Educational Policy Analysis and Strategic Research, V18, N4, 2023

Implementation of VR Technologies in Language Learning Settings: A Systematic Literature Review

Oya ÖZGÜN [1]
Bahçeşehir University
Olgun SADIK [2]
Middle East Technical University

Abstract

Virtual Reality (VR) is a technology with a potential impact on education. Due to cost and usability limitations, it has not been used extensively. However, recent research studies suggested VR as a learning environment with benefits on students' learning performance through experience. It especially has various benefits for language learners. Learning a new language requires interaction and an immersive learning experience. In order to reveal its benefits and challenges and make suggestions for future implementations, this study focused on using VR in language learning and reviewed the literature in terms of how VR was used in language learning environments. The researchers systematically discovered 32 studies between 2018 and 2022 and examined them in terms of research methods, languages, school groups, VR tools, benefits, and limitations of using VR in a language learning environment. The researchers found that using VR in a language learning environment influenced learners' motivation and academic performance in a positive way. In addition, VR makes the learning environment more realistic, engaged, simulated, and interactive. However, using VR for a long time may cause some health problems for some age groups. It was also noted that interaction between students and teachers was low, but the interaction between the environment and students was high. Therefore, using VR in language learning may decrease instructors' control in the learning environment. The researchers argue that VR is an effective tool for increasing academic performance but has some challenges for teachers and students regarding technical constraints and interaction. The implications and recommendations of this study inform the researchers, practitioners, policymakers, and administrators about how to implement VR in language learning environments.

Keywords: Virtual Reality, Language Learning, Technological Tools, Educational Technology, English as a Foreign Language

DOI: 10.29329/epasr.2023.631.2

Submitted: 18 August2023 **Accepted:** 03 December 2023 **Published:** 30 December 2023

[1] PhD Student, Faculty of Education, Bahçeşehir University, Istanbul, Turkey, ORCID: (0000-0003-3265-6269)
Correspondence: oyaozgunn@gmail.com

[2] Assoc. Prof. Dr., Faculty of Education, Middle East Technical University, Ankara, Turkey, ORCID: (0000-0002-8852-8189), Email: olgunsadik@gmail.com

Introduction

Digital technology supports successful learning outcomes and develops 21st-century skills. Meanwhile, it helps learners become responsible digital citizens and lifelong learners (Ng, 2015). Recent developments in digital technology enable people to use various new tools in educational environments (Chirico et al., 2015; Ng, 2015). One of these new technologies is virtual reality (VR). VR is an immersive, computer-empowered technology that depicts a natural environment. It allows a user to experience a simulation to be present and interact in that environment (Lloyd et al., 2017). Users are able to interact with digital objects in a three-dimensional (3D) virtual world (Sırakaya & Çakmak, 2018). It also empowers users to act in a dynamic digital environment by feeling reality through 3D objects and movements. Further, the participants can move around and see the 3D world from different angles (Yıldırım, 2017). Over the past decade, an array of diverse applications for VR technology has emerged, permeating both everyday life and professional contexts. One noteworthy application is its utilization in facilitating cultural immersion within language education wherein language acquisition exceeds the mere acquisition of syntax (Genc & Bada, 2005). For instance, Cheng et al. (2017) aimed to teach embodied cultural interaction to make language learning more enjoyable. The results proposed that VR provides an opportunity to enforce physical interaction and enhance language learning. Additionally, it is used in many fields, such as psychologists integrating VR as a part of their methods (Pan & Hamilton, 2018), interacting with robots (Burghardt et al., 2020), in the military (Liu et al., 2018), developing orthopedic training programs (McKnight et al., 2020), and rehabilitation therapy (Mekbib et al., 2020). Imran et al. (2021) used VR in dental teaching in the modern dental world so that students can interact with digital simulation and learn treatment skills before they transfer their knowledge into the real world. This application helped the students gain skills such as confidence and revising their knowledge without wasting materials. The researchers of the study indicated that VR is a promising technology which enhances dental education.

Benefits and Limitations of Using Virtual Reality

VR has many benefits for educational purposes as in other fields. Using VR is a safe and cost-effective option for dangerous tasks, such as training firefighters and industrial operators. VR environments have the potential to increase realism, engagement, and motivation (Menin et al., 2018; Mystakidis, 2022). Bourhim and Cherkaoui (2020) studied VR technology to examine people's pre-evacuation behavior under fire and found that simulation-based VR was an influential, realistic, and engaging experience. Spencer et al. (2019) focused on comparing role-play practice with simulations at a university setting and found that simulation sessions were practical and helpful practice tools. Therefore, this study indicated that VR can be used in simulations as an interactive environment. Similarly, Nissim and Weissblueth (2017) explored the experiences of pre-service student teachers in terms of teaching a unit with VR technology and found that using VR learning environments allowed them to increase their self-efficacy and encouraged them to be more innovative and creative.

In contrast to potential benefits, current computer-supported (CS) technologies are not accessible due to cost and usability issues. Hussein and Natterdal (2015) examined the limitations of VR educational applications and found that VR is not economical for some educational institutions. Likewise, Fransson et al. (2020) underlined the price of technology as a significant obstacle to using VR technology. Another limitation of VR is technical problems and cost. Technical problems and budget may prevent applying VR in language classrooms (Dawley & Dede, 2014; Lloyd et al., 2017). Producing content in a fully immersive experience is costly since real-world objects must be precisely replicated in 3D (Steffen et al., 2019).

Virtual Reality and Foreign Language Learning

Despite limitations of the use of VR, providing language learners with authentic and contextualized cultural experiences cannot be neglected (Shih, 2015). VR users have an opportunity to create new experiences with immersion and a sense of appearance. Immersion enhances the experiences of users. With this opportunity, a physical presence is not necessary. This feature enables the second language (L2) and foreign language (FL) learners to associate learning a new language with a cultural experience beyond geographical limitations without leaving their places. Additionally, interaction provides interpersonal communication. These features of VR play an essential role in language education (Lan, 2020). With the multisensory features of VR, including 360-degree and three-dimensional visualizations, students' experiences are highly immersive. Zoubi (2018) investigated the impact of exposure to English language with EFL college students in a quantitative study including questionnaires. Zoubi recommended that students should be continually exposed to a target language to improve their fluency and help them acquire the language. Therefore, Zoubi concluded that the most beneficial way to learn a foreign language is through language immersion. High-immersion VR technology provides realistic imitations of such settings (Rakowski & Wojdynski, 2018). Four main components for foreign language learning are immersion, learner participation, social interaction, and authenticity (Lan, 2014). *Figure 1* demonstrates how the key ingredients of successful language could be applied using three specific VR characteristics with learner-centered language activities (Lan, 2020).

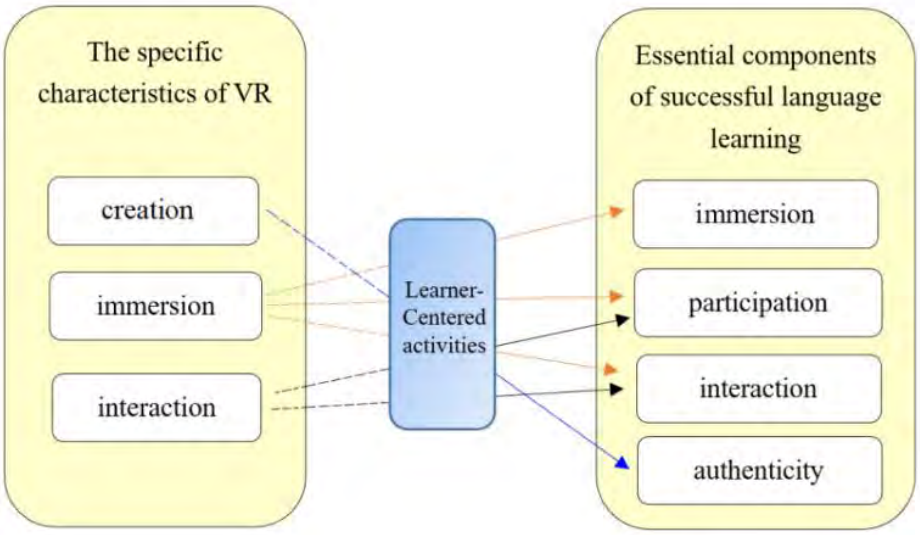

Figure 1. Matching the essential components of successful language learning to the specific characteristics of VR (Lan, 2020, p. 2)

The core components of VR are creation, immersion, and interactivity (Lan, 2020; Radianti et al., 2020; Ryan, 2015; Walsh & Pawlowski, 2002). *Creation* is the subjective experience of being in one place (Radianti et al., 2020). *Immersion* stands for blocking distractions and focusing on the information that the user would like to see. *Interactivity* is for interacting with events in the virtual world (Lan, 2020).

Incorporating VR into traditional language classrooms may be advantageous for teachers and educators because VR offers an immersive language learning environment by fostering social interaction (Solak & Erdem, 2015). Culture and language are inseparable from each other. Languages are the symbols of cultures. Therefore, cultural learning is important for exposure of L2 (Kuo & Lai, 2006). That's why geographical distance might cause an incomplete understanding of that culture and language. For a deeper understanding of cultural practices, total immersion in the target culture can encourage learners (Berti, 2021). Contextualized teaching may help the students relate the content to real-world situations. That is why highly immersive VR has an opportunity for language learners with a culturally authentic context, making the users feel a sense of being there (Shih, 2018). VR serves an authentic community and experiences how other people interact. With these experiences, active participation is fostered; meaningful and personalized understanding is constructed (Berti, 2021). Simulations in VR enable learners to use theoretical knowledge and experiment with equipment. Additionally, learners can learn from their mistakes and errors in the virtual world (Mystakidis, 2022).

VR is a technology that is used in a wide range of areas. It is inevitable to discover a deep understanding of VR in the future (Murray, 2020). However, VR in education still requires more investigation since research on it is limited (Özgen et al., 2021). Parmaxi (2020) studied the effects of VR on language learning between 2015 and 2018. The use of VR in education has increased in recent

years. With the emergence of the metaverse, the recognition of VR has also increased (Mystakidis, 2022).

Previous Literature Reviews in VR

The previous literature provided examples of systematic literature reviews about the use of VR technology in education (Lin & Lan, 2015; Ödemir, 2017; Radianti et al., 2020; Özeren et al., 2021). They primarily addressed questions regarding topics, technologies, methodologies, benefits, and limitations. For example, Lin and Lan (2015) examined trends in VR research from 2004 to 2013 in the four top CALL journals and recommended that VR can be used in language instruction. In another systematic literature review, Radianti et al. (2020) investigated how researchers applied immersive VR for higher education purposes by using systematic mapping to recognize design elements of the studies and found several gaps in the application of VR in higher education. For instance, the researchers stressed that theoretical frameworks were weak or missing in VR application development. The evaluation of VR applications was evaluated based on their usability of the VR apps instead of learning outcomes. Using VR has frequently been a part of experimental work rather than actual teaching. Özeren et al. (2021) aimed to conduct a descriptive analysis of the studies between 2016-2021 in VR in educational contexts. They found that half of the studies were quantitative experimental and were focusing on undergraduate students. Özdemir (2017) investigated the studies between 2007-2017 and found that VR environment's attraction and complexity caused distractibility. However, VR was successful in making abstract things more tangible and making learning more attractive and improving engagement and social communication skills.

When these studies are examined, the current study aims to review the literature to examine the use of VR in language learning in the last five years (between 2018 and 2022) and investigate how VR is used in language learning. This period is selected due to increasing interest in VR technologies (Çoban & Göksu, 2022; Hagge, 2021; Pack & Barrett, 2021) and its more effortless adaptability in improving language skills (Frazier et al., 2021; York et al., 2021). We also aim to inform emerging research and help identify the needs for future research in this area. Therefore, the current systematic literature review aims to identify:

1.Under what context were the studies conducted (language, the target audience, technology used in a language learning environment)?

2.What were the benefits and limitations of using VR in language learning environments?

By addressing these research questions, our objective is to delve into the developments of the past four years and identify potential gaps that could inform educational researchers and practitioners, prompting the formulation of new inquiries regarding the application of VR technologies for language education and instructional purposes.

Method

A comprehensive analysis of the literature regarding the utilization of VR in language learning was conducted. This analysis encompassed manuscripts published between 2018 and the end of 2022. We conducted ERIC, Scopus, and Web of Science database searches due to their extensive use and credibility in education research. The keywords for manuscripts were derived from the definitions of Virtual Reality in the literature, and they were put into the categories linked to "Virtual Reality" AND "Language Learning, "VR" AND "Language Education", "Virtual Reality" AND Language Skills, "VR and Language Teaching". The inclusion criteria were empirical research studies published in peer-reviewed journals in the aforementioned databases between 2018 and 2022. Finally, our search included 32 manuscripts met the specific criteria. The selection process of the studies is summarized in Figure 2 with the PRISMA flowchart.

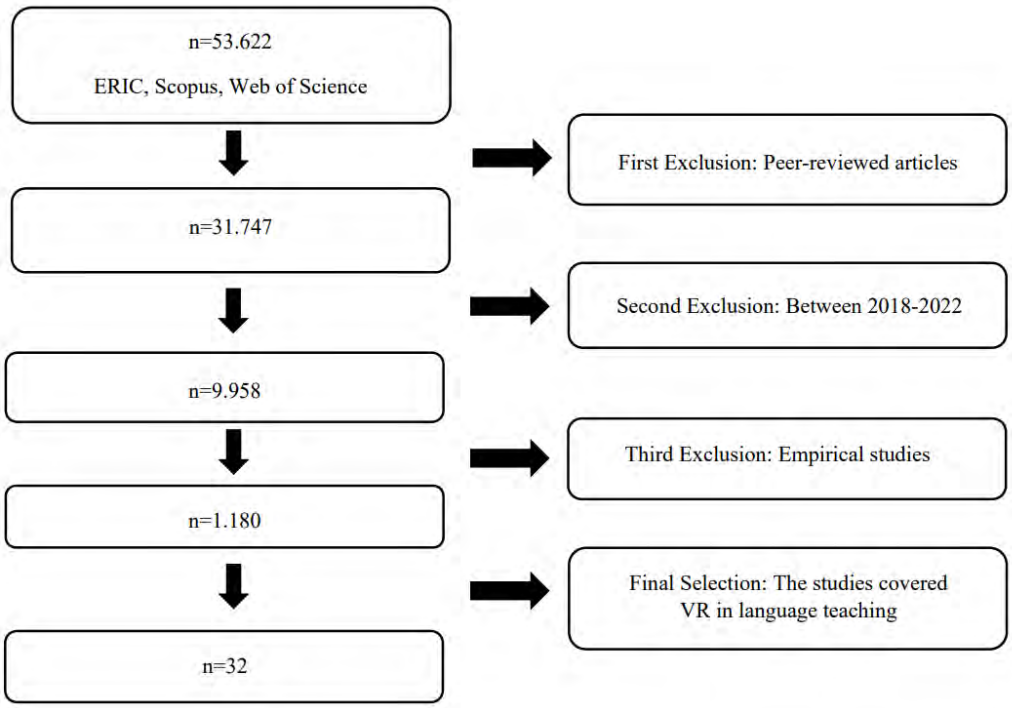

Figure 2. PRISMA workflow of the systematic review

At the outset, 53,622 studies were identified in the databases. Following the initial selection process, which excluded studies not published in peer-reviewed journals, the number reduced to 31,747. Subsequently, studies published before 2018 were excluded, resulting in 9,958 studies. Further refinement excluded non-empirical research, leaving 1,180 studies. These remaining studies were then filtered based on their focus. Those that delved into VR in fields other than language learning were removed, focusing solely on language-related studies. Ultimately, 32 studies meeting these specific criteria were included in this systematic literature review.

Inclusion and Exclusion Criteria for Refining the VR in Language Learning

The study's sample comprises 32 empirical studies focusing on VR's application in language learning, as detailed in Table 1. Selection of academic studies for the systematic literature review adhered to predetermined criteria. These articles were assessed based on four primary criteria: publication year, publication type, research methodologies, and specific topics. Detailed inclusion and exclusion criteria can be found in Table 1 for reference.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion Criteria	Exclusion Criteria
Publishing Year	Studies published between 2018 and 2022	Studies published before 2018
Publishing Type	Published in peer-reviewed journals.	Conference papers, master-doctoral theses, book chapters, reports.
Research Method	Qualitative and quantitative empirical studies. Experimental studies. Studies that clearly describe the method of the study.	Theoretical studies, meta-analyses.
Topics Covered	Studies covered using VR in language learning.	Studies in other fields

Data Analysis

We adhered to the inclusion criteria and identified 32 studies suitable for our review. To address our research questions, we meticulously extracted methods and findings from these chosen articles, organizing them into qualitative and quantitative tables for analysis. Each author conducted a comprehensive analysis of the collected data. For efficient study coding and information extraction, we developed a detailed coding spreadsheet. This form facilitated the organization of various study characteristics, such as research methods, school groups, languages, and technologies employed. Quantitative data were visually presented using descriptive figures, while both descriptive and thematic analysis methods were employed for qualitative data. Through thematic analysis, we classified the themes expressed in the articles, outlining the findings related to the utilization of VR in language learning by organizing and interpreting these themes.

Results

This study’s results are organized based on the research questions. Accordingly, the findings will be presented with two main titles. The first one is the contextual findings, including methods,

languages, school levels, and technologies. Another title is about the benefits and limitations of VR in language learning.

Contextual Findings

Languages

Eight languages in total were identified as the learning language in the target studies (See **Figure 3**). English was the most common language (n=22/32). The rest of the languages as follows, Chinese (n=3/32), French (n=2/32), Spanish (n=1/32), Finnish (n=1/32), Italian (n=1/32), Japanese (n=1/32), and German (n=1/32).

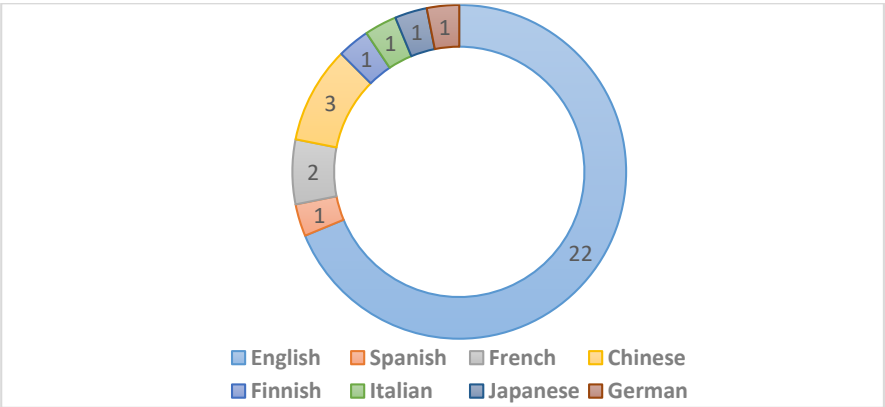

Figure 3. Languages/Contextual Findings

Target Audience of the Studies

Different target audience groups were found in the manuscripts (n=6) (See **Figure 4**). Undergraduate students participated in 16 studies (n=16/32). Middle school students joined in eight studies (n=8/32). Graduate students took part in three studies (n=3/32). High school students participated in three studies (n=3/32). One of the studies (Nobrega & Rozenfeld, 2019) included high school and middle school students together. In addition, an adult group ranging from 19-41 years old was also the participants in one of the studies (Fuhrman et al., 2021).

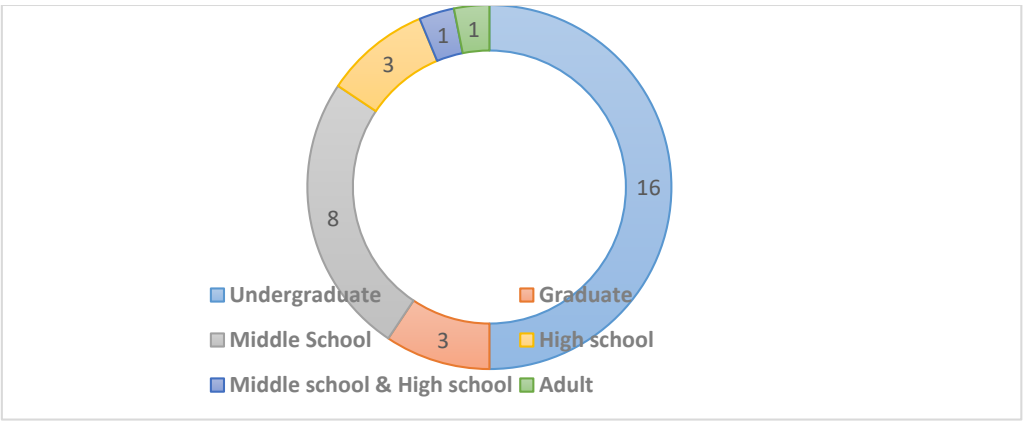

Figure 5. Target Audience/Contextual Findings

Technology Type

The literature review highlighted various VR technologies employed in language education, categorized based on language skills and application areas. The first group focuses on technologies geared toward enhancing language learning skills, encompassing studies targeting writing, speaking, listening, reading, and vocabulary knowledge.

Specifically, six manuscripts (See **Table 2**) emphasized the improvement of writing skills through various VR tools. Pack et al. (2020) observed a positive reception toward Oculus Rift and Touch VR tools' content, contributing to improved writing skills. Chen et al. (2021) noted enhanced self-efficacy in writing performance through the use of head-mounted VR sets. Huang et al. (2020) showcased developments in writing quality—content, appearance, and creativity—utilizing the Spherical-video VR tool. Lin et al. (2021) aimed to enhance vocabulary usage in writing via the EduVenture VR tool. Additionally, Dolgunsöz et al. (2018) reported long-term improvements in writing performance facilitated by VR goggles. Furthermore, Chen et al. (2020) highlighted students' positive engagement through the use of the Google Earth tool. However, it's important to note that using VR tools raised health concerns due to physical discomfort.

Table 2. The Technologies Used for Writing Skills

	VR Tool	Result
Pack et al. (2020)	Oculus Rift and Touch VR	The students enjoyed using the VR tool and had positive approach towards the material and the content.
Chen et al. (2021)	Head-mounted VR set	Self-efficacy and satisfaction directly influenced writing performance.
Huang et al. (2020)	Spherical video-based virtual reality	Improvement in writing performance in terms of content, appearance, and creativity was observed.
Lin et al. (2021)	EduVenture VR	Significant writing improvement in using sophisticated vocabulary was recognized.
Dolgunsöz et al. (2018)	VR Goggles	VR tool influenced long-term performance. Low video quality and physical discomfort were the challenges.
Chen et al. (2020)	Google Earth	There is an increase in writing skill performance. Students experienced engagement. They had a positive approach towards the tool.

Speaking skills have been a focus in six studies (See **Table 3**), showcasing numerous VR tools that enhance speaking abilities, accuracy, and knowledge retention. These tools offer diverse benefits for oral communication development. For instance, Liang (2018) utilized Second Life to improve

storytelling skills, leading to advancements in structuring stories as a speaking activity. In 3D learning environments, Yamazaki (2018) noted that vocabulary learning occurs concurrently with the development of speaking skills. ImmerseMe, as highlighted by Soto et al. (2020), enhanced interactivity, fostering exploration and experimentation, thereby promoting meaningful learning through speaking activities. Moreover, VR Glasses proved beneficial in advancing learners' communication skills in the target language, specifically in content creation and structure (Chen et al., 2021). Additionally, Chien et al. (2020) and Lin et al. (2021) both observed improvements in speaking skills for foreign languages regarding accuracy and knowledge retention, utilizing respectively spherical video-based VR tools and the EduVenture tool. These tools collectively contribute to enhancing speaking abilities in language learning contexts.

Table 3. The Technologies Used for Speaking Skill

	VR Tool	Result
Liang (2018)	Second Life	Storytelling was examined and engagement was improved. Formulating ideas and structuring stories were also another improvement points.
Yamazaki (2018)	3D Virtual Environment	Contextualized communicative competence was acquired. Incidentally encountered vocabulary was also improved.
Soto et al. (2020)	ImmerseMe	Meaningful learning in communicative skills was found. Tool was also defined as a successful tool which encouraged to explore, experiment, and interact to develop new skills.
Y. Chen et al. (2021)	VR Glasses	The tool was helpful for students apply body language in communication. In the content and structure, the students outperformed as well.
Chien et al. (2020)	Spherical video-based virtual reality	The tool was helpful for enhancing English speaking performance.
Lin et al. (2021)	EduVenture VR	Significant speaking gains in language accuracy and knowledge retention were identified.

The studies highlighted the enhancement of listening and reading skills through VR in three instances (refer to **Table 4**). These receptive skills in language learning were positively impacted by VR technologies. Lan et al. (2018) noted an improvement in listening comprehension within 3D virtual environments, showcasing how VR positively influenced this aspect of language learning. Tai and Chen (2021) utilized a mobile-rendered head-mounted display with the Mondly VR tool, providing an immersive experience that simulated real-life scenarios and enhanced interactivity, contributing to

improved listening skills. Furthermore, Wang et al. (2021) demonstrated enhanced reading comprehension through the use of a 3D video-based VR tool, showcasing its efficacy in improving this aspect of language learning as well. These studies collectively emphasize the positive impact VR has on enhancing receptive skills, such as listening and reading, in the context of language education.

Table 4. The Technologies Used for Listening and Reading Skills

	VR Tool	Result
Lan et al. (2018)	3D Virtual Environment	Students learned better in listening comprehension with the VR tool.
Tai and Chen (2021)	Mobile-rendered head-mounted display (MVR) Mondly VR tool	Students showed higher performance on listening comprehension and retention. It was an engaging and beneficial tool. They experienced simulated, interactive, and immersive virtual environments. The tool helped activate prior knowledge.
Wang et al. (2021)	3D video-based VR	Students enjoyed and benefited from the learning activities. Their reading comprehension was improved.

The studies outlined the significance of vocabulary acquisition in language learning through VR in several instances (refer to **Table 5**). VR tools have shown promise in enhancing vocabulary skills despite some associated challenges. J. G. Wu et al. (2021) observed enhanced vocabulary skills using an MVR tool in combination with a VR learning software. However, they also noted health-related issues as a challenge associated with the tool's usage. Alfadil (2020) reported achievements in vocabulary skills with the House of Languages VR tool. In summary, the utilization of VR headsets has proven to be an authentic and effective method for efficient vocabulary learning, as highlighted by Fuhrman et al. (2021). Despite the challenges such as health concerns associated with some VR tools, the overall impact on vocabulary acquisition appears to be positive and promising in language education.

Table 5. The Technologies Used for Vocabulary Acquisition

	VR Tool	Result
J. G. Wu et al. (2021)	Modern Operation Room (MOR); VR learning software tool	The tool helped enhance vocabulary learning. Health effects such as dizziness, fatigue, and neck pain were identified as a challenge.
Alfadil (2020)	House of Languages	Achievement in vocabulary acquisition was found.
Fuhrman et al. (2021)	VR headset	The tool served more authentic, multisensory, and motor context to efficient foreign language learning.

The literature also examined and outlined application-level advantages and challenges associated with different VR tools, with a predominant focus on academic impacts and benefits (See **Table 6**). Beyond VR's contribution to academic accomplishments, these studies emphasized a heightened level of motivation (e.g., Nobrega & Rozenfield, 2019). The majority of these studies depicted VR as an effective and efficient tool within educational settings, attributing it to increased student achievement and providing instructors with the opportunity to establish a student-centered learning environment (e.g., Parmaxi et al., 2021). Moreover, students' foreign language learning abilities saw improvements through the utilization of various VR tools (e.g., Berns et al., 2019).

Table 6. The Technologies Explored Academic Effects and Benefits

	VR Tool	Result
Acar and Cavas (2020)	VR headset	Positive effect on academic achievement was found.
Casañ-Pitarch and Gong (2021)	ImmerseMe	Achievement in learning Spanish was recognized. The tool was also found useful in the educational field.
Nicolaidou et al. (2021)	Oculus Rift	VR app was found as effective and engaging for language learning.
Nobrega and Rozenfeld (2019)	Google Cardboard, VR headset and 360 VR videos	It was found that VR promotes a high level of motivation and engagement. The tools also contributed to the development of the four linguistic competences.
Parmaxi et al. (2021)	Google Expeditions	The tool fostered a student-centered learning environment.

Repetto et al. (2021)	Immersive 360 videos	The tool helped a great performance on vocabulary learning and contribution to learning English.
Lin and Wang (2021)	Google Tour Creator	VR helped students improve self-efficacy for creative thinking. It was also reported that VR can be effectively into English learning.
Berns et al. (2019)	360 VR video (Let's date!)	It was reported that students improved their language learning competencies through an immersive and realistic environment. The tool focused on speaking and pronunciation as well.

Three studies emphasized the significance of understanding the culture associated with the target language (See **Table 7**). Familiarity with the target language's culture serves as a means of applying knowledge (Yeh et al., 2020). These researchers stressed the importance of cultural awareness, noting that VR tools facilitated students' exploration of the target culture within an authentic context (e.g., Xie et al., 2019). Moreover, four studies delved into the acquisition of language skills through VR tools (See **Table 8**). Researchers concluded that VR serves as an advantageous tool in developing students' language proficiency by fostering autonomy, interaction, and active learning experiences (e.g., Chen et al., 2022).

Table 7. The Technologies Explored the Culture of the Target Language

	VR Tool	Result
Yeh et al. (2020)	EduVenture	Scaffolding prior knowledge with new information of intercultural learning was recognized. Students were able to organize what they know about native culture and used the knowledge into practice. The tool also enhanced language competency of the learners.
Xie et al. (2019)	Google Cardboard and Expeditions	The students experienced an authentic context for Chinese language learning. The tool encouraged them to explore the target culture.
Mills et al. (2020)	360 VR Camera	VR narratives allowed the students to envision, experience, and understand the target culture.

Table 8. The Technologies Explored the Learning Ability

	VR Tool	Result
Ma (2021)	VR headset	It was found that English learning ability was developed.
Shadiev et al. (2021)	360 VR camera	VR tool improved students' learning a foreign language ability.
Chen et al. (2022)	3D VR environment & Robot-Assisted Language Learning (RALL)	VR increased motivation and engagement in learning. Besides, RALL could help develop autonomy, enhance interaction, and provide an active learning experience.
Xie et al. (2022)	Immersive-based language teaching environment	There is a positive correlation between VR and immersion-based language teaching environment. Additionally, immersion-based language teaching environment and academic achievement showed a great positive correlation.

Benefits and Limitations of Using VR

The analysis of 32 studies conducted between 2018 and 2022 revealed predominantly positive effects of VR on students' learning outcomes. **Table 9** presents a summary of the benefits and limitations of VR in language learning environments. The utilization of VR tools within a language learning context significantly influenced students' approach to learning a foreign language. They exhibited a positive inclination towards using VR tools as part of the learning environment and found pleasure in their utilization. Additionally, VR altered the ambiance of the learning setting (Acar & Cavas, 2020; Repetto et al., 2021; Shadiev et al., 2021) and impacted students' perspectives regarding course content and materials (Pack et al., 2020; Wang et al., 2021). These VR tools also contributed to heightened learner motivation (Nobrega & Rozenfeld, 2019; J.G. Wu et al., 2021), decreased language learning anxiety and cognitive overload, and increased learner engagement at the core of the learning process (Tai & Chen, 2021). This progress led to students experiencing a more flexible and student-centered learning environment (Parmaxi et al., 2021).

Additionally, VR environments have been instrumental in aiding students to enhance their vocabulary acquisition in the target language. They displayed improved performance when learning new words (Alfadil, 2020; Fuhrman et al., 2021; Repetto et al., 2021). Furthermore, students exhibited significant advancements in writing skills and enhanced vocabulary acquisition (Chen et al., 2020; Chen et al., 2021; Lin et al., 2021; Huang et al., 2020). However, Dolgunsöz et al. (2018) reported that VR

did not impact short-term writing performance. Moreover, students had the opportunity to elevate their proficiency in speaking the target language. Their communicative competence showed marked improvement after utilizing these tools (Soto et al., 2020; Chien et al., 2020; Lin et al., 2021; Yamazaki, 2018; Y. Chen et al., 2021). Concerning receptive skills, VR tools also influenced reading and listening abilities. Students demonstrated enhanced performance in comprehension activities due to their exposure to simulated and interactive environments (Lan et al., 2018; Tai & Chen, 2021; Wang et al., 2021).

While numerous advantages of integrating VR into language learning have been acknowledged, a few drawbacks regarding VR tools have emerged in studies. Dolgunsöz et al. (2018) highlighted technical limitations, such as low video quality, with students preferring higher-resolution videos. Physical discomfort was also noted, where despite the portability of VR goggles, some students found them heavy and ill-fitting, leading to discomfort (Dolgunsöz et al., 2018). Prolonged use of VR might result in dizziness and eye fatigue. Additionally, Alfadil (2020) noted that some students had unsupervised access to VR, potentially raising concerns about health effects due to extended use. Another limitation is the perceived low level of interactivity. Casañ-Pitarch and Gong (2021) pointed out the lack of interactive features with other users online, which could diminish collaboration and interactivity in the learning process.

Table 9. Summary of Benefits and Limitations of VR

Benefits of VR	Limitations of VR
Positive approach of the users (Acar & Cavas, 2020; Repetto et al., 2021; Shadiev et al., 2021; Pack et al., 2020; Wang et al., 2021)	Low video quality, physical discomfort, heavy equipment, dizziness, eye fatigue (Dolgunsöz et al., 2018)
High level of motivation (Nobrega & Rozenfeld, 2019; J.G. Wu et al., 2021) Low level of cognitive load (Tai & Chen, 2021)	Using VR at uncontrolled times, health problems (Alfadil, 2020)
Improvement in vocabulary acquisition (Alfadil, 2020; Fuhrman et al., 2021; Repetto et al.,2021)	Low level of interactivity and collaboration (Alfadil, 2020; Casañ-Pitarch & Gong, 2021)
Improvement in writing skill (Chen et al., 2020; Chen et al., 2021; Lin et al., 2021; Huang et al., 2020)	
Improvement in communicative competence (Soto et al., 2020; Chien et al., 2020; Lin et al., 2021; Yamazaki, 2018; Y. Chen et al., 2021)	
Improvement in receptive skills (Lan et al., 2018; Tai & Chen, 2021; Wang et al., 2021)	

Discussion, Conclusion and Recommendations

Context of the Studies

The present study aimed to uncover contextual findings from research conducted between 2018 and 2022. Among 32 manuscripts reviewed, 22 studies specifically investigated the use of VR for English language learning. This majority contrasts with the remaining studies, which focused on languages like Spanish, Finnish, Italian, Japanese, and German. Notably, undergraduate students emerged as the primary demographic within these studies. This aligns with findings by Huang et al. (2021), who also noted that university students constituted the main users of VR technologies. The exploration of VR tools in various studies revealed their diverse applications, catering to skill enhancement, academic performance assessment, and immersion in target cultures. The identified tools were instrumental in enhancing students' academic performance across different areas. Despite the potential observed for language learning achievement through VR, Dolgunsöz et al. (2018) suggested the long-term implementation of VR for writing skills to ensure sustained improvement in students' writing abilities. This conclusion underscores the need for continued utilization of VR for optimal skill enhancement.

Benefits and Limitations

The study's findings underscored the positive influence of VR tools in language learning environments, effectively enhancing engagement, simulation, and realism. Huang et al. (2010) conducted research on VR learning environments, emphasizing that innovative designs foster interactive learning experiences. Similarly, Alizadeh (2019) highlighted the motivational and engagement benefits of employing VR in language learning. Moreover, Symonenko et al. (2020) emphasized that VR creates essential conditions for bolstering motivation. In addition to positively impacting the learning environment, VR tools significantly enhance various foreign language skills—speaking, writing, reading, listening, and vocabulary. The systematic literature review highlighted a substantial improvement in learners' academic performance due to the immersive, realistic, and engaging nature of VR tools, fostering creative thinking and a sense of physical presence. Similarly, Dhimolea et al. (2022) discovered that VR tools enable interaction with 3D objects, thereby enhancing learning. Furthermore, Andujar and Buchner (2019) concluded that VR facilitates real-life interactions, aiding in the development of target language skills.

However, the study also revealed limitations associated with VR tools in language learning environments. Technical issues, such as low-video quality, pose a challenge, emphasizing the necessity for institutions to utilize high-resolution videos to boost learners' attention and motivation. Physical discomfort emerged as another constraint impacting both academic performance and learners' health, especially with prolonged use. Yıldırım et al. (2020) mentioned additional barriers, including safety concerns, student access, technology gaps, and instructors' comfort levels with VR tools. Annamalai et

al. (2022) identified the lack of human interaction as a challenge, limiting teachers' observation of students' learning processes. Similarly, Alfadil (2020) and Casañ-Pitarch & Gong (2021) highlighted the limited interaction between teachers and students compared to the robust interaction between content and students, posing challenges in engaging educators effectively.

Conclusion

The present study offered a comprehensive overview of VR technology in language learning from 2018 to 2022, culminating in the selection of 32 papers meeting the inclusion criteria. These papers were thoroughly analyzed, grouping and synthesizing details such as the languages studied, and the school demographics involved in VR technology within language learning environments. The study also delved into exploring and elucidating both the benefits and limitations of employing VR in language learning, highlighting ample opportunities to bolster language acquisition. With VR technology's expanding influence across diverse fields, its potential to deliver a dynamic learning experience is promising (Fussell & Truong, 2021, 2022).

Over the past five years, quantitative methods emerged as the most preferred approach, predominantly focusing on English language studies at the undergraduate level. The studies showcased a diverse range of VR technologies, each examined for various purposes, including skill-based investigations, assessing tool benefits and limitations, and gauging their impact on learning achievements. The primary advantage gleaned from this study is the affirmation of VR's progressive role in language classrooms. This technology has demonstrated the capacity to enhance and enrich language competencies, fostering a positive attitude towards language acquisition, bolstering student self-efficacy, mitigating anxiety and cognitive load, and amplifying motivation and engagement (Wu et al., 2021). However, technical constraints, such as low video quality, physical discomfort, and the weight of VR goggles, pose limitations for students. Additionally, the absence of interactivity within VR tools has been noted as a drawback. Future advancements in VR should prioritize enhancing interactivity (Annamalai et al., 2022; Casañ-Pitarch & Gong, 2021).

Nonetheless, a considerable dearth of studies addressing VR technology in language classrooms persists. While most studies center on English language learning, there is a pressing need for research exploring the impact of VR in other languages. Moreover, while the synthesized studies predominantly focused on undergraduate participants, future research should encompass younger learners. Furthermore, while speaking and writing skills received significant attention in the selected studies, future research should investigate the influence of VR on listening, reading skills, and grammar structures.

Recommendations for Researchers

The present study investigated the utilization of VR technology in language learning within the scope of studies conducted over the past five years. This research aimed to address a gap by delving

deeper into the integration of VR and language learning. The initial emphasis was on exploring the application of VR in enhancing foreign language skills, specifically focusing on speaking and writing abilities. However, the majority of the studies predominantly examined production skills—speaking and writing. It is recommended that future research delve into how VR impacts grammar and vocabulary retention. Some students encountered challenges in employing accurate grammatical structures (Baleghizadeh & Oladrostam, 2010; Ghorbani & Ebadi, 2020; Mahmoudi, 2020) while using the language, indicating a potential for leveraging VR tools to enhance grammar proficiency. Additionally, understanding the native culture associated with the target foreign language is crucial for comprehending the significance of learning and effectively communicating in that language. Within this study, we noted that three studies highlighted the importance of immersing in the target culture; future studies should further explore this aspect, particularly in connection with speaking skills.

Recommendations for Practitioners

The study presents several recommendations for practitioners regarding the utilization of VR tools within foreign language learning environments. Primarily, the research identified that VR tools significantly enhanced foreign language acquisition and bolstered learner motivation. We strongly advocate for practitioners to integrate VR tools into their instructional activities, particularly emphasizing their efficacy in improving speaking skills. In the context of writing activities, practitioners should consider longer durations for meaningful outcomes, as evidence suggests that prolonged use of VR tools positively impacts long-term writing performance. However, it's crucial to note that this effect might stem not solely from VR but also from sustained practice over time.

Moreover, the study observed a decrease in interaction between learners and instructors attributed to extensive technology use. To address this, we recommend practitioners incorporate activities that foster interaction between learners-learners and learners-instructors. This approach ensures students engage not only with technological tools but also with human interaction, thus creating a balanced learning environment.

Policy Implications

The study uncovers various dimensions with significant policy implications concerning the integration of VR in language learning environments. Despite the evident benefits of fostering an engaging learning atmosphere through VR, many policymakers and administrators hesitate due to concerns over high costs and limited knowledge regarding VR's utilization, benefits, and limitations. Berti et al. (2020) underscored the deficiency in studies examining highly immersive VR for cultural understanding and learner receptivity to its implementation in language classrooms. Integrating VR into language learning curricula becomes crucial to augment cultural knowledge, aligning with this study's assertion that language exposure should encompass a cultural experience.

Facilitating communication for language improvement is indispensable, yet real-time interaction with native speakers can pose logistical challenges. VR presents a cost-effective avenue for learners to engage in dialogue with native speakers, thus warranting its integration into language learning curricula, particularly within K-12 education, spearheaded by the Ministry of Education. However, it's notable that high-end VR headsets are preferred over low-budget options (Dhimolea et al., 2022), impacting accessibility.

While VR exhibits numerous benefits for skill-based learning and student motivation, curriculum developers must address cost and usability barriers to create an interactive learning atmosphere. Addressing physical discomfort associated with VR in language learning is pivotal; informing and obtaining participant approval while considering health concerns should be standard practice. Information sheets outlining potential health risks should precede VR usage in language learning environments.

Furthermore, ethical considerations demand meticulous attention when integrating VR into language education. Policymakers must establish comprehensive frameworks addressing data privacy, informed consent, and responsible immersive technology use to safeguard learner interests. Collaboration among policymakers, subject matter experts, and educational technology specialists is essential to bridge the gap between fostering innovation and ethically deploying VR in language learning environments.

Conflict of Interest

No potential conflict of interest was declared by the authors.

Funding Details

The authors did not receive any funding or financial support for the research, authorship, and/or publication of this article.

Ethical Statement

This study did not involve human participants, so ethical approval was not required.

Credit **Author Statement**

Conceptualization: Olgun Sadık, Data Curation: Oya Özgün, Methodology: Olgun Sadık Visualization: Oya Özgün, Supervision: Olgun Sadık, writing- original draft preparation: Oya Özgün, writing- review and editing: Olgun Sadık

References

Acar, A., & Çavaş, B. (2020). The effect of virtual reality enhanced learning environment on the 7th-grade students' reading and writing skills in English. *Malaysian Online Journal of Educational Sciences*, *8*(4), 22–33. https://files.eric.ed.gov/fulltext/EJ1271886.pdf

Alfadil, M. (2020). Effectiveness of virtual reality game in foreign language vocabulary acquisition. *Computers & Education*, *153*, 1–13. https://doi.org/10.1016/j.compedu.2020.103893

Alizadeh, M. (2019). Virtual reality in the language classroom: Theory and practice. *Call-Ej, 20*(3), 21-30.

Andujar, A., & Buchner, J. (2019). The potential of 3D virtual reality (VR) for language learning: an overview. In *Proceedings of the 15th International Conference Mobile Learning* (pp. 153-156). https://doi.org/10.33965/ml2019_201903R002

Annamalai, N., Uthayakumaran, A., & Zyoud, S. H. (2022). High school teachers' perception of AR and VR in English language teaching and learning activities: A developing country perspective. *Education and Information Technologies*, 1-27. https://doi.org/10.1007/s10639-022-11275-2

Baleghizadeh, S., & Oladrostam, E. (2010). The effect of mobile assisted language learning (MALL) on grammatical accuracy of EFL students. *Mextesol Journal*, *34*(2), 1-10.

Berns, A., Ruiz-Rube, I., Mota, J. M., Dodero, J. M., Castro, E., Ryynanen, O., & Werner, L. (2019). Let's date!": A 360-degree video application to support foreign language learning. *CALL and complexity—short papers from EUROCALL*, 39. https://doi.org/10.14705/rpnet.2019.38.983

Berti, M. (2021). The unexplored potential of virtual reality for cultural learning. *The EuroCALL Review*, *29*(1), 60–67. https://doi.org/10.4995/eurocall.2021.12809

Berti, M., Maranzana, S., & Monzingo, J. (2020). Fostering cultural understanding with virtual reality: A look at students' stereotypes and beliefs. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 10*(1), 47-59. https://doi.org/10.4018/IJCALLT.2020010104

Bourhim, E. M., & Cherkaoui, A. (2020). Efficacy of virtual reality for studying people's pre-evacuation behavior under fire. *International Journal of Human-Computer Studies*, *142*, 102484. https://doi.org/10.1016/j.ijhcs.2020.102484

Burghardt, A., Szybicki, D., Gierlak, P., Kurc, K., Pietrus, P., & Cygan, R. ł. (2020). Programming of industrial robots using virtual reality and digital twins. *Applied Sciences*, *10*(486), 1–12. https://doi.org/10.3390/app10020486

Casañ-Pitarch, R., & Gong, J. (2021). Testing ImmerseMe with chinese students: Acquisition of foreign language forms and vocabulary in spanish. *CercleS*, *11*(1), 219–233. http://doi.org/10.1515/cercles-2021-2016

Chen, C. Y., Chang, S. C., Hwang, G. J., & Zou, D. (2021). Facilitating EFL learners' active behaviors in speaking: a progressive question prompt-based peer-tutoring approach with VR contexts. *Interactive Learning Environments*, 1-20. https://doi.org/10.1080/10494820.2021.1878232

Chen, M., Chai, C. S., Jong, M. S. Y., & Chao, G. C. N. (2021). Modeling learners' self-concept in chinese descriptive writing based on the affordances of a virtual reality-supported environment. *Education and Information Technologies*, *26*, 6013–6032. https://doi.org/10.1007/s10639-021-10582-4

Chen, Y. L., Hsu, C. C., Lin, C. Y., & Hsu, H. H. (2022). Robot-Assisted Language Learning: Integrating Artificial Intelligence and Virtual Reality into English Tour Guide Practice. *Education Sciences*, *12*(7), 437. https://doi.org/10.3390/educsci12070437

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. https://doi.org/10.1080/09588221.2018.1544151

Cheng, A., Andersen, E., & Yang, L. (2017). *Teaching language and culture with a virtual reality game*. CHI 2017, Denver, CO, USA. http://dx.doi.org/10.1145/3025453.3025857

Chien, S.-Y., Hwang, G.-J., & Jong, M. S.-Y. (2020). Effects of peer assessment within the context of spherical video-based virtual reality on EFL students' English-Speaking performance and

learning perceptions. *Computers & Education*, *146*, 1–20. https://doi.org/10.1016/j.compedu.2019.103751

Chirico, A., Lucidi, F., Laurentiis, M. D., Milanese, C., Napoli, A., & Giordano, A. (2015). Virtual reality in health system: Beyond Entertainment. A Mini-Review on the efficacy of VR during cancer treatment. *Journal of Cellular Physiology*, *231*, 275–287. https://doi.org/10.1002/jcp.25117

Çoban, M., & Göksu, İ. (2022). Using virtual reality learning environments to motivate and socialize undergraduates in distance learning. *Participatory Educational Research*, *9*(2), 199-218. http://dx.doi.org/10.17275/per.22.36.9.2

Dawley, L., & Dede, C. (2014). Situated learning in virtual worlds and immersive simulations. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 723–734). Springer Publishing. https://doi.org/10.1007/978-1-4614-3185-5_58

Dhimolea, T.K., Kaplan-Rakowski, R. & Lin, L. (2022). A systematic review of research on high-immersion virtual reality for language learning. *TechTrends*, *66*, 810–824. https://doi.org/10.1007/s11528-022-00717-w

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

Fransson, G., Holmberg, J., & Westelius, C. (2020). The challenges of using head mounted virtual reality in k-12 schools from a teacher perspective. *Education and Information Technologies*, *25*, 3384–3404. https://doi.org/10.1007/s10639-020-10119-1

Frazier, E., Lege, R., & Bonner, E. (2021). Making virtual reality accessible for language learning: Applying the VR application analysis framework. *Teaching English with Technology*, *21*(1), 131-143.

Fuhrman, O., Eckerling, A., Friedmann, N., Tarrasch, R., & Raz, G. (2021). The moving learner: Object manipulation in virtual reality improves vocabulary learning. *Journal of Computer Assisted Learning*, *37*, 672–683. https://doi.org/10.1111/jcal.12515

Fussell, S. G., & Truong, D. (2021). Accepting virtual reality for dynamic learning: an extension of the technology acceptance model. *Interactive Learning Environments*, 1-18. https://doi.org/10.1080/10494820.2021.2009880

Fussell, S. G., & Truong, D. (2022). Using virtual reality for dynamic learning: an extended technology acceptance model. *Virtual Reality*, *26*(1), 249-267. https://doi.org/10.1007/s10055-021-00554-x

Genç, B., & Bada, E. (2005). Culture in language learning and teaching. *The reading matrix*, *5*(1).

Ghorbani, N., & Ebadi, S. (2020). Exploring learners' grammatical development in mobile assisted language learning. *Cogent Education*, *7*(1), 1704599. https://doi.org/10.1080/2331186X.2019.1704599

Hagge, P. (2021). Student perceptions of semester-long in-class virtual reality: Effectively using "Google Earth VR" in a higher education classroom. *Journal of Geography in Higher Education*, *45*(3), 342-360. https://doi.org/10.1080/03098265.2020.1827376

Huang, H. M., Rauch, U., & Liaw, S. S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education, 55*(3), 1171-1182. https://doi.org/10.1016/j.compedu.2010.05.014

Huang, H.-L., Hwang, G.-J., & Chang, C.-Y. (2020). Learning to be a writer: A spherical video-based virtual reality approach to supporting descriptive article writing in high school Chinese courses. *British Journal of Educational Technology*, *51*(4), 1386–1405. https://doi.org/10.1111/bjet.12893

Huang, X., Zou, D., Cheng, G., & Xie, H. (2021). A systematic review of AR and VR enhanced language learning. *Sustainability*, *13*(9), 4639. https://doi.org/10.3390/su13094639

Hussein, M., & Nätterdal, C. (2015). The benefits of virtual reality in education-A comparision study.

Imran, E., Adanir, N., & Khurshid, Z. (2021). Significance of haptic and virtual reality simulation (VRS) in the dental education: A review of literature. *Appl. Sci.*, *11*, 1–19. https://doi.org/10.3390/app112110196

Kuo, M. M., & Lai, C. C. (2006). Linguistics across cultures: The impact of culture on second language learning. *Online Submission*, *1*(1).

Lan, Y. J. (2014). Does second life improve mandarin learning by overseas Chinese students? *Language Learning & Technology*, 18(2), 36–56. Retrieved from http://llt.msu.edu/issues/june2014/action2.pdf

Lan, Y. J., Hsiao, I. Y., & Shih, M. F. (2018). Effective learning design of Game-based 3D virtual language learning environments for Special education students. *Journal of Educational Technology & Society*, 21(3), 213-227. http://www.jstor.org/stable/26458519

Lan, Y.-J. (2020). Immersion, interaction, and experience-oriented learning: Bringing virtual reality into FL learning. *Language Learning & Technology*, *24*(1), 1–15. https://doi.org/10.1016/bs.plm.2020.03.001

Liang, M. Y. (2018). Beyond elocution: Multimodal narrative discourse analysis of L2 storytelling. ReCALL, 31(1), 56–74. https://doi.org/10.1017/S0958344018000095

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. https://www.jstor.org/stable/jeductechsoci.18.4.486

Lin, V., Barrett, N. E., Liu, G.-Z., Chen, N.-S., & Jonge, M. S.-Y. (2021). Supporting dyadic learning of english for tourism purposes with scenery-based virtual reality. *Computer Assisted Language Learning*, 2–38. https://doi.org/10.1080/09588221.2021.1954663

Lin, Y.-J., & Wang, H. (2021). Using virtual reality to facilitate learners' creative self-efficacy and intrinsic motivation in an EFL classroom. *Education and Information Technologies*, *26*, 4487–4505. https://doi.org/10.1007/s10639-021-10472-9

Liu, X., Zhang, J., Hou, G., & Wang, Z. (2018, July). Virtual reality and its application in military. In *IOP Conference Series: Earth and Environmental Science* (Vol. 170, No. 3, p. 032155). IOP Publishing. https://doi.org/10.1088/1755-1315/170/3/032155

Lloyd, A., Rogerson, S., & Stead, G. (2017). Imagining the potential for using virtual reality technologies in language learning. In M. Carrier, R. M. Damerow, & K. M. Bailey (Eds.), *Digital language learning and teaching* (1st ed., pp. 222–234). Routledge. ISBN: 9781315523293 https://doi.org/10.4324/9781315523293-19

Ma, L. (2021). An immersive context teaching method for college english based on artificial intelligence and machine learning in virtual reality technology. *Mobile Information Systems*, 1–7. https://doi.org/10.1155/2021/2637439

Mahmoudi, M. (2020). The effect of online learning on grammatical accuracy among EFL upper-intermediate learners. *Journal of Language Teaching and Research*, *11*(6), 1011-1016. http://dx.doi.org/10.17507/jltr.1106.20

McKnight, R. R., Pean, C. A., Buck, J. S., Hwang, J. S., Hsu, J. R., & Pierrie, S. N. (2020). Virtual reality and augmented reality—translating surgical training into surgical technique. *Current Reviews in Musculoskeletal Medicine*, *13*(6), 663-674. https://doi.org/10.1007/s12178-020-09667-3

Mekbib, D. B., Han, J., Zhang, L., Fang, S., Jiang, H., Zhu, J., Roe, A.W., & Xu, D. (2020). Virtual reality therapy for upper limb rehabilitation in patients with stroke: a meta-analysis of randomized clinical trials. *Brain injury*, *34*(4), 456-465. https://doi.org/10.1080/02699052.2020.1725126

Menin, A., Torchelsen, R., & Nedel, L. (2018). An analysis of VR technology used in immersive simulations with a serious game perspective. *IEEE Computer Graphics and Applications*, 57–73. https://doi.org/10.1109/MCG.2018.021951633

Mills, N., Courtney, M., Dede, C., Dressen, A., & Gant, R. (2020). Culture and vision in virtual reality narratives. *Foreign Language Annals.*, *53*, 733–760. https://doi.org/10.1111/flan.12494

Murray, J. H. (2020). Virtual/reality: How to tell the difference. *Journal of Visual Culture*, *19*(1), 11–27. https://doi.org/10.1177/1470412920906253

Mystakidis, S. (2022). Metaverse. *Encyclopedia*, *2*, 486–497. https://doi.org/10.3390/encyclopedia2010031

Ng, W. (2015). New digital technology in education. *Switzerland: Springer*. https://doi.org/10.1007/978-3-319-05822-1

Nicolaidou, I., Pissas, P., & Boglou, D. (2021). Comparing immersive virtual reality to mobile applications in foreign language learning in higher education: A quasi-experiment. *Interactive Learning Environments*, 1–16. https://doi.org/10.1080/10494820.2020.1870504

Nissim, Y., & Weissblueth, E. (2017). Virtual reality (VR) as a source for self-efficacy in teacher training. *International Education Studies*, *10*(8), 52-59. https://doi.org/10.5539/ies.v10n8p52

Nobrega, F. A., & Rozenfeld, C. C. F. (2019). Virtual reality in the teaching of FLE in a brazilian public school. *Languages*, *4*(36), 1–13. https://doi.org/10.3390/languages4020036

Özdemir, M. (2017). Sarmalayan sanal gerçeklik teknolojisi ile öğrenme deneyimleri: sistematik bir inceleme. 11. *Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumuna Sunulmuş Bildiri*. https://doi.org/10.17860/mersinefd.336746

Özeren, E., Tosunoglu, E., Pekyurek, M. F., Seyhan, N., & Yilmaz, F. G. K. (2021). Eğitimde sanal gerçeklik çalışmaları: Güncel araştırmalardaki eğilimlerin analizi. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *21*(2), 390-401. https://dx.doi.org/10.17240/aibuefd.2021.21.62826-879293

Özgen, D. S., Afacan, Y., & Surer, E. (2021). Usability of virtual reality for basic design education: A comparative study with paper-based design. *International Journal of Technology and Design Education*, *31*, 357–377. https://doi.org/10.1007/s10798-019-09554-0

Pack, A., & Barrett, A. (2021). A Review of Virtual Reality and English for Academic Purposes: Understanding Where to Start. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 11*(1), 72-80. http://doi.org/10.4018/IJCALLT.2021010105

Pack, A., Barrett, A., Liang, H. N., & Monteiro, D. V. (2020). University EAP students' perceptions of using a prototype virtual reality learning environment to learn writing structure. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT)*, *10*(1), 27-46. https://doi.org/10.4018/IJCALLT.2020010103

Pan, X., & Hamilton, A. F. C. (2018). Why and how to use virtual reality to study human social interaction: The challenges of exploring a new research landscape. *British Journal of Psychology*, *109*, 395–417. https://doi.org/10.1111/bjop.12290

Parmaxi, A. (2020). Virtual reality in language learning: A systematic review and implications for research and practice. *Interactive Learning Environments*, 1–13. https://doi.org/10.1080/10494820.2020.1765392

Parmaxi, A., Athanasiou, A., & Demetriou, A. A. (2021). Introducing a student-led application of google expeditions: An exploratory study. *Educational Media International*, *58*(1), 37–59. https://doi.org/10.1080/09523987.2021.1908497

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, *147*, 103778. https://doi.org/10.1016/j.compedu.2019.103778

Repetto, C., Natale, A. F. D., Villani, D., Triberti, S., Germagnoli, S., & Riva, G. (2021). The use of immersive 360° videos for foreign language learning: A study on usage and efficacy among high-school students. *Interactive Learning Environments*, 1–17. https://doi.org/10.1080/10494820.2020.1863234

Ryan, M. L. (2015). *Narrative as virtual reality 2*. Baltimore: Johns Hopkins University Press. https://doi.org/10.1353/book.72246

Shadiev, R., Yu, J., & Sintawati, W. (2021). Exploring the impact of learning activities supported by 360-Degree video technology on language learning. *Frontiers in Psychology*, *12*, 1–18. https://doi.org/10.3389/fpsyg.2021.766924

Shih, Y. C. (2015). A virtual walk-through London: Culture learning through a cultural immersion experience. *Computer Assisted Language Learning*, *28*(5), 407–428. https://doi.org/10.1080/09588221.2013.851703

Shih, Y. C. (2018). Contextualizing language learning with street view panoramas. In Y. Qian (Ed.), *Integrating multi-user virtual environments in modern classrooms* (pp. 74–91). IGI Global. https://doi.org/10.4018/978-1-5225-3719-9.ch004

Shin, D. H. (2017). The role of affordance in the experience of virtual reality learning: Technological and affective affordances in virtual reality. *Telematics and Informatics, 34*(8), 1826-1836. https://doi.org/10.1016/j.tele.2017.05.013

Sırakaya, M. & Kılıç-Çakmak, E. (2018). Effects of Augmented Reality on Student Achievement and Self-Efficacy in Vocational Education and Training. International Journal for Research in Vocational Education and Training. 5. 1-18. https://doi.org/10.13152/IJRVET.5.1.1

Solak, E., & Erdem, G. (2015). A content analysis of virtual reality studies in foreign language education. *Participatory Educational Research (PER)*, 21–26. http://dx.doi.org/10.17275/per.15.spi.2.3

Soto, J. B., Ocampo, D. T., Colon, L. B., & Oropesa, A. V. (2020). Perceptions of ImmerseMe virtual reality platform to improve English communicative skills in higher education. International Journal of Interactive Mobile Technologies (iJIM),14(7), 4–19. https://doi.org/10.3991/ijim.v14i07.12181

Spencer, S., Drescher, T., Sears, J., Scruggs, A. F., & Schreffler, J. (2019). Comparing the efficacy of virtual simulation to traditional classroom role-play. *Journal of Educational Computing Research*, *57*(7), 1772-1785. https://doi.org/10.1177/0735633119855613

Steffen, J.H., Gaskin, J. E., Meservy, T. O., Jenkins, J. L. & Wolman, I. (2019). Framework of affordances for virtual reality and augmented reality. *Journal of Management Information Systems, 36*(3). 683-729. https://doi.org/10.1080/07421222.2019.1628877

Symonenko, S., Zaitseva, N., Osadchyi, V., Osadcha, K., & Shmeltser, E. (2020). Virtual reality in foreign language training at higher educational institutions. https://doi.org/10.31812/123456789/3759

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. https://doi.org/10.1177/0735633121994291

Walsh, K. R., & Pawlowski, S. D. (2002). Virtual reality: A technology in need of IS research. *Communications of the Association for Information Systems, 8*(1), 20. https://doi.org/10.17705/1CAIS.00820

Wang, Z., Guo, Y., Wang, Y., Tu, Y.-F., & Liu, C. (2021). Technological solutions for sustainable development: Effects of a visual prompt Scaffolding-Based virtual reality approach on EFL learners' reading comprehension, learning attitude, motivation, and anxiety. *Sustainability*, *13*, 1–15. https://doi.org/10.3390/su132413977

Wu, J. G., Miller, L., Huang, Q., & Wang, M. (2021). Learning with immersive virtual reality: An exploratory study of chinese college nursing students. *RELC Journal*, 1–17. https://doi.org/10.1177/00336882211044860

Wu, W. C. V., Manabe, K., Marek, M. W., & Shu, Y. (2021). Enhancing 21st-century competencies via virtual reality digital content creation. *Journal of Research on Technology in Education*, 1-22. https://doi.org/10.1080/15391523.2021.1962455

Xie, Y., Liu, Y., Zhang, F., & Zhou, P. (2022). Virtual Reality-Integrated Immersion-Based Teaching to English Language Learning Outcome. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.767363

Xie, Y., Ryder, L., & Chen, Y. (2019). Using interactive virtual reality tools in an advanced chinese language class: A case study. *TechTrends*, *63*, 251–259. https://doi.org/10.1007/s11528-019-00389-z

Yamazaki, K. (2018). Computer-assisted learning of communication (CALC): A case study of Japanese learning in a 3D virtual world. *ReCALL, 30*(2), 214-231. https://doi.org/10.1017/S0958344017000350

Yeh, H.-C., Tseng, S.-S., & Heng, L. (2020). Enhancing EFL students' intracultural learning through virtual reality. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2020.1734625

Yıldırım, B., Topalcengiz, E. S., Arıkan, G., & Timur, S. (2020). Using virtual reality in the classroom: Reflections of STEM teachers on the use of teaching and learning tools. *Journal of Education in Science Environment and Health*, *6*(3), 231-245. https://doi.org/10.21891/jeseh.711779

Yıldırım, I. (2017). The effects of gamification-based teaching practices on student achievement and students' attitudes toward lessons. *The Internet and Higher Education*, *33*, 86-92. https://doi.org/10.1016/j.iheduc.2017.02.002

York, J., Shibata, K., Tokutake, H., & Nakayama, H. (2021). Effect of SCMC on foreign language anxiety and learning experience: A comparison of voice, video, and VR-based oral interaction. *ReCALL, 33*(1), 49-70. https://doi.org/10.1017/S0958344020000154

Zoubi, S. M. A. (2018). The impact of exposure to English language on language acquisition. *Journal of Applied Linguistics and Language Research*, *5*(4), 151–162. Retrieved from http://jallr.com/index.php/JALLR/article/download/851/pdf851