language learning. The metaverse is a future development form of the Internet that integrates various information technologies, and there is huge development space for its integration with the field of education. This study aims to explore the second language learning based on the metaverse, attempting to integrate evidence and generate a model connecting the metaverse based on second language education. Due to the greatly enhanced sense of on-site experience, participation, and interaction in virtual environments, language learners can use the metaverse platform to achieve better learning experiences and higher academic performance. In addition, the virtual learning experience is also limited by many conditions (Nair & Yunus, 2021).

American science fiction writer Neil Stephenson first proposed the concept of "metaverse" in his book "Avalanche" and described it as a virtual urban environment parallel to real life. With the renaming of Facebook to "Yuan", "Metaverse" quickly exploded in front of the public and became the most popular buzzword of the year. At present, Microsoft, Tencent, ByteDance and other technology giants are all laying out the metauniverse, so 2021 is also regarded as the "first year of the metauniverse". In recent years, emerging educational technologies such as virtual reality and augmented reality have led the new direction of future education. However, overall, there is still a lack of literature review on attempts to combine metaverse with second language learning, and there is no necessary insights provided for current and future language teaching guidance (Tlii et al., 2022). Therefore, there are several unanswered questions, such as what evaluation factors are used in the metaverse; Or what are the challenges of using metaverse for second language learning. Therefore, this study aims to provide a systematic review of the application of metaverse in second language learning, in order to fill the research gap.

Methodology

This section discusses the relevant issues and challenges that higher education institutions face in learning second language learners based on the metaverse. The system review process is guided by PRISMA (the preferred reporting project for system review and meta-analysis) Rafiq et al (2021), and research on the system is conducted through the use of Scopus and WOS databases to identify and search for articles related to second language learning practices in higher education institutions based on the metaverse. Then, the process of this system continues, including several stages of identification, screening, qualification assessment, and exclusion. There is relatively little mainstream research on language teaching based on virtual reality technology in China, and the selection method of title, keyword, and abstract search is used. The CNKI database is first searched for keywords across the entire network, and then combined with the search results, Peking University core journals, CSSCI source journals, and CSSCI extended version source journals with high relevance to language and teaching, such as linguistics, translation studies, and technology assisted teaching, are selected one by one, Ensure high academic influence of journals.

The Review Protocol (PRISMA)

PRISMA (the preferred reporting item for systematic review and meta-analysis) was used as guidance throughout the entire process of preparing this systematic review paper. PRISMA is commonly used in the field of education (Rafiq et al., 2021). PRISMA provides three benefits: (1) it presents clear research questions for systematic research; (2) Established exclusion and inclusion criteria; (3) Enable researchers to access vast scientific literature databases. PRISMA provides researchers with an opportunity to rigorously search for the difficulties and challenges faced in the process of digital collaborative learning. This method can be used to determine the collaborative learning practices used by learning institutions in digital teaching.

Resources

The study relied on two main databases (WoS and Scopus) and two supporting databases (Science Direct and Mendeley). WoS is regarded as a robust database comprising about 33,000 journal articles and covering more than 256 disciplines including the subjects related to environmental studies, interdisciplinary social sciences, social issues, as well as development and planning. Over 100 years of comprehensive backfile and citation data established by Clarivate Analytics have been included in the World of Science (WoS) database. These data were also ranked by Clarivate Analytics into three different measures (citations, papers, and citations per paper). The second database used in this systematic literature review was Scopus, which consists of 22,800 journals from 5000 publishers all over the world. Scopus is regarded as one of the largest abstract and citation databases including peer-reviewed literature. It covers a wide range of subject areas such as environmental sciences, social science, as well as agriculture and biological sciences.

Systematic Searching Strategies

There are three main stages in the systematic searching strategies, namely identification, screening, and eligibility (Figure 1).

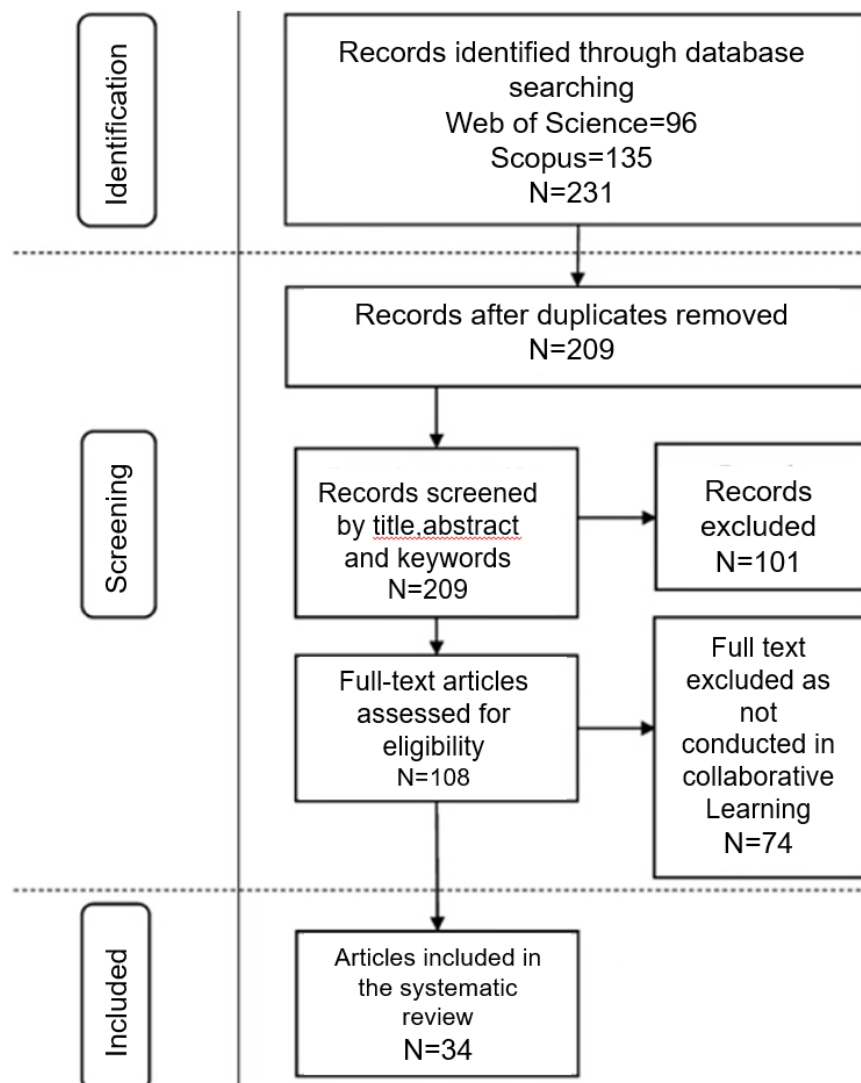


Figure 1. Flow diagram of the study.

Identification

The first phase, which is identification, is a process that finds related terms, synonyms, and variations for the main keywords for the study, namely blended learning, strategies, and ESL (Hashim et al., 2018). The purpose of this stage is to provide more alternatives for the identified database to search for more relevant articles to be included in the systematic review. This process relied on keywords used by previous studies, online thesaurus, and keywords suggested by Scopus. Furthermore, the keywords were developed according to the research question as recommended by. Boolean operator, phrase searching, and truncation were used by the authors on the database particularly Scopus and Web of Science to enrich the current keywords and produce the full search string. Keywords similar and related to digital cooperative learning were used as shown in Table 1. Both Scopus and Web of Science are considered the leading database in the systematic review, as they are comprehensive and have advanced search functions.

Moreover, these two databases have a multidisciplinary focus and can control the quality of the articles. A total of 231 articles were retrieved from the searching process through Scopus, Web of Science.

Table 1

The search string used for the systematic review process.

Database	Keyword Used
Scopus	TITLE-ABS-KEY (("Second language learning*" OR "Second language acquisition*" OR "L2 learning" OR "ESL learning" OR "ESL" OR "Bilingual education" OR "Language acquisition" OR "Language learning" OR "Multilingualism" OR "Language immersion" OR "Language education") AND ("Metaverse*" OR "Virtual reality" OR "VR" OR "Augmented reality" OR "AR" OR "Extended reality" OR "XR" OR "Virtual world" OR "Cyberspace" OR "Digital realm" OR "Online universe" OR "Immersive digital environment" OR "Synthetic reality" OR "Virtual space*"))
Web of Science	TS= (("Second language learning*" OR "Second language acquisition*" OR "L2 learning" OR "ESL learning" OR "Bilingual education" OR "Language acquisition" OR "Language learning" OR "Multilingualism" OR "Language immersion" OR "Language education") AND ("Metaverse*" OR "Virtual reality" OR "VR" OR "Augmented reality" OR "AR" OR "Extended reality" OR "XR" OR "Virtual world" OR "Cyberspace" OR "Digital realm" OR "Online universe" OR "Immersive digital environment" OR "Synthetic reality" OR "Virtual space*"))

Screening

Duplicate papers in Scopus and WOS were thoroughly detected by the researchers. The remaining publications were scrutinized in-depth to see if they met the researchers' requirements. The criteria for article selection were applied to all 231 articles, which was done automatically in the database with the sorting method. The criteria for selecting papers were based on the review's research question, as suggested. Since it is difficult for the authors to read all the articles, the authors have opted to adopt the advice, which states that writers should determine the time range of the articles before reviewing them.

The results of the search on the chosen database showed that there have been many studies done on cooperative learning since 2020. However, there were not many systematic reviews focused on the years after the year 2019. As a result, the period from 2020 to 2023 was chosen as one of the inclusion criteria. Only studies with empirical data that were published in a journal were included in the review to assure its quality. Furthermore, only items written in English were included to minimize misunderstandings. Moreover, only articles related to cooperative learning were selected for this review (Table 2). This method resulted in the removal of 22 duplicated articles and the exclusion of 101 articles that did not meet the inclusion criteria.

Table 2

The search string used for the systematic review process.

Criterion	Eligibility	Exclusion
Timeline	Between 2020 to 2023	<2020
Literature type	Empirical	Systematic reviews, books, chapters in a book, conference proceedings
Language	English	Non-English
Scope	Related to second language learning and HE	Not related to second language learning and HE

Eligibility

As for the third stage known as eligibility, a total of 108 articles were prepared. On a more important note, the titles, abstracts, and main contents of all the articles were thoroughly examined at this stage to ensure that they met the inclusion criteria (Table 2) and were suitable for use in the current study to meet the research objectives. As a result, 74 articles were eliminated since they were not related to empirical data and second language learning context. Finally, 34 articles were ready to be examined.

Exclusion Criteria

Only articles that truly met the criterion were included after the three steps. They included quantitative, qualitative research, and mixed methods. Book, book series, chapters in book, systematic review articles, conference proceedings, non-English publications published before 2020, and non-second language learning articles were all essential points for exclusion. All these factors were considered to generate high-quality data. Figure 1 illustrates the procedure followed.

Main Findings

Table 3

Summary of the selected studies

Study	Data base	Aim	Samples	Findings
Irina et al (2022)	WOS Scopus	The aim of this paper is to examine the advantages of using IT in English language learning process in higher education.	42 students	The tools of information technologies mentioned above help to form students' professional foreign-language competence, to improve motivation and performance. The pedagogical experiment was conducted to show the effectiveness of these tools.
Belda-Medina & Calvo-	WOS Scopus	This paper focuses on analyzing the digital competence and	85 college students	The statistical data and qualitative findings revealed that the

Ferrer (2022)		attitudes of teacher candidates to integrate AR in the foreign language classroom.		participants lacked practical knowledge on AR content creation and implementation in Education.
Nicolaidou et al (2023)	WOS Scopus	This quasi-experimental study investigated the effect of a Virtual Reality application on foreign language learning and compared engagement, engrossment, and immersion between two versions of the application (Virtual Reality and mobile).	40 students	Findings revealed a statistically significant difference in the experimental group students' vocabulary performance when students' pre-test and post-test scores were compared. Engagement, engrossment, and immersion received relatively high scores by Virtual Reality participants.
Huertas-Abril et al (2021)	WOS Scopus	This paper, after exploring the potential of AR in education, is aimed at comparing pre-service English as a Second Language (ESL), English as a Foreign Language (EFL) and Bilingual Education (BE) teachers' perceptions, uses and preferences from two universities, and analyze whether there are similarities and/or differences based on sociocultural context, approaches to education or teacher practices.	53 teachers	The findings reveal the positive attitudes towards integrating AR in ESL/EFL and bilingual contexts of the participants of the two institutions. The most noted advantages of AR are that it enhances classroom engagement and its focus is different from traditional teaching methods, increasing student motivation and facilitating their learning processes.
Chen et al (2022)	WOS	This mixed-methods study was grounded in the instructional motivation theory of ARCS (Attention, Relevance, Confidence and Satisfaction).	188 education students (i.e., pre-service teachers)	The results indicated the participants across the 3 majors positively perceived SV-IVR as having desirable benefits on "A," "R," and "S," but not "C." (Attention, Relevance, Confidence and Satisfaction)

Flores et al (2021)	WOS	It served as a pilot and sought to determine pre-service teachers' perceptions on the strengths and limitations in the use of augmented reality for the bilingual and ESL classroom.	27 bilingual and ESL pre-service teachers	The findings indicated that the participants view AR as a strength to keep students engaged and motivated. On the other hand, access to AR technology was perceived as a limitation.
Peixoto et al (2023)	WOS	This paper investigates the impact of different immersive Virtual Reality (iVR) technological approaches in teaching and learning English as a Foreign Language (EFL).	B1 level EFL classes	Results indicated that users showed significant satisfaction and preference for using this technology for learning, revealing enjoyment and motivation which are vital factors when learning a foreign language. However, no significant differences were found between learning via traditional listening exercises or the virtual system.
Chen et al (2022)	WOS	The study's main purpose was to examine the effects of VR on students' language learning academic performance, including linguistic gains and affective gains.	1144 participants	The results indicated that VR-assisted language learning had a medium effect on the linguistic gains and affective gains of students compared to non-VR conditions, respectively. The research indicates that VR technology has a great potential to improve language learning as an educational resource.
Xie et al (2022)	WOS	This article investigates the learning effects of the combination of immersive English teaching and virtual reality technology.	106 students	The results showed that there is a significantly positive correlation between VR and immersion-based language teaching. There is a significantly positive correlation between immersion-based

				language teaching and academic achievement, and VR is positively correlated with learning outcome.
Salmee & Abd Majid (2022)	<i>Scopus</i>	This study intended to determine the English language teachers' perceptions towards the use of AR by applying the Technology Acceptance Model (TAM) as the base of the research model.	180 English teachers	Findings indicate that the levels of AR acceptance of the English teachers are relatively high, as the respondents recorded a high level of PU, ATT and BI towards the use of AR while PEOU was at moderate level.
Jalaluddin et al (2020)	<i>Scopus</i>	This experimental study aimed to explore the effectiveness of using mobile augmented reality (MAR) application in vocabulary learning among LINUS students.	45 students	The results of this study provide the discussion on the practicality of using Augmented Reality to help the struggling learners to cope with acquiring and learning English language in ESL context.
Azar & Tan (2020)	<i>Scopus</i>	the main objectives of this research are (1) to contextually understand the university interns' perception of ICT Techs (MALL, Gamification, and VR) in teaching English and (2) to determine which of these ICT Techs (MALL, Gamification, and VR) would be most preferred by the interns for teaching English to students in Malaysia.	63 university interns	The results indicated that 38.1% chose MALL, 33% chose Gamification, and 29% chose VR, as their preferred technology to teach English for students during this Covid-19 Pandemic in Malaysia. Evidence suggested that online learning can be more effective for students.

Literature Review

Development of Virtual Reality Technology

In 1960, Heilig manufactured the "Sensorama" to provide viewers with 3D images, sound, odors, and other experiences, making it the world's first virtual reality device. In the 1970s and 1990s, due to limitations such as large size and high cost, virtual reality technology was mainly applied to national institutions such as molecular biology (GROPE program), aerospace (NASA program), military research, etc. In the 1990s, research on virtual reality technology shifted towards exploring "presence" and "interactivity", laying the groundwork for educational research. In 1990, Bricken first proposed the idea of applying virtual reality to

education. Afterwards, a large amount of research focused on virtual reality teaching. Multiple virtual reality platforms such as Second Life, Roblox, and Meta (Facebook) have broken through the limitations of physical classrooms, providing a language learning space for free communication, and are expected to integrate into a "educational metaverse" in the future.

The research and application of virtual reality technology in China started relatively late. In 1996, Wang Chengcheng and others wrote their first work on virtual reality, initiating academic research on virtual reality technology in China. In November 2001, the Chinese Computer Society held the first National Conference on Virtual Reality and Visual Chemistry. Subsequently, Beijing University of Aeronautics and Astronautics became the first university in China to build a virtual simulation laboratory. In 2019, Tencent and Roblox established a partnership. Companies such as ByteDance, Baidu and NetEase also actively carry out the virtual reality "meta universe" business. With the development of technology and the promotion of policies, domestic research has gradually increased, but empirical research is relatively scattered, with unclear positioning of virtual reality, unfocused analysis of augmented reality and virtual reality, and generalization of conclusions (Luo Heng et al., 2021).

Virtual Reality and Foreign Language Teaching Theory

Although domestic language teaching combines teaching tools such as computers and PPTs, it still fails to meet the teaching needs in providing students with a real language learning environment, resulting in language learners' emphasis on theory over practice and difficulty speaking when learning language (Ma Wulin and Ouyang Lingqing, 2020). Computer assisted language teaching in China is not yet mature, and there is a certain gap with international research (Xia Xiaoyan et al., 2021). The virtual teaching environment (EVE) based on virtual reality, combined with multimodal teaching methods, brings visual, auditory, and tactile senses into foreign language teaching classrooms, which can make up for the inherent shortcomings of traditional classrooms, such as the lack of learning context and interaction between teachers and students and students (Li Ying, 2020). Based on the characteristics of virtual reality technology, students enter the language learning environment from the first perspective, becoming the main body of knowledge acquisition, immersing themselves in concrete language knowledge and building bridges with new knowledge. Combining constructivism, situational learning, and participatory learning theories, they enrich traditional teaching models and promote the transformation of traditional teaching classrooms.

Constructivist Learning Theory

At the beginning of the 20th century, constructivism believed that human learning was a process of building bridges between new knowledge and existing knowledge, emphasizing the initiative of learning (Dewey, 1916). Under the framework of constructivism, personal constructivism, which constructs knowledge from the human mind, and social constructivism, which obtains knowledge through practice and social interaction (Vrasidas, 2000), both emphasize the influence of the environment on learners. When acquiring knowledge, learners not only need to absorb knowledge, but also connect with existing knowledge and become active promoters of constructing knowledge. Teachers are not about imparting knowledge, they should guide and promote learners to engage in meaningful construction. In a virtual reality environment, students focus on themselves to achieve experiential learning and problem-oriented learning in a simulated environment, actively construct knowledge, narrow

the gap between theoretical learning and practical application, materialize knowledge, promote the learning process, and comply with constructivist learning theory.

Situational Learning Theory

Lave & Wenger (1991) emphasized that learning is influenced by specific social and physical environments, advocating that all learning occurs in specific contexts, and emphasizing the importance of context in learning. The language teaching based on virtual reality technology identifies real and contextualized problems in the learning process through virtual scenes. Its core element is to provide learners with immersion and a sense of presence in different contexts, allowing students to incarnate as "roles" in the scene, and construct a knowledge learning system under a feedback mechanism to improve task performance and learning effectiveness. The virtual reality teaching environment conforms to the theory of situational learning.

Theory of Participatory Learning

At the end of the 20th century and the beginning of the 21st century, constructivism combined with modern technology to derive the theory of participatory learning. Participatory learning theories are mostly set in teaching scenarios assisted by technologies such as remote learning, and later refer to teaching theories that acquire knowledge through technological interaction (Kearsley&Shneiderman, 1998). The theory of participatory learning consists of three dimensions: behavior, emotion, and cognitive engagement. In a virtual teaching environment, the student-led teaching classroom is directly participated by students, and through virtual avatars, interaction with the environment, teachers and students is achieved to stimulate learning interest. Based on virtual reality technology, students can utilize multimodal information such as speech, voice intonation, gesture movements, and spatial environment during the interaction process to enhance their sense of participation and promote language learning.

Comparison of Language Teaching Research Based on Virtual Reality Technology at Home and Abroad

In terms of research methods, the initial stage of domestic research mainly focused on non empirical methods such as introducing foreign virtual reality platforms and projects, exploring the significance of virtual reality technology in language teaching, and analyzing the impact of virtual reality language teaching projects on learning mechanisms. The EU virtual reality project abroad provides reference for empirical research and tends to be empirical. What we present in Table 3 is an empirical study of 12 foreign literature related to this study.

Non Empirical Research

The research on language teaching based on virtual reality technology in China is mainly divided into three stages. The first stage introduces virtual reality platforms and foreign virtual reality language teaching projects. They introduced the largest virtual reality platforms abroad, Second Life Ma Wulin and Yan (2010), Russian 3D Multi User Russian Virtual World (VWRL) Chongyu and Jianlin (2012), the EU VILL @ GE project Ma Chongyu and Chen Jianlin (2013), and the EU IVY project (Liu Menglian, 2016). The second stage explores the significance of virtual reality technology in language teaching. Wang Xiaohua (2018) stated that virtual reality platforms can improve students' learning motivation and effectiveness, reduce learning anxiety, and propose classroom teaching through storytelling and role-

playing to enhance students' language communication skills. Li Ying (2018) analyzed the principles of virtual reality language speech classrooms and believed that virtual reality technology can train students' psychological stress ability and improve their speech ability. Ye Xindong et al (2019) created a virtual reality language learning ecosystem model, emphasizing the importance of context in foreign language learning at the macro level and exploring the social relationships between teachers and students in virtual contexts at the micro level. Li Ying and Qian (2021) explored the relationship between virtual humans and students from the perspective of embodied cognition, indicating that students can achieve embodied cognition through virtual humans. The third stage focuses on the impact of virtual reality technology on learning mechanisms. Wang Ke (2019) used listening and speaking classes as an example to explore the mechanism and application of "immersive experience". Dongping and Jianqiu (2020) introduced theoretical models of ecology, dialogue, and distributed virtual reality.

There are few non empirical studies on the use of virtual reality technology in language teaching abroad. Peterson (2011) compared the differences between text user interfaces and graphical user interfaces, stating that virtual avatars can improve presence and anonymity, but should address issues such as configuration and teacher workload during the teaching process. Ibáñez et al (2011) explored the impact of virtual reality technology on the improvement of listening, speaking, reading, and writing skills under the guidance of constructivist situational and social interaction theories. Palomeque&Pujolà (2018) analyzed the importance of nonverbal factors in virtual reality oral classrooms through social semiotics theory.

In summary, relevant research at home and abroad has gone through three stages: platform project introduction, exploration of construction significance, and analysis of teaching impact. Domestic research tends to introduce early project platforms, while foreign research tends to analyze students' internal learning mechanisms and explore the practical significance of virtual reality technology from the perspective of cognitive psychology.

Empirical Research Curriculum and Teaching Content

The curriculum of virtual reality language teaching and research abroad is rich, and the teaching objectives are clear. Language teaching based on virtual reality technology can restore the immersive language learning environment that traditional foreign language classrooms cannot obtain, providing students with an immersive language learning environment. Domestic research is mostly focused on language classroom research. Foreign research involves multiple languages, exploring different languages such as Chinese, Western, French, Japanese, and Russian based on language. In terms of research content, both domestic and foreign studies involve five dimensions: listening, speaking, reading, writing, and translation. Domestic teaching focuses mainly on output, with a large proportion of conversations, mainly training oral second language through contact with virtual environments and virtual humans. Foreign research has added subjective experiences such as presence, autonomous learning, teaching guidance, and learning effectiveness to domestic research, comprehensively exploring the impact of virtual reality technology on language teaching. In terms of teaching targets, both domestic and international students are mainly college students, with a relatively small proportion of primary and secondary school students. The main teaching targets in China are second language major students with smaller class

sizes, with a small number of students involved in university second language general courses. Foreign research does not have too many restrictions on the number of people, covering various stages from primary school to adulthood.

Teaching Platform

Domestic and foreign teaching platforms include development platforms (self-made/cooperative), online platforms, and supporting equipment platforms. The development platform utilizes creative engines such as OpenSim (Wang et al., 2017) and Unity Colletine (2011), requiring coordination between teachers and technical personnel to utilize open-source virtual world servers to create online virtual reality spaces that meet teaching requirements. Online platforms have formed a systematic virtual reality space that is relatively easy to operate, mainly including Second Life Chen (2020), World of War craft New garden & Zheng (2016), Third World Farmer Franciosi et al (2016), Meet Me Yamazaki (2018), and vTime (Liaw, 2019). Online virtual reality platform, teachers do not need to coordinate with technical personnel and can design teaching scenarios on their own. Students experience virtual scenes through virtual avatars and interact with others. Second Life and World of Warcraft are large-scale multiplayer online real-time strategy games with over a million active users both domestically and internationally.

Although virtual reality headworn displays have advantages such as high immersion, interactivity, and imagination, they are expensive and have closed devices. In domestic and international research, some head mounted display devices (such as Samsung Gear VR) have higher prices, and researchers face high budget pressure. Under the premise of unclear teaching effects, the utilization rate of virtual reality head mounted displays is low.

Advantages and Challenges of Language Teaching Based on Virtual Reality Technology

Teaching Advantages

Language teaching based on virtual reality technology can produce certain positive effects in listening, speaking, reading, writing, and translation. Students participating in empirical research both domestically and internationally highly recognize the use of virtual reality technology in language teaching, stating that experimental classes are lively and interesting (Chen & Hsu, 2020). Teachers express that virtual reality classrooms can enhance students' learning interest, attention, motivation, and innovation, alleviate classroom anxiety, improve communication skills, and ultimately improve the quality of students' language output (Yeh & Lan, 2018).

In language teaching based on virtual reality technology, the listening and speaking classroom (Newgarden&Zheng, 2016; Shao Nanxi and Wang Jue, 2017) utilizes the immersive nature of virtual reality technology to immerse students in a language learning environment, engage in real-time communication with native language learners, provide students with language learning contexts that traditional classrooms cannot achieve, reduce students' foreign language learning anxiety, and improve the quality of oral output. Introverted students can also actively participate in interactive teaching, improve self-confidence and self-efficacy, and actively practice foreign language speaking(Yunus et al., 2012). In addition, virtual reality technology provides students with indispensable visual information and spatial perception elements in interpreting, preparing them for practical interpreting. Foreign research is more abundant than domestic research. Language teaching explores multiple languages based on second language, focusing on learners' learning emotions and strategies (van Ginkel et al., 2019). It focuses on students' high sense of presence and immersive

experience in virtual reality environments, exploring how to apply what they have learned. At the same time, foreign research does not have too many restrictions on the number of lectures, duration, equipment, and research methods, providing reference significance for domestic experimental teaching research.

Teaching Challenges

There are many challenges in language teaching based on virtual reality technology, mainly including technology configuration, teaching staff, and teaching effectiveness. In terms of technical configuration, the virtual reality platform jointly designed and built by teachers and technicians closely adheres to actual teaching needs, and the teaching effect is good. However, self-made platforms require cooperation with enterprises, which requires a long preparation time and high expenses. Although online virtual reality platforms such as Second Life are convenient, they are not designed specifically for teaching scenarios, and there are many negative factors affecting students' learning experience and teachers' teaching experience. From the platform perspective, large-scale interactive game platforms have high requirements for computer configuration, and students with low computer configuration are unable to participate in virtual reality classrooms. In addition, online virtual reality platforms are mostly open platforms, and during the teaching process, there are problems such as strangers entering and spreading violence, which brings great difficulty to teaching management. The online virtual reality platform uses character avatars to communicate, missing important nonverbal information such as eye movements, facial expressions, and postures in low simulation scenarios (van Ginkel et al., 2019).

In terms of the teaching staff, before conducting virtual reality teaching, it is necessary to first train the corresponding course teachers to improve their computer-aided language teaching ability and information technology level (Zhang Luni et al., 2018); Secondly, virtual reality technology has increased the workload of teachers, who not only face certain pressure in classroom design, but also have a significant workload in post class detection and evaluation. In terms of teaching effectiveness, online virtual reality platforms have different learning opportunities for extroverted and introverted students (Zhang, 2013). Outgoing students dominate the dialogue between the two parties, while introverted students mainly experience virtual reality environments in a passive manner. Virtual reality language teaching also faces problems such as excessive colloquialism of the knowledge learned and unsuitable for written use.

Development and Suggestions

With the rapid development of technology, the potential of virtual reality technology in language teaching is enormous. Domestic research needs to be based on more empirical data, explore future research directions, and fully integrate technology and teaching. In terms of technology, with the deep integration of 5G, artificial intelligence technology, and education, the application prospects of virtual reality technology are becoming increasingly widespread. Classrooms with high interactivity require selecting virtual reality platforms and designing corresponding courses based on teaching settings and objectives. After being applied to classroom teaching, teachers need to maximize the use of virtual reality technology, allowing students to deeply experience the differences between virtual reality experimental classes and traditional classrooms.

In terms of technical configuration, teachers need to improve computer configuration according to needs and carry out experimental teaching through building virtual simulation

laboratories and other methods. When using an open platform, it is necessary to strictly manage phenomena such as students being late, leaving early, and unauthorized entry of people outside the classroom. At the same time, it is necessary to provide collective computer-assisted language teaching ability training and information technology level training for teachers, so that they can keep up with the development of the times and integrate technology into classroom teaching. In addition, teachers need to take care of introverted and low participation students in experimental classes to ensure the fairness of students' learning opportunities.

From the internet to the mobile internet and then to the metaverse, virtual reality technology has developed rapidly in areas such as environmental modeling, 3D virtualization, human-machine interaction, and artificial intelligence. The deep integration of technology and education is an inevitable development direction for future education. The "educational metaverse" created by the enrichment and integration of virtual reality platforms can achieve the normalization of teaching resource sharing and open communication, endowing traditional education with new significance, enriching traditional teaching from content to scenes. However, virtual reality technology does not deny traditional educational models, nor can it replace the responsibilities of teachers. Teachers act as guides and leaders in integrating technology into language teaching, and need to combine the development of technology with a rational perspective to treat technology and promote integrated teaching of industry, academia, and research.

Conclusion

This study selected 12 empirical studies related to the metaverse and elaborated on the research objectives and results of these articles, exploring the current situation and development of virtual reality technology assisted second language teaching based on the metaverse. In addition, this article also combines a large number of Chinese literature related to this study to analyze the advantages and challenges faced by second language teaching based on virtual reality technology in the field of higher education in China, and puts forward relevant suggestions. In order to optimize the interactive teaching experience and truly achieve simulation, immersion, and interaction in classroom learning, higher teaching configurations are needed. Teachers should fully consider the relationship between teaching costs and teaching effectiveness, and choose appropriate configurations. Secondly, language learning based on virtual reality technology places high demands on teachers, and schools need to provide systematic teaching training to improve their ability to use technical tools to assist language teaching and their level of information technology. In future research, China needs to keep up with international research trends and combine technologies such as 5G, 6G, 3D virtual, VR, AR, XR, and artificial intelligence to empirically verify the effectiveness of these new technologies in assisting second language teaching and learning, and actively explore innovative teaching and talent cultivation models for second language learning in the metaverse era.

This study explores how metaverse platforms can create an immersive learning environment for second language acquisition, and explores the potential of metaverse based systems to provide personalized and immersive language learning experiences, making a certain contribution to the theoretical framework in this field. This study provides information for the design and implementation of future language learning systems, and contributes to ongoing discussions on integrating metaverse technology into language education. In addition, this study is of great significance to language educators, instructional designers,

policy makers, and researchers, providing valuable insights for the future development of language learning systems in the metaverse.

References

- AlSaleem, B. I. A. (2023). The Efficiency of Metaverse Platforms in Language Learning Based on Jordanian Young Learners' Perceptions. *Arab World English Journal*, 14(1).
- Baceviciute, S., Terkildsen, T., & Makransky, G. (2020). Paper A Remediating Learning from Non-immersive to Immersive Media: Using EEG to Investigate the Effects of Environmental Embeddedness on Reading in Virtual Reality. *Designing Virtual Reality for Learning*, 63.
- Berntsen, K., Palacios, R. C., & Herranz, E. (2016, November). Virtual reality and its uses: a systematic literature review. In *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality* (pp. 435-439).
- Blasing, M. T. (2010). Second language in Second Life: Exploring interaction, identity and pedagogical practice in a virtual world. *The Slavic and East European Journal*, 96-117.
- Borrero, N. E., & Yeh, C. J. (2010). Ecological English language learning among ethnic minority youth. *Educational researcher*, 39(8), 571-581.
- Cantone, A. A., Francese, R., Sais, R., Santosuosso, O. P., Sepe, A., Spera, S., ... & Vitiello, G. (2023, September). Contextualized Experiential Language Learning in the Metaverse. In *Proceedings of the 15th Biannual Conference of the Italian SIGCHI Chapter* (pp. 1-7).
- Chang, B., Sheldon, L., Si, M., & Hand, A. (2012). Foreign language learning in immersive virtual environments. In *The Engineering Reality of Virtual Reality 2012* (Vol. 8289, pp. 9-17). SPIE.
- Christoforou, M. (2022). Enhancing the ESP lesson with IMMERSE: a pedagogical example of a metaverse language learning platform. In *Conference Proceedings. Innovation in Language Learning 2022*.
- Collentine, K. (2011). Learner autonomy in a task-based 3D world and production.
- Du, W., & Hu, Z. (2021). A Study on the Attitude and Practice of Chinese Teachers and Students Towards VR Teaching for Foreign Language Learning. In *Intelligent Human Systems Integration 2021: Proceedings of the 4th International Conference on Intelligent Human Systems Integration (IHSI 2021): Integrating People and Intelligent Systems, February 22-24, 2021, Palermo, Italy* (pp. 728-732). Springer International Publishing.
- Godwin-Jones, R. (2023). Emerging spaces for language learning: AI bots, ambient intelligence, and the metaverse.
- Grant, S. J., Huang, H., & Pasfield-Neofitou, S. E. (2013). Language learning in virtual worlds: The role of foreign language and technical anxiety. *Journal for virtual worlds research*, 6(1).
- Howard, M. C., Gutworth, M. B., & Jacobs, R. R. (2021). A meta-analysis of virtual reality training programs. *Computers in Human Behavior*, 121, 106808.
- Ibáñez, M. B., García, J. J., Galán, S., Maroto, D., Morillo, D., & Kloos, C. D. (2011). Design and implementation of a 3D multi-user virtual world for language learning. *Journal of Educational Technology & Society*, 14(4), 2-10.
- Ishizuka, H. (2011). Language Learning System Realizing SLA Theories in a 3D Virtual World. In *EdMedia+ Innovate Learning* (pp. 3651-3659). Association for the Advancement of Computing in Education (AACE).

- Issa Ahmad AlSaleem, B. (2023). The Efficiency of Metaverse Platforms in Language Learning Based on Jordanian Young Learners' Perceptions. *Arab World English Journal (AWEJ) Volume, 14*.
- John, E., & Yunus, M. M. (2021). A systematic review of social media integration to teach speaking. *Sustainability, 13*(16), 9047.
- Kanematsu, H., Fukumura, Y., Barry, D. M., Sohn, S. Y., & Taguchi, R. (2010). Multilingual discussion in metaverse among students from the USA, Korea and Japan. In *Knowledge-Based and Intelligent Information and Engineering Systems: 14th International Conference, KES 2010, Cardiff, UK, September 8-10, 2010, Proceedings, Part IV 14* (pp. 200-209). Springer Berlin Heidelberg.
- Karacan, C. G., & Akoglu, K. (2021). Educational augmented reality technology for language learning and teaching: A comprehensive review. *Shanlax International Journal of Education, 9*(2), 68-79.
- Karathanos, K. (2009). Exploring US mainstream teachers' perspectives on use of the native language in instruction with English language learner students. *International Journal of Bilingual Education and Bilingualism, 12*(6), 615-633.
- Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for technology-based teaching and learning. *Educational technology, 38*(5), 20-23.
- Khatoony, S. (2019, December). An innovative teaching with serious games through virtual reality assisted language learning. In *2019 International Serious Games Symposium (ISGS)* (pp. 100-108). IEEE.
- Lan, Y. J. (2020). Immersion into virtual reality for language learning. In *Psychology of learning and motivation* (Vol. 72, pp. 1-26). Academic Press.
- Lawrence, G., & Ahmed, F. (2023). Avatar teaching and learning: Examining language teaching and learning practices in Virtual Reality Environments. In *Research Anthology on Virtual Environments and Building the Metaverse* (pp. 522-542). IGI Global.
- Lee, S. M. (2023). Second Language Learning through an Emergent Narrative in a Narrative-rich Customizable Metaverse Platform. *IEEE Transactions on Learning Technologies*.
- Li, M., & Yu, Z. (2023). A systematic review on the metaverse-based blended English learning. *Frontiers in Psychology, 13*, 1087508.
- Lu, C., Lyu, J., Zhang, L., Gong, A., Fan, Y., Yan, J., & Li, X. (2020). Nuclear power plants with artificial intelligence in industry 4.0 era: Top-level design and current applications—A systemic review. *IEEE Access, 8*, 194315-194332..
- Lu, X., Dai, G., Tian, L., & Liu, W. (2023, July). Student-centered Education in Metaverse: Transforming the Language Listening Curriculum. In *International Conference on Neural Computing for Advanced Applications* (pp. 478-491). Singapore: Springer Nature Singapore.
- Mikropoulos, T. A., & Natsis, A. (2011). Educational virtual environments: A ten-year review of empirical research (1999–2009). *Computers & education, 56*(3), 769-780.
- Nakahira, K. T., Rodrigo, N. R., Taguchi, R., Kanematsuy, H., & Fukumural, Y. (2010, November). Design of a multilinguistic Problem Based Learning learning environment in the metaverse. In *2010 2nd International Symposium on Aware Computing* (pp. 298-303). IEEE.
- Ortega, L. (2007). Meaningful L2 practice in foreign language classrooms: A cognitive-interactionist SLA perspective. *Practice in a second language: Perspectives from applied linguistics and cognitive psychology, 180-207*..

- Parmaxi, A. (2023). Virtual reality in language learning: A systematic review and implications for research and practice. *Interactive learning environments*, 31(1), 172-184.
- Parmaxi, A. (2023). Virtual reality in language learning: A systematic review and implications for research and practice. *Interactive learning environments*, 31(1), 172-184.
- Peterson, M. (2011). Towards a research agenda for the use of three-dimensional virtual worlds in language learning. *Calico Journal*, 29(1), 67-80.
- Peterson, M., Wang, Q., & Mirzaei, M. S. (2023). The use of network-based virtual worlds in second language education: A research review. *Research Anthology on Virtual Environments and Building the Metaverse*, 218-236.
- Rafiq, K. R. M., Hashim, H., & Yunus, M. M. (2021). Sustaining education with mobile learning for English for specific purposes (ESP): A systematic review (2012–2021). *Sustainability*, 13(17), 9768.
- Rajendran, T., & Yunus, M. M. (2021). A systematic literature review on the use of mobile-assisted language Learning (MALL) for enhancing speaking skills among ESL and EFL learners. *International Journal of Academic Research in Progressive Education and Development*, 10(1), 586-609.
- Ramalingam, S., Yunus, M. M., & Hashim, H. (2022). Blended learning strategies for sustainable English as a second language education: a systematic review. *Sustainability*, 14(13), 8051.
- Tamai, M., Inaba, M., Hosoi, K., Thawonmas, R., Uemura, M., & Nakamura, A. (2011, October). Constructing situated learning platform for Japanese Language and Culture in 3D Metaverse. In *2011 Second International Conference on Culture and Computing* (pp. 189-190). IEEE.
- Thrasher, T. (2023). Meeting in the Metaverse: Language Learners' Insights into the Affordances of Virtual Reality. In *Reimagining Education: Studies and Stories for Effective Learning in an Evolving Digital Environment* (pp. 179-194). Cham: Springer International Publishing.
- Wang, H., & Lai, P. C. (2023). Classroom Interaction and Second Language Acquisition in the Metaverse World. In *Strategies and Opportunities for Technology in the Metaverse World* (pp. 186-195). IGI Global.
- Wu, B., Yu, X., & Gu, X. (2020). Effectiveness of immersive virtual reality using head-mounted displays on learning performance: A meta-analysis. *British Journal of Educational Technology*, 51(6), 1991-2005.
- Wu, J. G., Zhang, D., & Lee, S. M. (2023). Into the Brave New Metaverse: Envisaging Future Language Teaching and Learning. *IEEE Transactions on Learning Technologies*.
- Yang, J. C., Chen, C. H., & Jeng, M. C. (2010). Integrating video-capture virtual reality technology into a physically interactive learning environment for English learning. *Computers & Education*, 55(3), 1346-1356.
- Zhang, H. (2013). Pedagogical challenges of spoken English learning in the Second Life virtual world: A case study. *British Journal of Educational Technology*, 44(2), 243-254.