Virtual Reality Games in Foreign Language Education: A Systematic Review

Nilay Çakır [a] [*]

[a] Iznik Ilçe Milli Eğitim Müdürlüğü, Bursa, Turkiye; https://orcid.org/0009-0003-9473-4901

Article Info	Abstract
Date submitted: 28/03/2024 Date accepted: 22/04/2024 Date published: 24/04/2024 *Review Article*	The integration of technology in modern education has led to innovative approaches to learning, such as the use of Virtual Reality (VR) in foreign language education. The current literature review primarily focuses on the benefits and drawbacks from the viewpoint of the student, paying little attention to the experiences and difficulties teachers encounter when incorporating VR games into their language teaching. This systematic review, examining 46 studies between 2010 and 2023 with the PRISMA methodology, delves deeply into the topic of VR game usage for foreign language education. The data were analysed using a descriptive content analysis approach. This systematic review explores the use of VR games in foreign language education, revealing their potential to provide immersive and engaging learning environments. It also highlights the positive impact of VR games on students' motivation and enjoyment of language learning activities. However, challenges such as technical constraints, limited accessibility to VR equipment, and teacher training in VR integration remain. The review emphasises the need for curriculum alignment and pedagogical support to maximise the educational benefits of VR games. **Keywords:** foreign language education, PRISMA model, systematic review, virtual reality, VR games.

Introduction

In the realm of modern education, the integration of technology has paved the way for innovative approaches to learning (Levy & Hubbard,2016), and one recent innovation is the use of Virtual Reality (VR) in foreign language education (Radianti et al., 2019; Yu, 2021). Virtual reality, which is a computer technology that gives users the impression of being immersed in a virtual environment that does not really exist (Fassi et al., 2016. p. 140), has become a powerful tool that can create worlds uniquely designed for educational purposes. VR is a computer simulation of a real-world scenario in which a human subject may engage with the virtual environment, occasionally using unconventional interfaces like helmets and spectacles that display the scene and audio (Fassi et al., 2016. p. 140). The immersive nature of VR not only facilitates social interaction among users, allowing them to communicate through avatars and mapped facial expressions (Chung, 2011; Kasapakis & Dzardanova, 2022), but also provides a flexible platform that can be customized to meet the diverse needs of learners (Rahman et al.,2023). VR games and their

[*] Nilay Çakır, Iznik Ilçe Milli Eğitim Müdürlüğü, Bursa, Turkiye, nilayceylan87@gmail.com

incorporation into foreign language education have been the subject of recent research that have shed light on the various ways that educators might use this technology to improve language learning.

Researchers have looked at the educational uses of virtual reality games and shown how they may be used to create immersive environments that facilitate language acquisition. According to research, virtual reality games give language learners the chance to practice speaking, listening, reading, and writing within realistic and contextually rich scenarios (Alfadil, 2020; Chen et al., 2020; Ebadi & Ebadijalal, 2022; Khatoony, 2019; Reitz et al.,2019; Tai, & Chen, 2021; Tai et al., 2022, Yang et al., 2020; Yeh et al., 2022). The literature also suggests that the interactive nature of VR games engages students in authentic language use, fostering a more dynamic and enjoyable learning experience (Ebert, 2015; Freina & Ott, 2015; Krokos et al., 2019; Lin & Lan, 2015; Nicolaidou et al., 2023; O'Brien & Levy, 2008; Solak & Erdem, 2015; Tilhou et al., 2020).

As educators increasingly consider the adoption of VR games, attention has been directed toward understanding the associated advantages and disadvantages. Studies have highlighted advantages such as higher student motivation, increased engagement and intercultural sensitivity, and improved retention (Chung, 2011; DeWitt et al., 2022; Divekar et al., 2018; Fussell & Truong, 2021; Merchant et al., 2014; Li et al., 2020; Shadiev & Yang, 2020; Ziyatdinova & Bezrukov, 2021), while acknowledging challenges such as the requirement for specialist equipment, possible technical problems, and worries about excessive screen time (Barrett et al., 2023; Dooly et al., 2023; Dolgunsöz et al., 2018; Kaplan-Rakowski & Gruber,2023; Kavanagh et al.2017; Li & Kou,2021; Mills et al. 2020).

Although the analysis of the literature offers insightful information about the application of VR games in language learning, there is a noticeable research gap concerning the investigation of long-term learning outcomes and maintained engagement. While a lot of study has focused on the short-term advantages of VR gaming, like higher motivation and engagement, little is known about how long-term use of these games will affect language learners. Understanding how VR games contribute to the development of language skills in the extended educational journey is essential for informing educators and policymakers. Moreover, the literature review primarily concentrates on the benefits and drawbacks from the viewpoint of the student, paying little attention to the experiences and difficulties that teachers encounter when incorporating VR games into their language teaching. Exploring the pedagogical implications, teacher training needs, and the practicalities of incorporating VR games into curriculum planning would provide a more holistic understanding of the dynamics involved.

By addressing some crucial concerns in the literature, this systematic review, examining studies between 2010 and 2023 with the PRISMA methodology, delves deeply into the topic of VR game usage for foreign language education. It explores the various language skills students can practice while playing VR games and examines how effective they can be in teaching a new language. It also discusses the advantages and disadvantages of using VR games, not just for students but also for teachers to present a whole picture. The following research questions shed light on whether VR games can truly make learning a new language more interesting and effective:

1. How can VR games be used in foreign language education?
2. Which language skills can be practiced through VR games?
3. What are the advantages and disadvantages of VR games for language teachers and learners?

Literature Review

The integration of technology in modern education has led to innovative approaches to learning, such as the use of Virtual Reality (VR) in foreign language education (Levy & Hubbard, 2016; Radianti et al., 2019; Yu, 2021). Virtual reality is a computer simulation of a real-world scenario in which a human subject may engage with the virtual environment, occasionally using unconventional interfaces like helmets and spectacles that display the scene and audio (Fassi et al., 2016. p. 140). VR has become a powerful tool that can create worlds uniquely designed for educational purposes. The immersive nature of VR not only facilitates social interaction among users, allowing them to communicate through avatars and mapped facial expressions (Chung, 2011; Kasapakis & Dzardanova, 2022), but also provides a flexible platform that can be customised to meet the diverse needs of learners (Rahman et al.,2023).

VR games integration in language education is in line with the increased focus on 21st-century skills and digital literacy, utilising technology to create more engaging and productive learning settings. These games, targeting different languages like English, Chinese, and German, can be used at various educational levels from primary school to adult learners. Previous studies on the practical applications of VR games have demonstrated how these immersive environments can be used to support language learning. They enhance language skills like vocabulary, listening, and speaking, and create a safe environment for learners to practise without fear of real-world consequences. One key area is vocabulary acquisition. Some studies show that students who play VR games achieve higher vocabulary acquisition achievements than those using traditional methods (Alfadil, 2020; Chen, 2021; Lin et al, 2019; Tai et al., 2022) and grasping virtual objects improves vocabulary call and retention (Andra et al.,2021; Kaplan-Rakowski,2019; Kwok et al., 2022; Si, 2015). Another significant aspect is the improvement of oral language skills. VR games had a significant effect on language learners' pronunciation (Khatoony, 2019) and oral competence (Ebadi & Ebadijalal, 2022; Reitz et al.,2019; Yang et al., 2020), which increases the willingness of learners to communicate. VR environments provide a safe and interactive space for learners to practise speaking and listening, mimicking real-life conversations and interactions. Tai and Chen (2021) claim that MVR players significantly improve listening comprehension and retention compared to video watchers by providing simulated and interactive environments, activating prior knowledge, reduced anxiety, and prevented cognitive overload. The potential of VR games to cater to different learning styles and needs offers a novel tool for foreign language educators. The studies also suggest that VR can enhance traditional language learning methods, providing a more engaging and interactive experience for learners (Ebert, 2015; Freina & Ott, 2015; Krokos et al., 2019; Lin & Lan, 2015; Nicolaidou et al., 2023; O'Brien & Levy, 2008; Solak & Erdem, 2015; Tilhou et al., 2020). Additionally, the findings in Yeh et al. (2020) study also present that VR technology enhances EFL students' intercultural learning by providing a more immersive and engaging learning experience.

The adoption of VR games by educators has been a topic of interest, with studies highlighting its benefits such as increased student motivation, engagement, intercultural sensitivity, and retention (Chung, 2011; DeWitt et al., 2022; Divekar et al., 2018; Fussell & Truong, 2021; Merchant et al., 2014; Li et al., 2020; Shadiev & Yang, 2020; Ziyatdinova & Bezrukov, 2021). However, challenges such as the need for specialist equipment, potential technical issues, and concerns about excessive screen time have also been identified in several research. There are technical challenges associated with implementing VR, such as the need for new technical skills, resource-intensive setups, and user experience (Kavanagh et al.2017). According to the study of Barret et al. (2023), users' perceptions of their own technology-using abilities improve the likelihood that positive attitudes will emerge and that the technology will ultimately be

adopted. In Dolgunsöz et al. research (2018), which aims to investigate the impact of VR experience on enhancing EFL writing skills, most learners enjoyed VR videos, but expressed technical limitations like low quality and physical discomfort. Furthermore, it is stated in some studies that the use of high-immersion virtual reality causes discomfort or motion sickness for some students, and is not accessible to all due to cost or technological limitations (Kaplan-Rakowski & Gruber,2023; Mills et al. 2020). Dooly et al. (2023) also indicate that production of the target language is less controlled and less accurate in VR compared to face-to-face "traditional" oral activities in the classroom.

The literature on the use of VR games in language learning is limited, with a focus on short-term benefits like increased motivation and engagement. However, there is a lack of research on long-term learning outcomes and engagement. Understanding how VR games contribute to language skill development is crucial for educators and policymakers. The literature review mainly focuses on student benefits and drawbacks, neglecting teacher experiences and difficulties. A comprehensive understanding of pedagogical implications, teacher training needs, and practicalities of incorporating VR games into curriculum planning would provide a more comprehensive understanding of the dynamics involved.

Methodology

In this study, the data was gathered through a systematic research methodology which identified the steps necessary to conduct a literature review with the PRISMA model (Preferred Reporting Items for Systematic reviews and Meta- Analyses). The systematic design and gradual exclusion of qualifying criteria ensured the validity and comprehensiveness of the review.

Eligibility Criteria

The PRISMA methodology lays out a number of steps and directives designed to make the research more transparent in terms of outlining the objectives, actions taken, and results of the systematic review (Moher et al.,2009). All the studies were selected based on the pre-defined inclusion and exclusion criteria. The exclusion criteria were deliberately structured to be incremental. In practical terms, if an article fails to meet exclusion criteria 1, it is immediately excluded without being further examined in light of additional exclusion criteria.

Inclusion Criteria

IC1- The paper has the following terms in the title, abstract or keywords: "virtual reality and foreign language", "virtual reality and gamification", "virtual reality games in foreign language" etc.

IC2- Research Articles published between 2010-2023

IC3- The paper should be open access.

Exclusion Criteria

EC-1 - Study is not written in English;

EC-2 - The papers that are not research articles;

EC-3 - The papers that are systematic or literature review;

EC-4 -The articles that are not published in journals (indexed by SSCI, ESCI or Scopus)

EC-5 -The paper does not consider Virtual Reality for FL/SL teaching/learning;

EC-6 -The paper does not consider teaching/learning of a foreign/second/other language;

EC-7 - The study does not use gamification or games.

Search Strategy

The initial step of the search strategy was retrieving data from databases using the search string based on IC-1 in the databases Scopus, Web of Science, Elsevier, and ERIC. These databases are acknowledged as important and trustworthy resources for top-notch articles in the fields of technology and education. Firstly, a search was conducted using the mentioned search strings, incorporating key terms such as "Virtual reality and foreign language", "Virtual reality and gamification", "Virtual reality games in foreign language" and "Virtual reality games in second language". Subsequently, research results were refined sequentially based on inclusion and exclusion criteria. The retrieved papers were imported to Mendeley using the BibTex format, which made it possible to remove the duplicate documents, make changes, and export it to a spreadsheet.

Study Selection

For each paper, the eligibility criteria were applied to the title, abstract, and keywords. The abstracts of the retrieved papers were independently reviewed in a standardised manner by two researchers. In cases of disagreement, the articles were kept for more detailed analysis during the full-text examination phase.

Data Collection Process

The data collection form shown in Figure 1 was utilised to gather information from the studies included in the research. The research questions were found to correspond to the elements covered in the data collection form. This information consisted of the following elements: title of the article; year of the publication; research method / design, sample size; which languages were covered in the study; which educational stages were targeted; which VR tools were used; which factors were evaluated; which language skills were practiced; what advantages of VR games were found for both teachers and students; what disadvantages of VR games were found for both teachers and students. Each study was systematically documented and individually assessed following the standards outlined in the form.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Title of the Study	Publication year	Research Method / Design	Sample Size	Covered Languages	Educational Stages	Vr Tools	Evaluated Factors	Language Skills	Advantages for Teachers	Disadvantages for Teachers	Advantages for Students	Disadvantages for Students
2													
3													
4													
5													

Fig. 1. Data Collection Form

Identification of studies for analysis

In the first phase, 3842 records were identified in the databases mentioned earlier. 2604 records were excluded as they were not open access research articles. Later, 955 records were removed based on

exclusion criteria identified in the Eligibility Criteria section above, leaving a total 283 full-text papers. After the duplicate articles were removed (n = 119), 164 research articles were screened by the researcher. 118 articles were excluded due to some different reasons based on exclusion criteria. After this process, the final number of full-text papers was 46. Figure 2 presents a flow diagram with a report of the results gained in each phase.
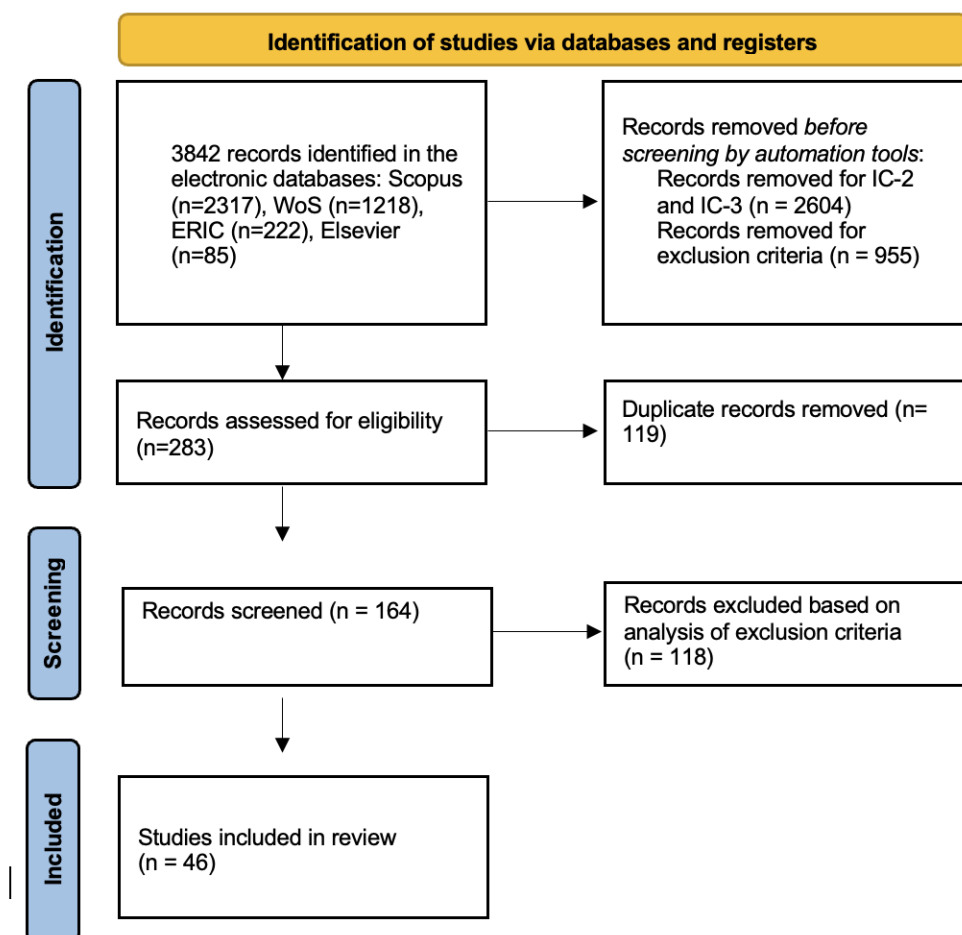

Fig. 2. Flow Diagram of Study Selection

Reporting

The criteria in the data collecting form were used to analyse and record each study that was part of the research separately. The recorded studies were examined using a process known as descriptive content analysis which is systematic investigations that evaluate trends and research findings in a descriptive dimension by considering studies done on a certain topic (Sozbilir, Kutu and Yasar, 2012). Frequency and percentage values were used to present the data from the studies that underwent descriptive content analysis.

Results

This systematic review, conducted between 2010 and 2023 using the PRISMA methodology, addresses significant gaps in the literature by thoroughly examining the usage of VR games for foreign language education. After a rigorous selection process, 46 articles were analysed for the study. The results were presented in different sections.

Publication Year

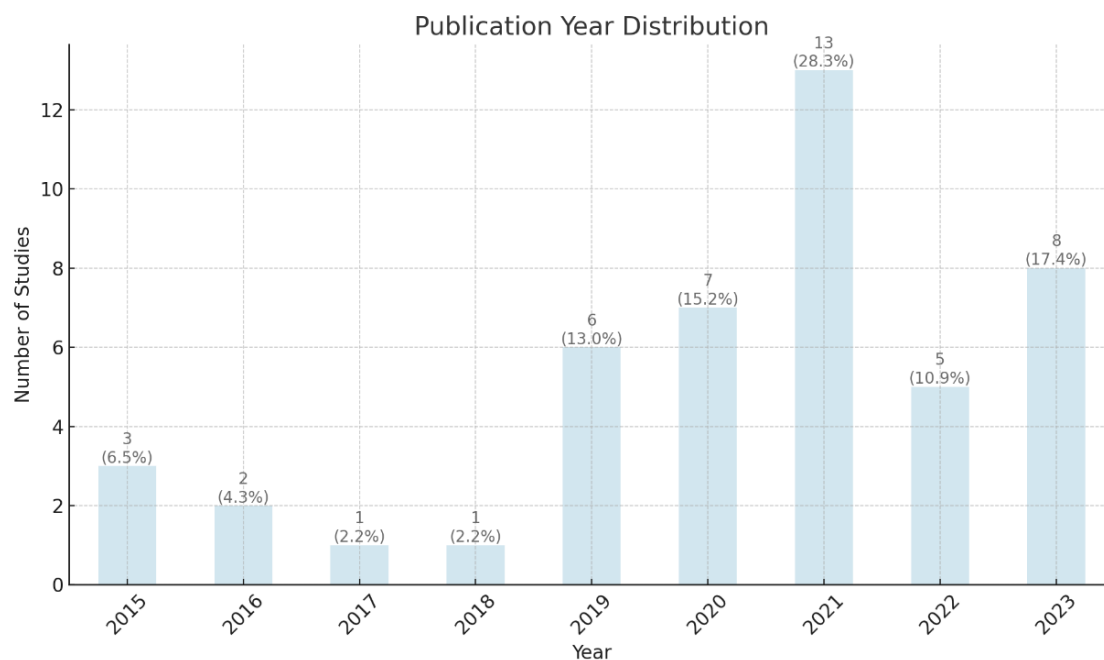The distribution of the studies according to publication year is presented in Figure 3.

Fig. 3. Publication Year Distribution

The data comprises 46 studies, with no missing year entries. The year 2021 emerges as the most prolific, accounting for 28.3% of the total publications. It's followed by 2023 and 2020, contributing 17.4% and 15.2%, respectively. The years 2019 and 2022 each represent a significant share as well, with 13.0% and 10.9% of the studies. The years 2015, 2016, 2017, and 2018 show lesser activity, contributing 6.5%, 4.3%, 2.2%, and 2.2% respectively. Even though this review has been conducted between 2010 and 2023, there are no studies between 2010 and 2014. This pattern indicates a growing interest and publication rate in the field, especially in the most recent years, peaking notably in 2021. A captivating trend emerges, particularly in relation to the COVID-19 pandemic, which began impacting the world significantly in early 2020.

Research Method and Design

The distribution of the studies according to research method and design is presented in Figure 4.
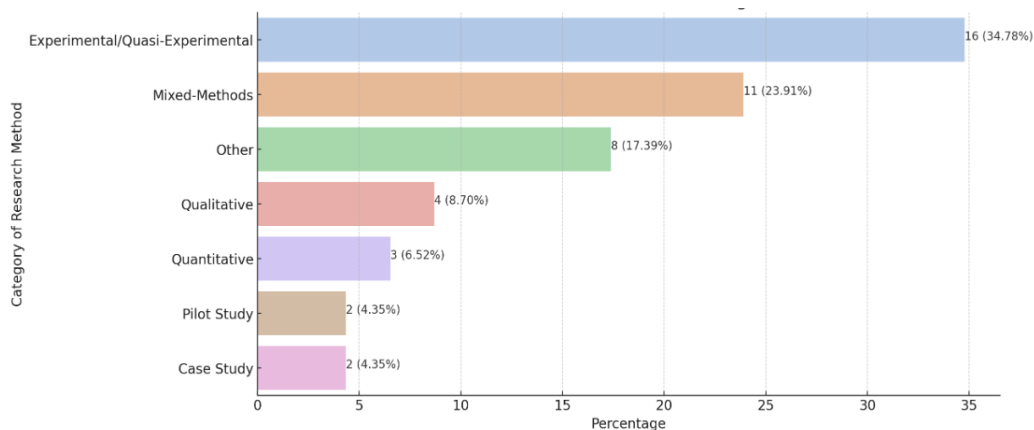
Fig. 4. Research Method and Design Distribution

When the dataset is examined, it is observed that the most common approach is the Experimental/Quasi-Experimental method, which constitutes 34.78% of the studies. This indicates a strong preference for structured and controlled research setups within the field. Mixed-Methods, encompassing both qualitative and quantitative elements, also form a substantial part (23.91%), demonstrating their importance in comprehensive research. Qualitative research designs are used in 8.70% of the studies, while quantitative methods are employed in 6.52%. Both Pilot Study designs and Case Studies each makeup 4.35% of the total. The category labelled 'Other', which includes diverse and non-standard methodologies, represents 17.39%. The variety in research methods underscores the diverse methodologies embraced in this research area.

Sample Size

The distribution of the studies according to sample size is presented in Figure 5.
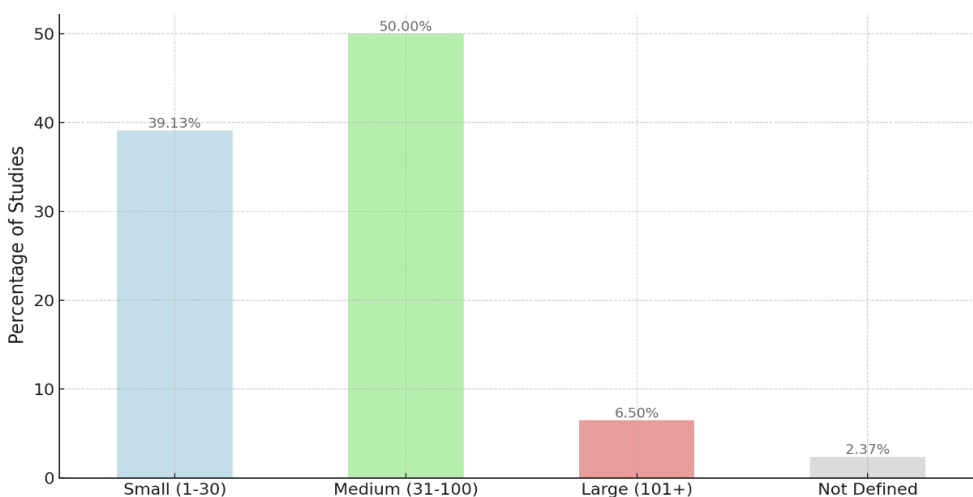

Fig. 5. Sample Size Distribution

The analysis of sample sizes in the dataset reveals insightful trends about the research practices in the field. Medium sample sizes (31-100 participants), which make up 50% of the studies, are the most common. This prevalence suggests that researchers often seek a balance between the depth of individual data points and the statistical power needed for generalizability. On the other hand, small sample sizes (1-30 participants), accounting for 39.13% of the studies, indicate a significant inclination towards detailed, qualitative research, where in-depth insights from a smaller group are prioritized. Large sample sizes (101 or more participants) are relatively rare, constituting only 6,5% of the studies. This scarcity might be attributed to the logistical and resource constraints inherent in managing large-scale research. In 2 studies, sample size is not defined clearly.

Covered Language

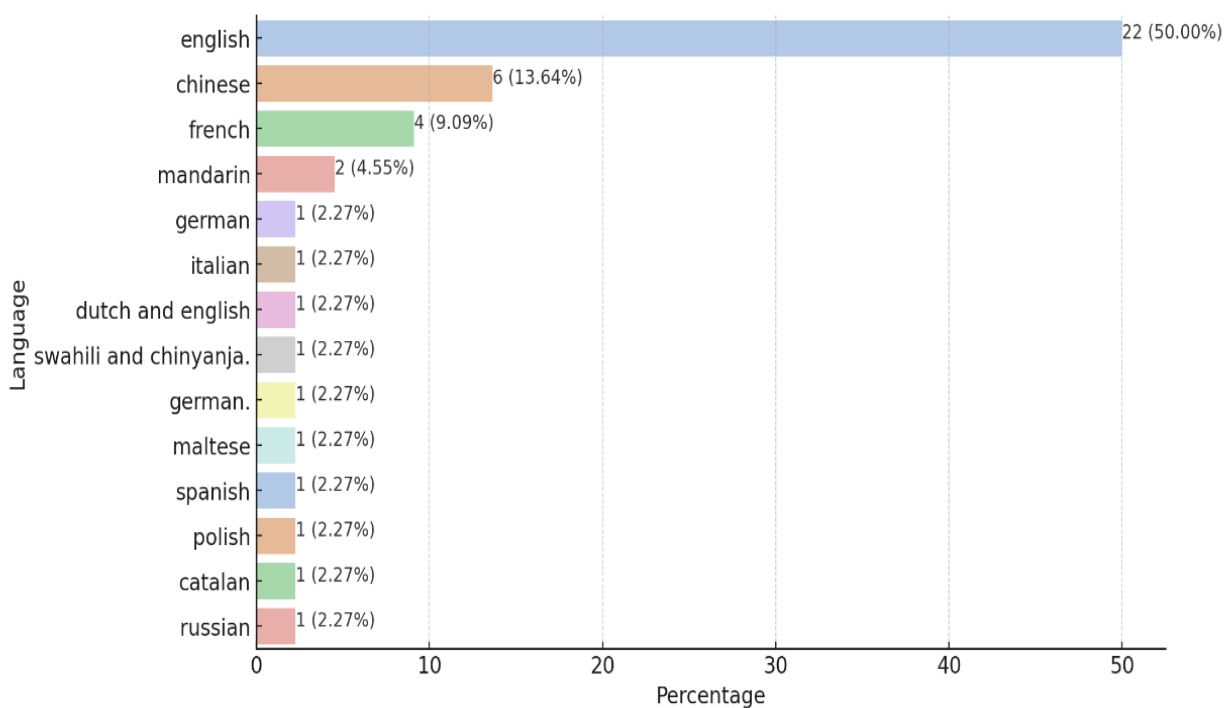The distribution of the studies according to covered language is presented in Figure 6.

Fig. 6. Covered Language Distribution

When Figure 6 is examined, English emerges as the predominant language, covering 50% of the studies. This overwhelming majority underscores English's global academic influence and its status as the lingua franca in many research areas. Chinese, including Mandarin, accounts for a notable 18.18% of the studies (13.64% for Chinese and 4.55% for Mandarin separately). This reflects the growing academic contributions and research interest in the Chinese-speaking world. Other languages like French (9.09%), German (2.27%), and Spanish (2.27%) also find representation, though to a lesser extent. Several languages such Arabic, Dutch, Italian, and Russian appear only once in the dataset, each contributing to 2.27% of the total.

Educational Stages

The distribution of the studies according to educational stage is presented in Figure 7.
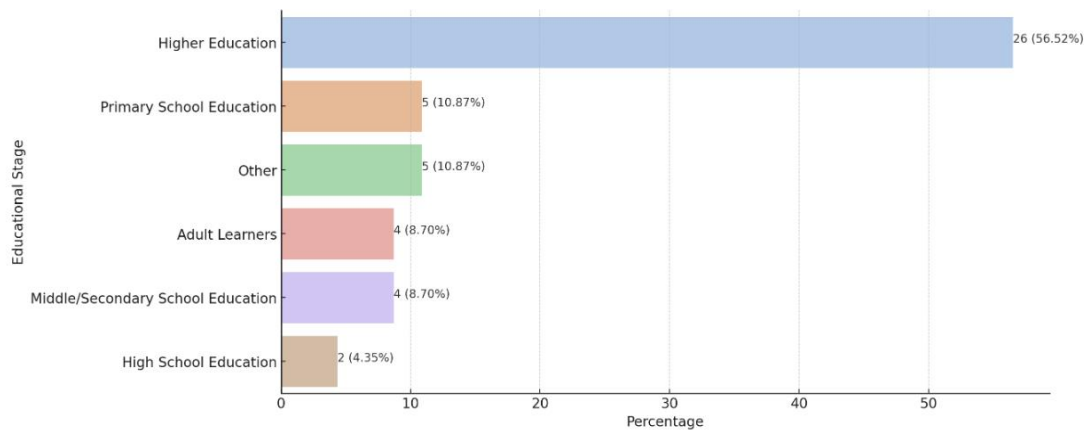

Fig. 7. Educational Stages Distribution

When the categorization of "Educational Stages" in the dataset is examined, it becomes evident that the majority of the studies, specifically 26 out of 46, focus on higher education. This accounts for a significant 56.52% of the total. Primary school education is the next most prominent category, encompassing 6 studies and making up 13.04% of the research. Middle/Secondary school education and adult learners are represented in 3 (6.52%) and 4 (8.70%) of the studies, respectively. Research focusing on high school education comprises a smaller fraction, with 2 studies accounting for 4.35% of the total. Finally, teachers are the subject of the least number of studies, with only 1 study, representing 2.17% of the total research. This distribution highlights a strong inclination towards higher education and primary school research, with other educational stages receiving comparatively less attention.

Virtual Reality Tools

Categorising the "VR Tools" used in the studies involves grouping them into broader types based on their functionality and platform. The categorization is as below:

- Specific VR Hardware: Tools like Oculus Rift, Oculus Quest, Google Cardboard, and similar specific hardware devices.
- VR Software Platforms: This includes platforms like Second Life, Unity game engine, Unreal Engine, etc., which are used to create or host VR environments.
- Educational VR Applications: Specific applications developed for educational purposes, like EduVenture or ImmerseMe.
- General VR Technologies: Broad, unspecified mentions of VR technology, which might include a range of hardware and software tools.
- Others: This includes unique or less common tools that don't fit neatly into the other categories, like spherical video-based VR technology or speech recognition units.

The distribution of the studies according to VR tools used or examined in the articles is presented in Figure 8.
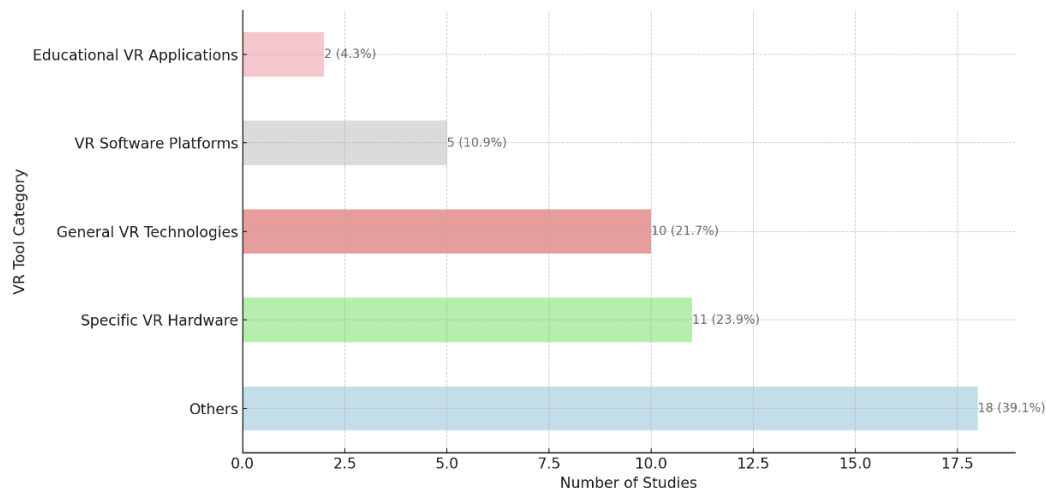

Fig. 8. VR Tools Distribution

Upon examining the categorization of "VR Tools" in the dataset, it becomes evident that the use of specific VR hardware, such as Oculus Rift, Oculus Quest, and Google Cardboard, is the most prominent, constituting the majority of the tools (23.91%) used in the studies. This preference for well-known VR hardware reflects the field's inclination towards established, reliable technology for immersive experiences. Similarly, VR software platforms like Second Life, Unity, and Unreal Engine are also widely utilised (10.9%), indicating their significance in creating versatile and engaging VR environments for research. The general VR technologies category, which encompasses a broader range of VR tools without specifying particular brands or types, also holds a notable share (21.7%). Educational VR applications, tailored for specific learning experiences, form a smaller but significant part (6.52%) of the VR tools used, highlighting their specialised role in enhancing educational outcomes. The 'Other' category (39.1%), which includes a variety of unique and less common VR-related technologies, demonstrates the diversity and experimental nature of VR tools in educational research. The names of VR tools and platforms are presented in Table 1.

Table 1.

VR Tools used in the articles

Themes	Codes
Specific VR Hardware	● Oculus Rift ● Oculus Dash ● Oculus Quest ● Google Cardboard

Themes	Codes
VR Software Platforms	• Unity Game Engine • Unity 3D • Unreal engine 4 • Second Life
Educational VR Applications	• EduVenture • ImmerseMe
Others	• Veative • Virtual Worlds • Google Expeditions • vTime XR • Open Sims • Virtual Experiential Language Learning Environment (VELLE) • Mozilla Hubs • EnglishLife.cz VR videoconferencing • Gizmo • Immerse

Evaluated Factors

These factors cover different aspects of language learning and teaching, particularly in relation to virtual reality (VR) tools. The distribution of the studies according to evaluated factors in the articles is presented in Figure 9.
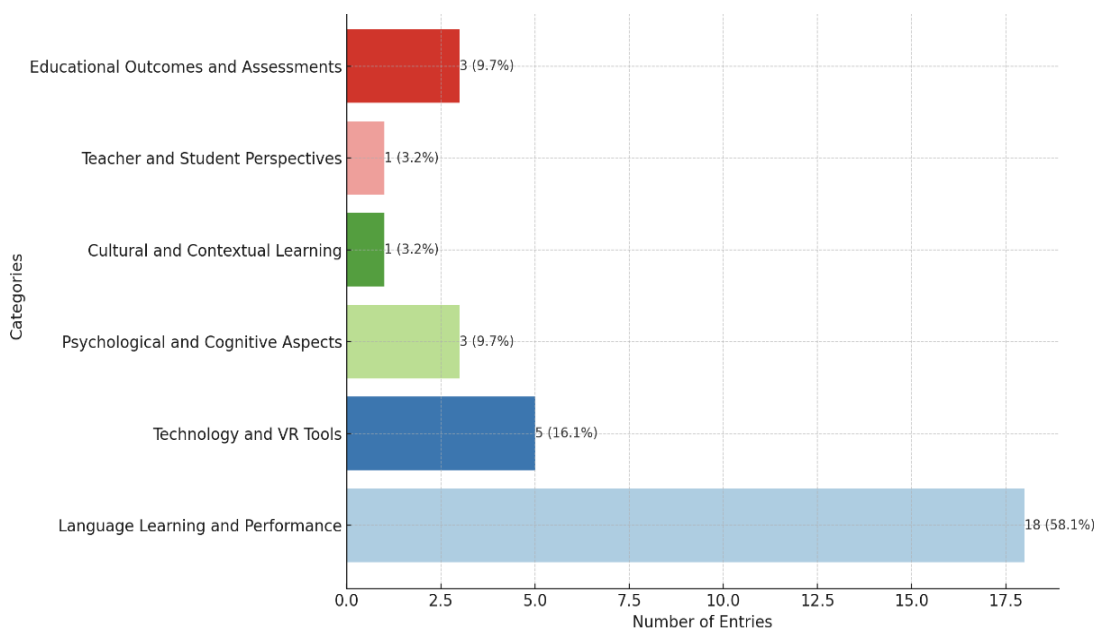

Fig 9. Evaluated Factors Distribution

When examining the categorized 'Evaluated Factors' from the dataset, it is observed that 18 studies (58.1%) are related to 'Language Learning and Performance' which includes impact on language learning (e.g., vocabulary acquisition, pronunciation, language production skills) and students' language performance (e.g. oral performance, communicative ability, language proficiency). 'Technology and VR Tools', which are related to the impact of VR on learning experiences like immersion and engagement and their challenges, are the subject of 5 studies (16.1%). The 'Psychological and Cognitive Aspects' are explored in 3 studies (9.7%), highlighting the effects of VR tools on motivation, self-efficacy, and anxiety and the role of working memory and spatial reasoning. 'Cultural and Contextual Learning' and 'Teacher and Student Perspectives' each have 1 study (3.2%), suggesting these areas are less emphasized in the current dataset. Moreover, 'Educational Outcomes and Assessments' are the focus of 3 studies (9.7%), indicating a balanced interest in educational results and methods of assessment in language learning.

Language Skills

Language Skills are grouped as in the categorization below:

- General Language Learning: This includes entries that refer broadly to language learning without specifying a particular skill, like "language learning in general" or "all language skills."

- Speaking and Pronunciation Skills: Entries focusing on speaking abilities, pronunciation, fluency, intonation, and similar aspects fall into this category.

- Vocabulary Acquisition: This category covers entries specifically mentioning vocabulary learning, recall, and retention.

- Reading and Writing Skills: Entries that emphasize reading and writing abilities, including grammar, spelling, and content, are grouped here.

- Communicative Abilities: This includes skills related to communicative competence, oral production, and other aspects of communication strategies.

- Other Specific Skills: This category covers more unique or less frequently mentioned skills like intercultural communicative competence, pragmatic performance, or specific language forms.

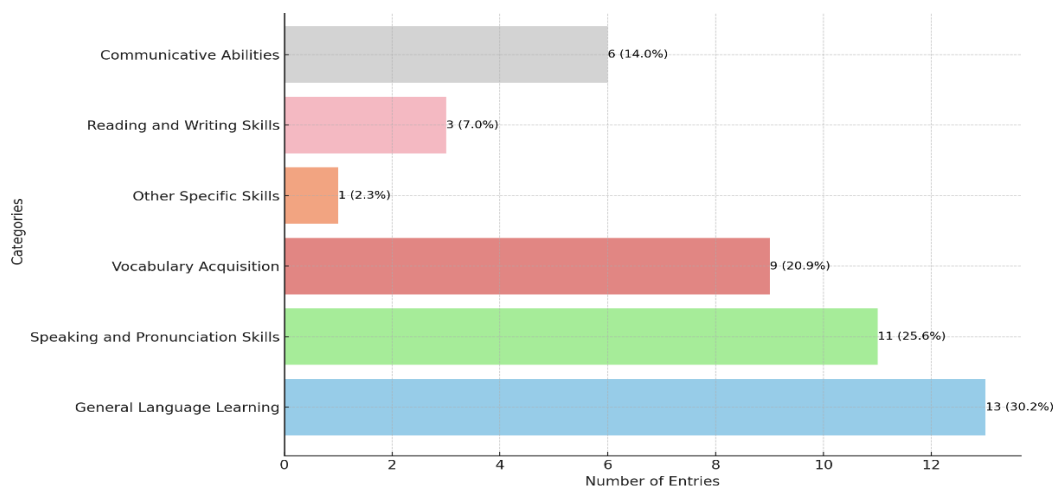The distribution of the studies according to language skills is presented in Figure 10.

Fig. 10. Language Skills Distribution

Upon examining the language skills categorization within the dataset, it becomes apparent that "General Language Learning" is the most prevalent category, encompassing 47.2% of the studies. This indicates a broad interest in language learning without a specific focus on particular skills. Following closely, "Speaking and Pronunciation Skills" account for 26.3% of the studies, highlighting a significant emphasis on oral language capabilities. "Vocabulary Acquisition" is another notable category, representing 15.8% of the studies, which suggests a focused interest in the learning and retention of vocabulary. "Reading and Writing Skills" make up 5.3% of the studies, pointing to a modest but specific interest in these fundamental language skills. The "Communicative Abilities" category, covering aspects like communicative competence and oral production, comprises 2.6% of the studies, indicating a more targeted area of research within language learning. The "Other Specific Skills" category, which includes unique or less frequently mentioned skills, accounts for 2.6% of the studies, reflecting niche interests in the field. This distribution of language skills within the dataset provides insightful perspectives on the research trends and areas of focus in language learning studies.

Advantages and Disadvantages for Language Teachers and Learners

The advantages and disadvantages of VR usage for language teachers are presented in Table 2.

Table 2.

Advantages and Disadvantages of VR usage for Language Teachers

Themes	Codes
Advantages	• Enhanced Engagement and Interaction • Innovative Teaching Approaches • Enhanced Language Skills and Learning Experience • Technology Integration • Improved Communication • Pedagogical Effectiveness • Anxiety and Performance Improvement
Disadvantages	• Control and Accuracy Issues • Implementation Challenges • Cost and Training Barriers • Integration Limitations • System Refinement Needs • Physical Issues

The articles reviewed highlight numerous advantages for language teachers using VR in their teaching. Firstly, VR empowers educators to design lessons that are more captivating and interactive, leading to a more gratifying and productive teaching experience as they witness a direct increase in student engagement and interest. Secondly, VR provides a platform for teachers to explore and implement novel teaching strategies. This includes the use of immersive narratives, interactive role-plays, and simulations of real-world scenarios, which can add a dynamic quality to language instruction. Thirdly, VR enables educators to offer a learning experience that is both impactful and memorable. Creating environments that are both immersive and realistic aids in enhancing student comprehension and the retention of language concepts. Fourthly, the incorporation of VR into educational programs positions teachers at the cutting edge of educational technology, improving not just the learning experience but also their personal technical abilities and digital knowledge. Fifthly, VR can be used by teachers to craft situations that promote more effective communication in the language being taught, aiding significantly in group activities and cooperative learning. Sixthly, VR contributes to the effectiveness of teaching methods by allowing educators to use more hands-on and experiential approaches, often surpassing the efficiency of conventional lecture-style teaching. Finally, teachers can create a less intimidating environment for language learning, which can play a crucial role in lowering student anxiety, thereby fostering a conducive atmosphere for practicing speaking and interactive skills.

While VR offers innovative opportunities for language teaching, these disadvantages highlight the practical and logistical challenges teachers may face in its implementation. First of all, ensuring the accuracy of language content and the appropriateness of interactions within VR is difficult. This might impact the quality of teaching and the learning outcomes. Second, implementing VR in the classroom is complex. Teachers must consider factors like classroom management, aligning VR activities with curriculum standards, and ensuring all students are equally engaged and benefiting from the technology. Third, the high cost of VR equipment and software is a significant barrier. Additionally, teachers need additional training not only in the technology itself but also in designing and facilitating VR-based learning experiences, which can be both time-consuming and costly. Fourth, integrating VR technology with existing educational frameworks and systems is challenging. Teachers struggle to find VR content that aligns with their teaching goals or to blend VR experiences seamlessly with traditional teaching methods. Fifth, VR technology, being relatively new in educational contexts, still needs refinement. Issues such as software bugs, limited content availability, or non-intuitive interfaces create obstacles for teachers in delivering effective lessons. Additionally, there are physical considerations, such as the potential for VR-induced motion sickness in some users, and the need for physical space to use VR safely. The advantages and disadvantages of VR usage for language learners are presented in Table 3.

Table 3.

Advantages and Disadvantages of VR usage for Language Learners

Themes	Codes
Advantages	• Enhanced Learning Experience
	• Improved Language Skills
	• Increased Engagement and Interaction
	• Immersive Learning Environment
	• Cultural Understanding
	• Reduction of Anxiety
	• Independent and Creative Learning
	• Technological Familiarity
	• Communication and Social Skills
Disadvantages	• Technical and Practical Limitations
	• Less Effective Language Production
	• VR Sickness and Physical Discomfort
	• Accessibility and Cost Concerns
	• Motivation and Engagement Issues
	• Visual Discomfort and Fatigue
	• Distraction from Learning Opportunities
	• Disadvantages in Assessment Settings

Virtual Reality offers various advantages for language learners, enhancing the overall learning experience in several significant ways. Firstly, it provides an enriched, immersive learning experience, far surpassing traditional textbook-based methods, leading to better retention and a deeper understanding of language concepts. This immersive environment also allows for improved language skills, particularly in conversational and vocabulary development, by simulating real-life scenarios. The technology's engaging nature increases learner interaction and involvement, a key factor in language acquisition. Moreover, VR offers a unique opportunity for cultural immersion, enabling learners to virtually experience different cultures and contexts, which not only aids in language learning but also in developing a broader cultural understanding. A major advantage of VR is its ability to create a safe, controlled environment for language practice, significantly reducing the anxiety associated with learning and speaking a new language. This reduction in anxiety fosters more confident and effective communication. VR also encourages independent and creative learning, allowing learners to explore and practise at their own pace, leading to a more personalised learning experience. In addition to language skills, VR familiarises learners with modern technology, an essential skill in today's digital world. Lastly, VR enhances communication and social skills by providing opportunities for virtual interactions in the target language, ranging from structured exercises to spontaneous communications, akin to real-life interactions. Collectively, these benefits contribute to a

more effective, enjoyable, and holistic language learning journey, making VR a powerful tool in language education.

Although Virtual Reality (VR) presents innovative methods in language learning, it also brings several disadvantages that encompass both technical challenges and educational drawbacks. Issues related to the technical aspects and practical implementation, such as the dependability of software, compatibility of hardware, and the overall effectiveness of VR experiences, impact the efficiency of language learning within a VR environment. The nature of VR, being pre-set, leads to less effective language production compared to traditional interactive learning, limiting the opportunity for dynamic language interaction. A notable concern is the discomfort and sickness associated with VR, including symptoms like nausea and disorientation, which can significantly reduce the appeal of the learning experience. The high costs and limited accessibility of VR technology are significant barriers, potentially widening educational inequality. Engagement levels with VR can vary; while initially stimulating, long-term interest might decline, particularly if the VR content doesn't cater to the learners' interests or learning styles. Prolonged use of VR headsets can cause visual discomfort and fatigue, affecting concentration and learning efficiency. The novelty of VR might also lead to distractions, with learners focusing more on the technology than on language learning objectives. Finally, assessing language skills in a VR context presents unique challenges, as conventional evaluation techniques may not be fully applicable in a virtual setting, which could lead to inconsistencies in measuring language proficiency.

Discussion

Virtual Reality (VR) games have emerged as a dynamic and effective tool in foreign language education, as evidenced by various studies compiled in this systematic review. This study was designed around three key research questions, aimed at delving deeply into the topic of VR game usage for foreign language education. The main research findings were discussed to provide answers to the study's research questions.

RQ1: How can VR games be used in foreign language education?

The use of VR games in foreign language education demonstrates a significant potential across various educational stages and language contexts. These studies, covering languages such as English, Chinese, and German, and targeting educational levels from primary school to adult learners, highlight the versatility and adaptability of VR in language learning curricula. Based on the findings of the review, VR technologies can be used in foreign language education to enhance immersive learning experiences, providing real-life scenarios for language practice, as mentioned in prior studies (Ebert, 2015; Freina & Ott, 2015; Krokos et al., 2019; Lin & Lan, 2015; Nicolaidou et al., 2023; O'Brien & Levy, 2008; Solak & Erdem, 2015; Tilhou et al., 2020). VR's ability to create immersive experiences that closely mimic real-world scenarios allows learners to practice and apply language skills in lifelike settings, bridging the gap between classroom learning and practical language use. These tools facilitate a safe environment for learners to practice language without the fear of real-world consequences, encouraging experimentation and active learning. This study also highlights the potential of VR games to cater to different learning styles and needs, offering a novel and effective tool for foreign language educators, which aligns with Rahman et al.'s study (2023). Another key feature is cultural immersion, where VR is used to simulate travel experiences, allowing learners to virtually explore different countries and cultures. This immersive approach not only enhances

language learning by providing contextual and practical use of the language but also deepens the learner's understanding and appreciation of diverse cultures. The studies suggest that VR can enhance traditional language learning methods, providing a more engaging and interactive experience for learners.

On the basis of findings, the choice of VR tools and methods should align with the learners' age, language proficiency level, and learning objectives. For adults, VR can offer more complex and realistic scenarios for practical language use, whereas for children, VR should focus on engaging, interactive, and educational content. Sophisticated VR headsets like the Oculus Rift provide immersive experiences that are particularly well-suited for adult learners. A range of VR apps specifically designed for language learning, such as ImmerseMe, complement these headsets. These applications immerse users in everyday situations, like ordering food in a restaurant or asking for directions in a foreign country, thereby facilitating the practical application of language skills. Additionally, collaborative platforms such as Immerse or Second Life present unique opportunities for adult learners to interact with native speakers and peers from around the globe in a virtual setting. The methodology employed in VR for adults focuses predominantly on practical application and conversational practice.

In the context of language education for children, VR offers a range of child-friendly tools and methodologies that prioritize engagement and interactive learning. Child-friendly VR headsets, such as Google Cardboard or Oculus Quest, are designed to be lighter and more comfortable, catering specifically to the needs of younger users. However, it's essential that these devices are used under adult supervision and for limited periods to prevent any potential discomfort or health issues. One of the most effective applications of VR in children's language learning is through educational VR games. Platforms like EduVenture VR offer a variety of games tailored for language learning, which are both educational and engaging. These games typically feature colourful and interactive elements, making the learning process enjoyable and captivating for young minds. Additionally, VR can be used to create interactive stories, allowing children to immerse themselves in a narrative context where they can actively participate and learn new words and phrases.

RQ2: Which language skills can be practiced through VR games?

VR technology offers a dynamic platform for practicing a diverse range of language skills, which is in line with other studies in education context (Alfadil, 2020; Chen et al., 2020; Ebadi & Ebadijalal, 2022; Khatooni, 2019; Reitz et al.,2019; Tai, & Chen, 2021; Tai et al., 2022; Yang et al., 2020; Yeh et al., 2022). While a diverse range of language skills are explored in VR-based language learning research, the most emphasized areas tend to be those that benefit most from the immersive and interactive capabilities of VR technologies, such as vocabulary acquisition, communicative competence, and oral production skills. This review reveals a clear emphasis on certain language skills, with vocabulary acquisition standing out as a particularly prominent area of focus. This trend highlights the effectiveness of VR's immersive nature in enhancing vocabulary learning through contextual associations. Additionally, communicative competence, encompassing both verbal and non-verbal skills, emerges as a significant research interest, reflecting the growing recognition of interactive skills in language education. Oral production and pronunciation skills also receive considerable attention, as VR's interactive and immersive environments offer a unique platform for practicing and improving speaking and pronunciation, complete with immediate feedback. While reading and writing skills are explored to a lesser extent, they are nonetheless important components of VR-based language studies, benefiting from VR's capability to make text interaction more engaging.

RQ2: What are the advantages and disadvantages of VR games for language teachers and learners?

The integration of VR technology into foreign language education, as revealed by this systematic review, brings a mix of advantages and disadvantages for both language teachers and learners. For teachers, VR offers an innovative teaching method, enabling them to make language lessons more dynamic and engaging. This technology fosters enhanced student engagement, as the immersive nature of VR captures students' interest more effectively than traditional methods. Additionally, VR allows for customizable learning experiences, giving teachers the flexibility to tailor lessons to diverse student needs and learning styles. However, there are notable disadvantages, including the technical challenges associated with implementing VR. Teachers may need to develop new technical skills, and setting up VR in educational settings can be resource-intensive, demanding significant time, effort, and financial investment.

For language learners, the advantages are pronounced in the immersive learning environment that VR provides. This immersive experience aids in better retention of language skills and concepts, allowing students to practice language in realistic and varied scenarios, thus enhancing their practical language skills. The novelty and interactive nature of VR also serve to increase student motivation and enthusiasm for language learning. On the flip side, access and equity issues arise as not all students may have equal access to VR technology, potentially leading to disparities in learning opportunities. Additionally, there's a risk of over-reliance on technology, which might shift focus away from other critical aspects of language learning, such as face-to-face interactions and conventional learning methods.

The study on the use of Virtual Reality (VR) in foreign language education presents multifaceted and significant implications that span across educational practices, technological integration, research directions, and policymaking in language learning. It highlights the transformative potential of VR in redefining traditional language teaching methodologies. The immersive nature of VR can make learning more engaging and interactive, potentially leading to improved student motivation and better retention of language concepts, suggesting that educators and institutions should integrate VR into their curricula to enrich the learning experience. The specialized nature of VR implies a need for professional development for educators, encompassing both technical and pedagogical aspects to effectively use VR in language teaching. This necessitates training focused on achieving specific educational outcomes while maintaining an engaging learning environment.

Conclusion

This systematic review presents multifaceted and significant implications that span across educational practices, technological integration, research directions, and policymaking in language learning. It highlights the transformative potential of VR in redefining traditional language teaching methodologies. The immersive nature of VR can make learning more engaging and interactive, potentially leading to improved student motivation and better retention of language concepts, suggesting that educators and institutions should integrate VR into their curricula to enrich the learning experience. The specialized nature of VR implies a need for professional development for educators, encompassing both technical and pedagogical aspects to effectively use VR in language teaching. This necessitates training focused on achieving specific educational outcomes while maintaining an engaging learning environment.

The study also indicates the need for expanded research in VR and language education, especially regarding its impact on reading and writing skills and long-term efficacy. This calls for ongoing academic inquiry to

fully understand VR's potential and limitations in language learning. Technological accessibility and infrastructure emerge as key concerns, implying that educational institutions and policymakers should invest in necessary technology and infrastructure to make VR accessible to a broader range of students. The study highlights the importance of balancing VR with traditional teaching methods, advocating for VR to complement, rather than replace, conventional face-to-face teaching.

Equity and inclusivity in education are also crucial implications, highlighting the need for strategies to ensure all students have access to VR technologies, thereby preventing a digital divide. Policy implications are significant, calling for policy development at various levels to support VR integration in education, including funding, training, and appropriate usage guidelines, particularly for younger learners. Additionally, VR's role in cultural and linguistic immersion is emphasised, providing learners with experiences not possible in traditional classrooms and leading to a more comprehensive understanding of the language in its cultural context. In conclusion, the study suggests that the future of language education should encompass a holistic approach, including technological adoption, pedagogical innovation, research, and policy support, to maximise the potential of VR in enhancing language learning experiences.

References

Alfadil, M. (2020). Effectiveness of virtual reality games in foreign language vocabulary acquisition. *Computers & Education*, *153*, 103893.

Andrä, C., Mathias, B., Schwager, A., Macedonia, M., & von Kriegstein, K. (2021). Grasping Virtual Objects Benefits Vocabulary Learning in a Second Language. *Educational Psychology Review.*

Bacca-Acosta, J., et al. (2021). Scaffolding in immersive virtual reality learning environments: An eye-tracking study on prepositions of place in English. *Educational Technology Research and Development.*

Barrett, A., Pack, A., Guo, Y., & Wang, N. (2023). Technology acceptance model and multi-user virtual reality learning environments for Chinese language education. *Interactive Learning Environments*, *31*(3), 1665-1682.

Casañ-Pitarch, R., & Gong, Y. (2021). Testing ImmerseMe with Chinese students: acquisition of foreign language forms and vocabulary in Spanish. *CercleS*, 11(1), 219–233. https://doi.org/10.1515/cercles-2021-2016

Chen, C.-Y., Chen, Y.-L., & Hwang, G.-J. (2020). Facilitating EFL learners' active behaviors in speaking: A progressive question prompt-based peer-tutoring approach with VR contexts. *Interactive Learning Environments*, 1-16. https://doi.org/10.1080/10494820.2020.1840649

Chen, J. (2021). Virtual reality in problem-based learning contexts: Effects on English learning motivation, vocabulary acquisition and problem-solving performance. *Journal of Computer Assisted Learning*, 37(4), 851–860.

Chen, J. C. (2016). The crossroads of English language learners, task-based instruction, and 3D multi-user virtual learning in Second Life. *Computers & Education*, 98, 53-68. doi: 10.1016/j.compedu.2016.03.007.

Chen, P.-H. (2020). The design of applying gamification in an immersive virtual reality virtual laboratory for powder-bed binder jetting 3DP training. *Education Sciences*, 10(7), 172. https://doi.org/10.3390/educsci10070172

Chen, Y. L. (2016). The effects of virtual reality learning environments on student cognitive and linguistic development. *The Asia-Pacific Education Researcher*, *25*, 637-646.

Chen, Y., Smith, T. J., York, C. S., & Mayall, H. J. (2020). Google Earth Virtual Reality and expository writing for young English Learners from a Funds of Knowledge perspective. *Computer Assisted Language Learning*, *33*(1-2), 1-25.

Chung, L. Y. (2011, October). Using avatars to enhance active learning: Integration of virtual reality tools into college English curriculum. In *The 16th North-East Asia symposium on nano, information technology and reliability* (pp. 29-33). IEEE.

Chu, S.-T., Hwang, G.-J., & Hwang, G.-H. (2023). A Goal-Oriented Reflection Strategy-Based Virtual Reality Approach to Promoting Students' Learning Achievement, Motivation, and Reflective Thinking. *Sustainability*, 15(6), 3192.

DeWitt, D., Chan, S. F., & Loban, R. (2022). Virtual reality for developing intercultural communication competence in Mandarin as a Foreign language. *Educational technology research and development*, *70*(2), 615-638.

Divekar, R. R., Drozdal, J., Zhou, Y., Song, Z., Allen, D., Rouhani, R., ... & Su, H. (2018, June). Interaction challenges in ai equipped environments built to teach foreign languages through dialogue and task-completion. In *Proceedings of the 2018 Designing Interactive Systems Conference* (pp. 597-609).

Dolgunsöz, E., Yildirim, G., & Yildirim, S. (2018). The effect of virtual reality on EFL writing performance. *Journal of Language and Linguistic Studies*, *14*(1), 278-292.

Dooly, M., Thrasher, T., & Sadler, R. (2023). "Whoa! Incredible!:" Language Learning Experiences in Virtual Reality. *RELC Journal,* 54(2), 321–339. DOI: 10.1177/00336882231167610

Ebadi, S., & Ebadijalal, M. (2022). The effect of Google Expeditions virtual reality on EFL learners' willingness to communicate and oral proficiency. *Computer Assisted Language Learning*, *35*(8), 1975-2000.

Ebert, D., Gupta, S., & Makedon, F. (2016, June). Ogma: A virtual reality language acquisition system. In *Proceedings of the 9th acm international conference on pervasive technologies related to assistive environments* (pp. 1-5).

Eisenlauer, V., & Sosa, D. (2022). Pedagogic Meaning-Making in Spherical Video-Based Virtual Reality – a Case Study from the EFL Classroom. *Designs for Learning,* 14(1), 129–136. DOI: https://doi.org/10.16993/dfl.191

Freina, L., & Ott, M. (2015, April). A literature review on immersive virtual reality in education: state of the art and perspectives. In *The international scientific conference elearning and software for education* (Vol. 1, No. 133, pp. 10-1007).

Fussell, S. G., & Truong, D. (2021). Accepting virtual reality for dynamic learning: An extension of the technology acceptance model. *Interactive Learning Environments*, 1-18.

Garrido-Iñigo, P., & Rodríguez-Moreno, F. (2015). The reality of virtual worlds: Pros and cons of their application to foreign language teaching. *Interactive Learning Environments*, 23(4), 453–470. https://doi.org/10.1080/10494820.2013.788034

Hoang, D. T. N., & Bowskill, N. (2021). Exploring the potential of VR in enhancing authentic learning for EFL tertiary students in Vietnam. *Teaching English with Technology*, 23(1), 1-22. https://doi.org/10.56297/BKAM1691/AMZJ7070

Jiao, L., Zhu, M., Xu, Z., Zhou, G., Schwieter, J. W., & Liu, C. (2023). An ERP study on novel word learning in an immersive virtual reality context. Bilingualism: *Language and Cognition*, 27, 128-136. https://doi.org/10.1017/S136672892300038X

Kaplan-Rakowski, R. (2019). The effect of stereoscopic three-dimensional images on recall of foreign language vocabulary. *Contemporary Educational Technology,* 10(4), 324-337. https://doi.org/10.30935/cet.634172

Kaplan-Rakowski, R., & Gruber, A. (2023). The impact of high-immersion virtual reality on foreign language anxiety. *Smart Learning Environments*, 10(46). https://doi.org/10.1186/s40561-023-00263-9

Kasapakis, V., & Dzardanova, E. (2022). Virtual reality learning environments: using high-fidelity avatars to enhance distance learning experience. *Interactive Learning Environments*, 1-14.

Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A systematic review of virtual reality in education. *Themes in Science and Technology Education*, *10*(2), 85-119.

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.

Khezrlou, S., & Keshavarz, M. H. (2020). Virtual reality assisted pronunciation training (VRAPT) for young EFL learners: A Study of Iranian Children. *Journal of Educational Technology & Society*, 23(3), 1-13.

Khodabandeh, F. (2022). Exploring the Applicability of Virtual Reality-Enhanced Education on Extrovert and Introvert EFL Learners' Paragraph Writing. *International Journal of Educational Technology in Higher Education*, 19(1), 27. https://doi.org/10.1186/s41239-022-00298-9

Krokos, E., Plaisant, C., & Varshney, A. (2019). Virtual memory palaces: Immersion aids recall. Virtual Reality, 23(1), 1–15. http://doi:10.1007/s10055-018-0346-3.

Kwok, J. K.-Y., Essoe, J. K.-Y., & Wagner, A. D. (2022). Enhancing learning and retention with distinctive virtual reality contexts: neurobiological and behavioural evidence. *Science of Learning*, 7(1), 1-14. https://doi.org/10.1038/s41539-021-00110-9

Lee, A. (2019). Using virtual reality to test academic listening proficiency. *Korean Journal of English Language and Linguistics*, 15(4), 694-706.

Levy, M., & Hubbard, P. (2016). *Theory in computer-assisted language learning research and practice.* In The Routledge handbook of language learning and technology (pp.50-64). Routledge.

Li, C., Ip, H. H., Wong, Y. M., & Lam, W. S. (2020). An empirical study on using virtual reality for enhancing the youth's intercultural sensitivity in Hong Kong. *Journal of Computer Assisted Learning*, *36*(5), 625-635.

Li, J., & Kou, Q. (2021). Designing tasks through Second Life for Chinese as a Foreign Language Learners in UK universities. *Education Research International*, 2021, 1-11. https://doi.org/10.1155/2021/6639479

Lin, C.-H., Li, H.-C., Yang, J.-C., & Liang, J.-C. (2019). Immersive Virtual Reality as an effective tool for second language vocabulary learning. *Languages*, 4(1), 13. https://doi.org/10.3390/languages4010013

Lin, M., & Lan, Y. (2019). Using interactive virtual reality tools for Chinese language and culture learning: A case study in an advanced Chinese course. *TechTrends*, 63(3), 251–259.

Lin, T. J., & Lan, Y. J. (2015). Language learning in virtual reality environments: Past, present, and future. *Journal of Educational Technology & Society*, *18*(4), 486-497.

Luo, L., & Li, L. (2020). Facilitating Communicative Ability of EFL Learners through High-Immersion VR: A Design-Based Research Approach. *Journal of Educational Technology & Society*, 23(3), 1-14.

Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & education*, *70*, 29-40.

Mills, N., Courtney, M., Dede, C., Dressen, A., & Gant, R. (2020). Culture and vision in virtual reality narratives. *Foreign Language Annals*, 53(4), 738-753. doi: 10.1111/flan.12494

Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G (2009). The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med., 6, e1000097.

Nicolaïdou, I., Zaphiris, P., & Parmaxi, A. (2021). Comparing immersive Virtual Reality to mobile applications in foreign language learning in higher education: a quasi-experiment. *Interactive Learning Environments,* 1-16.

Nicolaidou, I., Pissas, P., & Boglou, D. (2023). Comparing immersive virtual reality to mobile applications in foreign language learning in higher education: A quasi-experiment. *Interactive Learning Environments*, *31*(4), 2001-2015.

Nobrega, F. A., & Rozenfeld, C. C. (2019). Virtual reality in the teaching of FLE in a Brazilian public school. *Languages*, 4(2), 1-13.

O'Brien, M. G., & Levy, R. M. (2008). Exploration through virtual reality: Encounters with the target culture. *Canadian modern language review*, *64*(4), 663-691.

Orakçı, Ş. (2020). The effect of virtual reality enhanced the learning environment on 7th Grade students' academic achievements in reading and writing in English. *Malaysian Online Journal of Educational Sciences,* 8(4), 25-32.

Palomo-Duarte, M., Berns, A., Balderas, A., Dodero, J. M., & Camacho, D. (2021). Evidence-Based Assessment of Student Performance in Virtual Worlds. *Sustainability*, 13(1), 244. https://doi.org/10.3390/su13010244

Parmaxi, A. (2023). Virtual reality in language learning: A systematic review and implications for research and practice. *Interactive learning environments*, *31*(1), 172-184.

Peeters, D., Runnqvist, E., Bertrand, D., & Hagoort, P. (2017). Sustained inhibition of the native language in bilingual language production: A virtual reality approach. *Bilingualism: Language and Cognition*, 20(5), 1033-1048. https://doi.org/10.1017/S1366728917000396

Qiu, X. (2020). Virtual reality as a tech tool for students studying Russian in China. *Russian Language Studies*, 18(3), 328–341. http://dx.doi.org/10.22363/2618-8163-2020-18-3-328-341

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2019). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. Computers & Education, 147, 103778. http://doi:10.1016/j.compedu.2019.103778.

Rahman, K. R., Shitol, S. K., Islam, M. S., Iftekrar, K. T., & Pranto, S. A. H. A. (2023). Use of Metaverse Technology in Education Domain. *Journal of Metaverse*, *3*(1), 79-86.

Reitz, L., Sohny, A., & Lochmann, G. (2019). VR-based gamification of communication training and oral examination in a second language. In *Computer-Assisted Language Learning: Concepts, Methodologies, Tools, and Applications* (pp. 811-828). IGI Global.

Schneider, C. (2016). Learning languages in 3D worlds with Machinima. In *S. Papadima-Sophocleous, L. Bradley, & S. Thouësny* (Eds.), CALL communities and culture – short papers from EUROCALL 2016 (pp. 418-423). Research-publishing.net

Shadiev, R., & Yang, M. (2020). Review of studies on technology-enhanced language learning and teaching. *Sustainability*, *12*(2), 524.

Si, M. (2015). A Virtual Space for Children: A Computer Game for Second Language Learning. International Journal of Artificial Intelligence in Education, 25(3), 271-290.

Solak, E., & Erdem, G. (2015). A content analysis of virtual reality studies in foreign language education. *Participatory Educational Research*, *2*(5), 21-26.

Taguchi, N. (2021). Immersive virtual reality for pragmatics task development: A comparison of speech act performance in computer-based and VR-based role-play tasks. TESOL *Quarterly*, 55(1), 307-334. https://doi.org/10.1002/tesq.3070

Tai, T. Y., & Chen, H. H. J. (2021). The impact of immersive virtual reality on EFL learners' listening comprehension. *Journal of Educational Computing Research*, *59*(7), 1272-1293.

Tai, T. Y., Chen, H. H. J., & Todd, G. (2022). The impact of a virtual reality app on adolescent EFL learners' vocabulary learning. *Computer Assisted Language Learning*, *35*(4), 892-917.

Tan, S. H., & Tan, S. Y. (2023). Developing intercultural communicative competence (ICC) through Virtual Reality (VR) technology in Mandarin as a Second Language (MSL) Course for Primary School Pupils. *Malaysian Online Journal of Educational Sciences,* 11(1), 2-12. http://mojes.um.edu.my/index.php/MOJES/article/view/1149/731

Thrasher, T. (2021). The impact of virtual reality on L2 French learners' language anxiety and oral comprehensibility. *CALICO Journal*, 38(1), 1-22. https://doi.org/10.1558/cj.41292

Tilhou, R., Taylor, V., & Crompton, H. (2020). 3D virtual reality in K-12 education: A thematic systematic review. *Emerging technologies and pedagogies in the curriculum*, 169-184.

Urueta, S. H. (2023). Challenges facing the adoption of VR for language education: Evaluating dual-frame system design as a possible solution. *International Journal of Information and Education Technology*, *13*(6), 1001–1008. https://doi.org/10.18178/ijiet.2023.13.6.1898

Valls-Ratés, Ï., Niebuhr, O., & Prieto, P. (2022). Unguided virtual-reality training can enhance the oral presentation skills of high-school students. *Frontiers in Communication*, 7, 910952. https://doi.org/10.3389/fcomm.2022.910952

Wu, Y.-H., & Hung, S.-T. (2021). The effects of virtual reality infused English speaking performance on elementary school students. *Journal of Educational Computing Research,* 60(6), 1565-1582

Yang, F. C. O., Lo, F. Y. R., Hsieh, J. C., & Wu, W. C. V. (2020). Facilitating communicative ability of EFL learners via high-immersion virtual reality. *Journal of Educational Technology & Society*, *23*(1), 30-49.

Yang, H., Tsung, L., & Cao, L. (2021). The use of communication strategies by second language learners of Chinese in a virtual reality learning environment. *SAGE Open*, 11(2), 21582440221141877. https://doi.org/10.1177/21582440221141877

Yeh, H.-C., Tseng, S.-S., & Heng, L. (2020). Enhancing EFL students' intracultural learning through virtual reality. *Interactive Learning Environments*, 1-15. https://doi.org/10.1080/10494820.2020.1840649

Yu, Z. (2021). A meta-analysis of the effect of virtual reality technology use in education. *Interactive Learning Environments*, 1-21.

Zammit, J. (2023). Exploring the effectiveness of Virtual Reality in teaching Maltese. *Computers & Education: X Reality*, 3, 100035

Zejda, D., & Canoy, E. (2014-2015). Videoconferencing and virtual reality in language education. *International Journal for Talent Development and Creativity*, 2(2), 175-185.

Zhao, Y., & Yang, L. (2023). Promoting international high-school students' Chinese language learning: A mind mapping-based spherical video-based virtual reality approach. *Journal of Computer Assisted Learning*, 39(3), 1002-1016

Ziyatdinova, J., & Bezrukov, A. (2021). Virtual reality for developing intercultural communication skills of engineering students. In *Educating Engineers for Future Industrial Revolutions: Proceedings of the 23rd International Conference on Interactive Collaborative Learning (ICL2020), Volume 1 23* (pp. 621-628). Springer International Publishing.