Design and Evaluation of Task-Based Role-Play Speaking Activities in a VR Environment for Authentic Learning

A Design-Based Research Approach

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Design Principles
Design-based Research
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Research has highlighted a lack of consideration for pedagogy and virtual reality (VR) affordances in designing learning activities within VR environments. Therefore, this design-based research put forward and implemented three design principles grounded in task-based language teaching (TBLT) pedagogy, focusing on two key VR affordances—authenticity and interaction—to develop task-based role-play speaking activities that were put into practice in a workshop series offered to undergraduate Chinese students interested in improving their English speaking. Sixteen Chinese undergraduate students engaged in the workshop series, completing eight tasks over eight sessions within a VR application called Immerse. Data from semi-structured interviews were thematically analyzed to explore how the design of the speaking activities supported English as a foreign language (EFL) learners in enhancing their speaking proficiency within VR environments. The design principles created and implemented in this design case study can serve as guidelines for designing and assessing speaking activities in VR

environments, ensuring that educational practices are pedagogically sound and technologically enhanced.

Introduction

Authentic learning experiences are essential for English as a foreign language (EFL) learners to effectively use the target language and process language input in real-world scenarios (Yilmaz, 2021). They can immerse EFL learners in real-life scenarios, requiring them to react to various context-related factors while speaking (Moeller & Catalano, 2015). However, many EFL learners lack opportunities for authentic learning experiences, which often results in unsatisfactory performance in speaking proficiency (Chen & Hwang, 2020).

Virtual reality (VR) is a viable technological tool to provide authentic learning experiences, allowing language learners to practice and improve their speaking skills (Lan, 2020; Scavarelli et al., 2021). Researchers have identified numerous benefits of using VR for learning to speak a foreign language, such as interactive and collaborative learning (Chang et al., 2012; Lan, 2020; Liaw, 2019), learner engagement (Chang et al., 2012; Wu & Hung, 2022), improved learner motivation (Alizadeh, 2019; Liaw, 2019), reduction of learner anxiety and stress (Chen & Hwang, 2020; Thrasher, 2022), improved communicative competence (Yamazaki, 2018), and contextualization of speaking activities (Chang et al., 2012).

However, providing an opportunity for learning in a traditional classroom or a simulated virtual reality environment does not automatically ensure learning will occur. Learning effectiveness is derived from the tasks, activities, and fundamental pedagogical strategies that technology supports or facilitates (Dalgarno & Lee, 2009). Research indicates that VR learning activities are often designed without adequate consideration of pedagogy, highlighting a lack of methodological models for integrating language teaching into virtual environments (Baxter & Hainey, 2019; Dalgarno & Lee, 2009; Johnston et al., 2017; Lowell & Yan, 2023). This gap underscores the need to develop design principles for design learning activities grounded in well-established pedagogy and VR affordances to create authentic learning experiences for EFL learners.

A design principle is a guideline or advice for taking a particular action to address a design problem (McAdams, 2003). It informs the designers or readers about a fundamental concept, fact, or acquired knowledge within a specific field of application (Briggs, 1991; Brown & Green, 2019). It is contextually and temporally situated, offering information on the scope of the relevant area and the current state of the art in the field (Fu et al., 2016). Numerous researchers emphasize the importance of integrating scientifically validated principles into educational practices to enhance their effectiveness. They argue that design principles should steer interventions and contribute to the generation of new knowledge (Gagne et al., 2005; Mayer, 2008; Sahin, 2009). By clearly articulating design principles, theoretical assumptions can be converted into precise guidelines addressing specific technological affordances, pedagogical approaches, or student tasks (Hanghøj et al., 2022).

The purpose of this research study is to propose three design principles based on task-based language teaching (TBLT) pedagogy and two VR affordances—authenticity and interaction. We investigate how eight task-based role-play speaking activities, designed according to these principles, can support EFL learners in developing speaking proficiency in VR environments.

Literature Review

This literature review examines the challenges faced by EFL learners in improving their speaking skills, explores the potential of VR with its two affordances for language learning, discusses the principles and practices of TBLT pedagogy, and finally highlights the necessity of developing design principles that align with pedagogy and leverage VR affordances to establish best practices for VR-enhanced authentic learning.

EFL Learners' Challenges in Improving Speaking Skills

Developing speaking skills is paramount for EFL learners as they are a gateway to effective communication and integration into their target language communities (Moeller & Abbott, 2018). Proficient speaking abilities enable learners to accurately express their thoughts, ideas, and emotions, fostering meaningful interactions with native speakers and fellow learners (Richards & Rodgers, 2014). However, EFL learners encounter numerous challenges when seeking to improve their speaking skills, including fear of making mistakes, limited vocabulary and grammar knowledge, lack of speaking opportunities, limited self-confidence, and language anxiety (Leong & Ahmadi, 2017; Paneerselvam & Mohamad, 2019; Ratnasari, 2020).

Among these challenges, the lack of authenticity in language learning significantly hinders the development of speaking skills (Chen & Hwang, 2020; Davis et al., 2020; Enkin, 2022; Yang et al., 2020). Traditional methods of teaching speaking—such as the grammar-translation method and rote memorization—along with outdated language resources like textbooks and images and learning activities such as mechanical speaking drills and fill-in-the-gap exercises, often fail to provide meaningful connections to real-life situations (Richards & Rodgers, 2014). This inadequacy negatively impacts three facets of authenticity: the authenticity of language, the authenticity of the situation, and the authenticity of the task (Renau Renau, 2016; Taylor, 1994).

The lack of authentic learning experiences presents a substantial barrier to EFL learners, highlighting the pressing need for innovative methodologies that bridge the gap between traditional methods of teaching speaking skills and the learners' need for authentic learning experiences. Addressing this gap is crucial for fostering more effective language learning and ensuring that EFL learners can engage confidently and competently in real-world communication.

Virtual Reality and Its Two Affordances in Language Learning

VR, a technology that provides users with a three-dimensional, computer-generated environment, is a promising tool for facilitating language learning (Lan, 2020; Lowell & Yan, 2024; Peixoto et al., 2019; Scavarelli et al., 2021). VR experiences range from highly imaginative to realistic simulations and can be accessed via computer or mobile device screens, surround-screen projection rooms, or head-mounted displays (HMDs) like VR headsets or goggles (Southgate, 2022).

VR has been increasingly adopted for language learning over the past two decades due to its unique affordances of authenticity of the environment and interaction (Dalgarno & Lee, 2009; Lin & Lan, 2015; Schwienhorst, 2002). Authenticity in VR refers to its capacity to create and present scenarios, experiences, and processes that closely mimic real life (Thompson et al., 2018). This affordance is unique to VR technology because of its multisensory attributes; it engages the user's senses of sight and sound and can even incorporate smell and touch (Wang et al., 2021). Therefore, VR can create authentic language learning environments, such as virtual marketplaces, airports, or everyday social situations (Lan, 2020). These authentic contexts function as essential scaffolding tools that facilitate learners' language production (Lin & Lan, 2015), providing context-specific language experiences that closely resemble real-life scenarios (Enkin, 2022; Wu & Hung, 2022). By experiencing authentic language environments in VR, learners can apply their English-speaking skills in context (Chen & Hwang, 2020), helping them adapt language use to various situations and improving both language proficiency and communication effectiveness (Dhimolea et al., 2022).

Furthermore, VR enables interactive experiences where users engage with the virtual environment and its elements (Wu & Hung, 2022). This interaction, unique to VR, includes embodied actions such as view control, navigation, and object manipulation (Dalgarno & Lee, 2009). Wang et al. (2019) identified three types of VR interaction in language learning: the interaction between avatars (AA interaction), the interaction between the avatar and the contexts (AC interaction), and the intra-relation among avatars and a context (ACA interaction), (p. 893). AA interaction refers to verbal, textual, or motion-based communication between avatars. AC interaction involves how an avatar manipulates objects or engages with the 3D environment. Finally, ACA interaction describes how avatars interact with each other through contextual elements, such as virtual note cards (Wang et al., 2019). These interactive features of VR have been identified as crucial for the success of VR-assisted language learning (Chen et al., 2022), especially to support meaningful language exchanges and improve students' grammar and vocabulary in their spoken performance (Wu & Hung, 2022). Therefore, VR is a valuable tool for teachers and educators aiming to create engaging and interactive language learning environments (Ozgun & Sadık, 2023).

Authenticity and interaction are crucial in language learning within VR environments (Chen et al., 2022; Dalgarno & Lee, 2009; Lin & Lan, 2015). VR provides realistic simulations that facilitate authentic interactions, allowing learners to practice language skills in contextually

appropriate ways, thereby enhancing the authenticity of the learning experience (Enkin, 2022; Wu & Hung, 2022). In addition, authenticity and interaction align with essential components of successful language learning which are immersion, participation, interaction, and authenticity (Lan, 2020), making VR a potent tool for providing authentic and interactive learning experiences that help EFL learners develop their speaking skills.

Task-Based Language Teaching Pedagogy

Despite the potential benefits of VR for improving speaking skills, the success of providing EFL learners with an authentic learning experience in VR depends on designing real-life learning activities that follow pedagogy and leverage VR affordances (Asad et al., 2021; Fowler, 2015; Jowallah et al., 2018; Lowell & Yan, 2023; Parmaxi, 2020). Pedagogy, defined by Biesta (2012) as "the art and science of teaching, encompassing various methods, strategies, and approaches employed in the instructional process" (p.153), helps educators understand learners' needs, design impactful learning experiences, and encourage active involvement and critical thinking. It serves as a cornerstone in education, providing a framework for effective teaching practices and achieving educational goals (Kabulova, 2023). Pedagogy can positively impact EFL learners' learning experiences and academic achievements (Bragg, 2012; Matovu et al., 2023), spark interest in the subject matter (Sun et al., 2021), and foster an environment that motivates students to actively participate, solve problems, and acquire knowledge and skills (Hwa, 2018; O'Rourke et al., 2017).

TBLT has been widely adopted in language speaking education (Hu, 2021; Nita & Rozimela, 2019). This approach is well-suited for VR-enhanced learning due to its learner-centered emphasis on meaningful interactions and authentic language use (Chen, 2023), aligning with the affordances of VR—authenticity and interaction. Engaging learners in task-oriented activities creates a more contextualized environment for activating learning processes compared to form-focused exercises, offering better opportunities for language acquisition (Ellis, 2000; Long, 2014; Nunan, 2004). Moreover, tasks promote negotiation, modification, rephrasing, and experimentation, which are essential for foreign language learning (Nunan, 2004). Nunan (2004) defines a task as an activity that involves learners in understanding, manipulating, producing, or interacting using the target language. Tasks provide learners with the necessary information for learning (Ellis, 2000). Therefore, TBLT can enhance oral language production and support meaning negotiation through tasks (Winnefeld, 2013).

Various types of EFL tasks exist, particularly in communicative instruction. For example, Pica et al. (1993) classifies tasks based on the type of interaction involved in completing them. Their classification includes jigsaw tasks, information-gap tasks, problem-solving tasks, decision-making tasks, and opinion exchange tasks. Similarly, Willis (1996) identifies six types of tasks based on traditional knowledge hierarchies. She categorizes these tasks as listing, ordering and sorting, comparing, problem solving, sharing personal experiences, and creative tasks. These task types emphasize interaction and meaningful communication, which are essential for developing speaking skills in EFL learners. By integrating tasks such as these within VR environments, educators can create authentic and interactive learning experiences that can enhance language proficiency and communication abilities.

Research has indicated a lack of consideration for pedagogy and VR affordances in designing learning activities within VR environments (Baxter & Hainey, 2019; Dalgarno & Lee, 2009; Johnston et al., 2017; Lowell & Yan, 2023). Mikropoulos and Natsis (2011) reviewed research from 1999 to 2009 on VR integration in educational environments and found a scarcity of studies with well-defined theoretical pedagogical frameworks. Similarly, Fowler (2015) noted a lack of clear pedagogical models in studies focusing on VR use in educational environments. Parmaxi (2020) conducted a systematic literature review on using VR in language learning from 2015 to 2018 and concluded that a closer alignment between VR affordances and pedagogy is urgently needed for effective educational applications. As both teachers and learners need guidance in planning and implementing pedagogically sound learning activities in VR environments, applied research aimed at deriving and evaluating design principles to design the learning activities is crucial for informing best practices in integrating VR technology with pedagogy.

Instructional Design Framework

Based on TBLT pedagogy and two VR affordances, we propose three design principles for instructional designers and educators to create task-based role-play speaking activities for EFL learners to develop speaking proficiency in VR environments. These principles can guide interventions, generate new knowledge, and offer guidelines for designing tasks that leverage specific VR capabilities and language learning pedagogy (Hanghøj et al., 2022). The three design principles are explained as follows:

Authentic Tasks with Authentic Materials in Authentic Contexts. TBLT emphasizes using authentic tasks supported by authentic materials, where students undertake practical tasks reflecting real-world scenarios, such as problem-solving, decision-making, and project completion (Chen, 2023; Nunan, 2004). These tasks relate directly to students' daily lives and needs, heightening the practical relevance of language practice and enabling learners to apply their speaking skills in everyday situations (Long, 2014). Additionally, the authentic environment created by VR adds contextualization to speaking-based activities that no other platform can match (Enkin, 2022). Therefore, through designing authentic tasks with authentic materials in authentic contexts, this design principle addresses three facets of authenticity: the authenticity of language, the authenticity of the situation, and the authenticity of the task (Renau Renau, 2016; Taylor, 1994), ultimately providing authentic learning experiences for EFL learners.

Interaction among the Learners through the Context. Tasks are designed to facilitate interaction among learners through the context, which includes both virtual environments and virtual objects (Lan et al., 2013). These tasks encourage negotiation, modification, rephrasing, and experimentation—essential components of second language learning (Nunan, 2004). To promote learner interaction, we incorporate role plays as tasks. Role plays provide learners with opportunities to use the target language and conversational resources, stimulating authentic conversational interactions across various social contexts and roles (Rojas & Villafuerte, 2018). Our design considerations also focus on facilitating learner interaction through the context, which is ACA interaction, describing how learners interact with each other using the context (Wang et al., 2019). For example, learners use tools in VR environments to complete tasks. As learners see, hear, and manipulate objects within the virtual environment through control, navigation, and object manipulation (Dalgarno & Lee, 2009), learners become increasingly attentive, gain a better understanding of the context, and engage more deeply with speaking activities (Lan, 2015).

Teacher-Based Timely Scaffolding and Feedback. The combination of scaffolding and feedback in language learning environments is crucial for improving learners' linguistic achievement and interaction (Fang et al., 2020). Scaffolding, as defined by Shepard (2005), is the "support that teachers provide to the learner during problem-solving—in the form of reminders, hints, and encouragement—to ensure successful completion of a task" (p. 66). Instructors can provide various forms of scaffolding, such as conceptual, metacognitive, procedural, strategic, and motivational support, to help students reach the course objectives (Richardson et al., 2021). In language learning, scaffolding has proven effective for addressing students' interests and needs, providing metalinguistic information, clarifications, highlighting errors, and offering corrective feedback (Zarei & Rezadoust, 2020). By utilizing scaffolding strategies, such as linguistic scaffolding, teachers can tailor the amount of help they provide based on learners' existing proficiency levels (Sykes et al., 2008), help EFL students transition from dependence on the teacher to more independent performance (Rassaei, 2014), and greatly influence students' academic language development (Lucero, 2013).

Research Question

In this study, we proposed three design principles aligned with TBLT pedagogy and two VR affordances. Using these principles, we designed and implemented eight task-based role-play speaking activities. We then evaluated these activities to address the following research question: How does the design of task-based role-play speaking activities based on the three design principles support the development of EFL learners' speaking proficiency in a VR environment?

Methods

For this study, we employed a design-based research (DBR) methodology grounded in the TBLT framework to design and evaluate task-based role-play speaking activities in VR environments. DBR "is a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (Wang & Hannafin, 2005, pp. 6–7). DBR studies involve multiple parties such as designers, researchers, and practitioners with diverse expertise to guide the design, conduct, and reporting of the research (McKenney & Reeves, 2018). DBR is also characterized as being pragmatic, grounded, interactive, iterative, flexible, integrative, and contextual (Richardson et al., 2022, p. 218). This methodology facilitates the creation of practical and efficient solutions to real-world challenges in educational environments and serves as an effective means for enhancing educational practices (McKenney & Reeves, 2018). Before the study, we obtained approval from the Ethical Review Board of Purdue University. No-IRB2023597.

Selection of Site and Participants

The study took place at a prominent public university in China and included 16 female freshmen who voluntarily joined a non-credit workshop series to develop their English-speaking proficiency using a VR technology called Immerse. All participants were proficient in Chinese, with an average of 12 years of EFL study. They brought diverse EFL learning experiences to the project, including participation in extracurricular speaking classes and online gaming. None of the participants had prior exposure to VR applications. They were guided by an experienced online EFL instructor and participated in eight role-play speaking activities.

VR Platform

This design project utilized desktop-based VR Immerse (https://www.immerse.online/), a specialized VR application explicitly designed for real-time language teaching and learning. The Immerse application functions as a virtual learning experience platform, facilitating teacher-led, communicative, task- or problem-based activities within contextually relevant virtual settings for language learning, practice, or skill development (Kern, 2021). The Immerse application provides users with access to more than 30 distinct and highly interactive environments, such as homes, restaurants, or art studios, allowing students to physically manipulate various objects and collaborate with peers.

Design Research Process

McKenney and Reeves (2018) proposed four phases in an educational design research process with analysis and exploration, design and construction, evaluation and reflection, and implementation and spread. The three core phases are described as follows.

Phase 1: Analysis and Exploration

In this phase, researchers and the instructor aimed to understand the problem, context, and practitioners. During the Analysis, a literature review on TBLT and VR affordances was conducted to gain theoretical insights that shaped the understanding of the problem and context. During the Exploration, three design principles were proposed based on the literature review. Next, the researchers and the instructor conducted a document analysis, examining the speaking course syllabus for the freshman in the participant school and identifying the theme and task topics in the speaking activities. Based on the topics of the tasks, five VR environments -Airport, Fast food, Restaurant, Shopping Mall, and Hotel- in Immerse were selected. Additionally, to better understand the learners' characteristics to inform the design of the task-based role-play speaking activities, a survey was administered to collect demographic information, including gender, age, academic year, years of English study, and VR experience.

Phase 2: Design and Construction

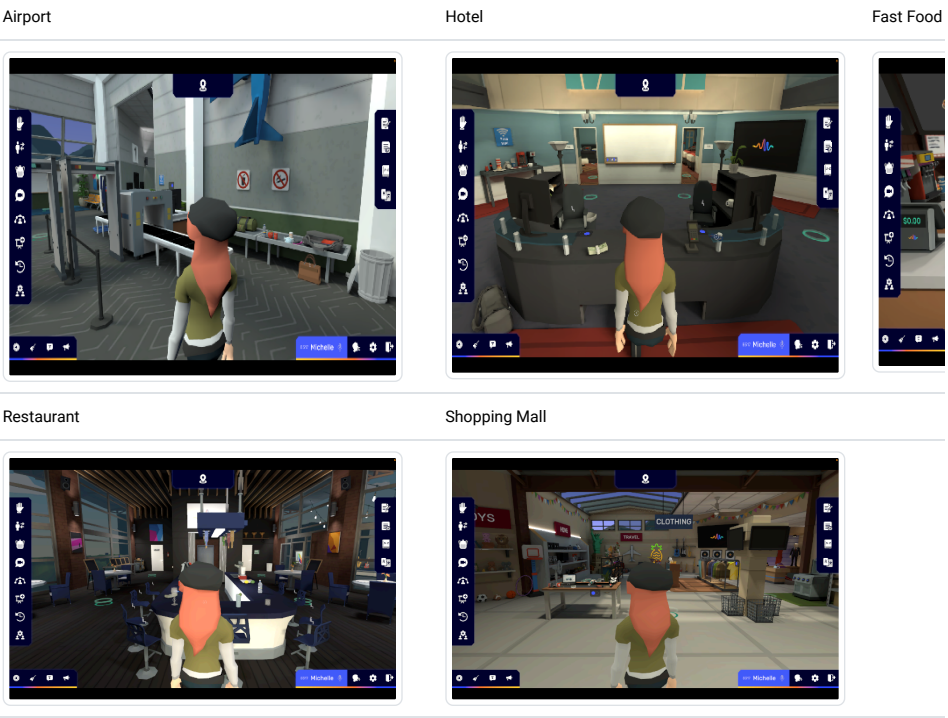
The researchers and the instructional designers worked together to solve the problem in this phase. Eight task-based role-play speaking activities across five Immerse environments were designed, each covering different tasks to help EFL learners improve their speaking skills.

During the Design and Construction, the task-based role-play speaking activities were designed based on the proposed three design principles: authentic tasks with authentic materials in authentic contexts, interaction among the learners through the context, and teacher-based timely scaffolding and feedback. The first design principle revolved around centering students' learning experiences on authentic speaking tasks, supported by authentic learning materials and contexts. Building on the principles of TBLT that real-world tasks are organized around specific themes (Waluyo, 2019), and English is widely used for communication while traveling abroad, eight task-based role-play speaking activities were designed based on typical travel procedures and focused on scenarios students might encounter during international travel and the transactions they would need to conduct in English. These eight role-play speaking activities included checking in at the airport, going through a security check, ordering food at McDonald's, checking in at a hotel, ordering in a fine restaurant, paying the bill, shopping in a mall and checking out of the hotel and took place in the five VR environments selected in the first phase. These settings provided

students with realistic environments to practice and apply their language skills in context. The five environments for the eight task-based role-play speaking activities are illustrated in Figure 1.

Figure 1

Five Environments for the Task-Based Role-Play Speaking Activities



The second principle focused on designing tasks that emphasized interaction among the learners through the context. Through actively exploring and manipulating objects in task completion, students could gain a better understanding and knowledge transfer (Johnson et al., 2016). Before starting the tasks, students explored the VR learning environment and interacted with virtual objects by themselves. For instance, they used a scanner to scan objects and learn vocabulary and pronunciation. They also manipulated objects, like eating hamburgers at McDonald's or blowing a trumpet at a shopping mall. This interaction made the experience more realistic and enjoyable. As students engaged in completing the tasks, they were encouraged to interact with objects to make the learning experience authentic. For example, while ordering food in a restaurant, one student acted as a customer reading the menu, while the other played the waiter bringing food and drinks. As interacting with virtual objects requires active participation, prompting learners to describe, explain, and discuss their actions, it could help practice their speaking skills. Additionally, students interacted with each other through the context by assisting peers struggling with interactions, which provided more opportunities for speaking practice and collaborative learning.

The third principle involved instructors offering students timely scaffolding and feedback within VR environments. In a virtual learning environment, teachers act as guides who organize the environment, establish the rules, and craft the narrative to support learners in achieving positive educational outcomes (Quintana & Fernandez, 2015). For example, when the instructor led the students to navigate the virtual environment, he could write the words on sticky notes and attach them to the objects. He could also provide students with sample dialogues containing relevant vocabulary and grammar structures and prompt students to generate new conversations based on the sample dialogue so that learners could transition from reproductive to creative language use in line with TBLT principles (Nunan, 2004). In addition, the instructor could use the Team Manager function in Immerse to assign students to different groups where he could easily access and offer in-time scaffolding and feedback when students encountered difficulties with the tasks to enhance their awareness of correct language usage.

Since the survey revealed that none of the participants had experience with VR-enhanced learning, we created a job aid for the tools used in Immerse and conducted a 1.5-hour

training session for both participants and the instructor to familiarize them with navigating and interacting within the Immerse platform.

Phase 3: Evaluation and Reflection

In this phase, the researchers assessed the effectiveness of the proposed design principles in enhancing EFL learners' speaking skills following their participation in eight workshops. During the Evaluation, the researchers developed an interview protocol, recruited participants, and conducted semi-structured interviews with six participants. During the Reflection, the interview data were analyzed, and researchers reflected on the integration of research and development to generate theoretical insights. The findings offered a deeper understanding of how the task-based role-play speaking activities, designed according to the three proposed design principles, influenced the learners' experiences in VR environments. The DBR process is illustrated in Table 1.

Table 1

Design Research Process in Designing Task-Based Role-Play Speaking Activities

Phase 1	**Phase 2**	**Phase 3**
Analysis and Exploration	**Design and Construction**	**Evaluation and Reflection**
Literature review on TBLT and VR affordances Three design principles development Document analysis of the speaking syllabus to identify the needs Selection of five VR environments Survey to identify learners' characteristics	Teacher training on how to use the VR application to teach language Students training on how to navigate VR environment and use VR tools Design of eight task-based role-play speaking activities Job aid on how to use the VR application	Interview protocol development Recruitment of participants for the semi-structured interview Interviewing six participants Data analysis

Data Collection and Analysis

Six students were interviewed about their perception of how the design of speaking activities, guided by the design principles, supported them in enhancing their speaking proficiency with Immerse. See Appendix for the interview questions.

Thematic analysis (Creswell & Creswell, 2017) was utilized to examine the transcriptions of the interview data, a common method in qualitative research for identifying patterns (Braun & Clarke, 2012). Six interview recordings were transcribed verbatim into written scripts. The coding, performed using NVivo qualitative data analysis software, combined deductive and inductive approaches (Saldaña, 2016). Deductive coding was used to test or confirm three existing design principles within the data, while inductive coding allowed the discovery of unexpected or novel findings not anticipated by existing theories.

During the first coding cycle, the researcher reviewed the data line by line, applying in vivo coding to generate initial, descriptive codes directly from the participants' words (Saldaña, 2016). In the second cycle, the researcher identified patterns among the in vivo codes and synthesized them into pattern codes (Saldaña, 2016). In the third cycle, these pattern codes were clustered and grouped into three emerging themes. To finalize and refine the themes, the researcher verified the themes, codes, and supporting data. To ensure the trustworthiness of the qualitative analysis, the second researcher reviewed the codes, patterns, and themes. Any discrepancies were discussed and resolved, leading to a 100% inter-rater agreement.

Findings

There were three main themes identified after the analysis: 1. Engaging students with authentic, practical, and fun tasks significantly boosts their motivation, participation, and ability to apply knowledge in real-life contexts. 2. Interacting among the learners through the context enhances enjoyment, collaborative learning, vocabulary retention, and creates a

relaxed learning environment. 3. The teacher-based timely scaffolding and feedback helped students overcome communication barriers and build their confidence.

Theme 1

Engaging students with authentic, practical, and fun tasks significantly boosts their motivation, participation, and ability to apply knowledge in real-life contexts. Authenticity in tasks creates relevance by reflecting on real-world situations, challenges, and contexts (Enkin, 2022; Wu & Hung, 2022). This connection to practical scenarios helps students see the immediate applicability and value of what they are learning, increasing their intrinsic motivation to engage with the material (Lan et al., 2013). In addition, the practicality of tasks is crucial as it emphasizes the practical benefits and applications of the knowledge or skills being learned (Chen & Hwang, 2020; Dhimolea et al., 2022). When students perceive tasks as directly relevant to their goals, needs, or future endeavors, they are more likely to invest effort and attention in mastering the content (Lowell & Tagare, 2023). Moreover, fun tasks capture students' curiosity, creativity, and enthusiasm for learning. When tasks are engaging, stimulating, or involve elements of choice, exploration, or novelty, students are naturally drawn to them and are more likely to remain focused, persistent, and proactive in their learning journey. These findings are exemplified by the following quotes, with student names anonymized as "S" followed by a number.

> *You know when you have to travel to a remote place, you have to take an airplane. When you are hungry, you will go to some restaurant and order what you like or what you don't like. When you are traveling, most airports, fast food restaurants, and hotels will all be included, and you must talk about your feelings, and what you want with people (S3).*

> *Because we always must travel to other places like the airport, it can be helpful, and also, we always go out to eat, and then the fashion restaurant and also some hotels and this environment can be used for conversation. What we learned can be used in our real life if we just meet this environment (S6).*

> *I am more conscious about how to express the activities in English. I get to know more about the procedure of checking in at the airport and I can better communicate with foreigners at the airport with what I have learned (S15).*

> *First, I'm not quite familiar with the procedures on how to check in a hotel or check out the hotel. After the lessons, we got a deep insight into this kind of topic (S3).*

> *The themes of each class are very practical, allowing me to apply the knowledge I have learned in my daily life (S1).*

> *It is very practical and interesting (S2).*

> *They are very practical and very close to life (S11).*

> *I learned a lot of new words and how to deal with some daily conversations, like how to order food. The topic is really useful in my daily life and close to the native English speakers' daily life (S14).*

> *These eight activities are close to our daily life and can put learning into practice. Different scenarios are conducive to different practical dialogues (S15).*

Theme 2

Interacting among the learners through the context enhances enjoyment, collaborative learning, vocabulary retention, and creates a relaxing learning environment. Engaging with the virtual context can increase enjoyment because it often provides interactive and dynamic experiences that captivate students' interest and imagination (Wu & Hung, 2022). Collaborative learning in such environments encourages active participation, peer interaction, and shared problem-solving, creating a supportive and engaging atmosphere. Furthermore, the multisensory nature of virtual environments can help reinforce vocabulary through visual, auditory, and interactive cues, enhancing memory retention (Chang et al., 2012). Finally, the interactive nature of VR environments can reduce stress and anxiety (Chen & Hwang, 2020), promoting a more relaxing and conducive learning environment for students to explore and experiment with new concepts and skills. These findings are exemplified by the following quotes, with student names anonymized as "S" followed by a number.

> *I feel the interaction with the object increases fun (S14).*

> *After we all know how to interact with objects, it is fun (S3).*

When you're using these tools, maybe some other people are watching, and they will ask you some questions about how you use it, and how you feel when you use it (S3).

You can just shoot water guns towards the people. Even though I don't know how to say these objects in English, people know what I am talking about. And someone can teach me how to use that object (S3).

I don't have many chances to practice speaking English with a lot of people. I don't know whether I speak it correctly or not if I practice speaking on my own. But when I speak with partners, if they don't understand what I mean, I know I didn't express it clearly (S15).

The virtual environment helps me a lot remember new words. I can link the words with the objects easily and I think it is very close to the way that native speakers learn their language. In this way, we would use the words we learnt in conversation more easily instead of just remembering the words and their meanings which may cause the situation that I cannot quickly recall the words when I see the objects (S14).

If I'm having a conversation with my partner, we can also have a conversation while interacting with the objects and that can help us make us feel like interacting in real life, and it makes us just like immersed in the environment and have a real conversation. We can see or pick up objects. We can understand the word more clearly, and it helps us in learning new words (S6).

The instructor asks us to bring an object whose meaning we don't know. I felt a sense of fulfillment when I brought it to the whole class showing I knew the meaning of that word (S15).

I felt relaxed when I ate the cake or played the guitar in VR which is helpful for my study (S15).

I was more relaxed when presented with some objects in front of me. I felt less nervous when something was there to distract my whole attention (S5).

Theme 3

The teacher-based timely scaffolding and feedback help students overcome communication barriers and build their confidence. The instructor's timely support and feedback are crucial because they provide students with the guidance they need exactly when they encounter difficulties (Kaplan & Gruber, 2021). This immediate assistance helps them navigate challenges more effectively, ensuring they stay on track and complete their tasks successfully (Chen et al., 2021). Additionally, knowing that help is readily available reduces students' anxiety and boosts their confidence, creating a more relaxed and supportive learning environment. These findings are exemplified by the following quotes, with student names anonymized as "S" followed by a number.

The instructor corrected my mistakes in pronunciation and asked all students to read after him so I could remember it better and know my weaknesses better. He also provided feedback on our reflection, and we can improve based on his feedback. I may not have realized it if he hadn't pointed it out, which helped me avoid making the same mistakes (S15).

I feel it helps me most that the teacher can teach me how to express what I can't express in English. When you don't know how to do it, he can teach you or give you reminders, and hints in real time (S3).

When we are having a conversation with a partner, sometimes I don't know what to say or we finish the conversation too quickly, teachers gave us some guidance or tips to expand the conversation (S14).

When I have a problem in communication, the teacher will kindly remind me. It made me realize it's okay to be wrong (S11).

The instructor is really patient and gave us a lot of encouragement to build our confidence, and the feedback is really helpful for my future learning (S14).

The teacher explained patiently. The learning atmosphere is relaxed and pleasant (S8).

Our instructors are both kind and good at encouraging us and helping us build up confidence (S3).

The teacher is patient and always encourages and guides us. It is really helpful to build our confidence. Finally, the feedback is helpful for my future learning (S14).

The feedback at the end is very helpful because it makes me more aware of how to improve my spoken English (S11).

Discussion

Adopting design-based research, the study investigates how eight task-based role-play speaking activities designed based on the proposed three design principles can support EFL learners in developing speaking proficiency in VR environments. Our findings revealed that task-based role-play speaking activities created according to the first design principle of using authentic tasks supported by authentic materials in authentic contexts significantly motivated students to actively participate in learning and enhance their ability to apply knowledge in real-life scenarios. This is corroborated by the assertion that authenticity allows learners to engage themselves in real-world situations, foster active involvement and social interaction, which are crucial components of successful language acquisition (Tai, 2021). Participants appreciated the focus on everyday conversations and activities in the VR scenarios and consistently highlighted the authenticity of the learning experience presented in the VR environment. They emphasized the authenticity of tasks such as airport check-ins, dining experiences, and hotel accommodations, indicating that these activities are closely related to their daily experiences and interactions. This authenticity of the learning experience in the VR scenarios is also emphasized by Azir et al. (2024), as they found VR allows learners to immerse themselves in authentic contexts, thereby enhancing their speaking skills through authentic conversations, pronunciation practice, and vocabulary building. Students also expressed how the language skills and knowledge acquired through VR-based authentic activities can be directly transferred to their everyday lives. This finding aligns with Dalgarno and Lee's (2009) VR learning affordances, suggesting that VR can support learning tasks by contextualizing learning, thereby enhancing the transfer of knowledge and skills to real-world contexts. Moreover, several participants mentioned feeling more confident in their ability to communicate in English, particularly in situations related to what they have learned in the class. They attributed this increased confidence to their improved understanding of procedures such as airport check-ins and hotel accommodations, highlighting the practical benefits of engaging in authentic language learning activities in authentic contexts.

Furthermore, our study indicated that task-based role-play speaking activities designed based on the second design principle of interaction among the learners through the context can boost enjoyment, encourage collaborative learning, help with vocabulary retention, and create a relaxing learning environment for students. They found the interactive elements engaging and fun, contributing positively to their overall perception of the activities. This is confirmed by Huang et al. (2021), who stated that VR tools in language learning can boost motivation, foster interaction, and decrease learning anxiety, resulting in positive attitudes toward the use of VR. In addition, participants highlighted the social interaction of using VR tools for language learning. They mentioned the possibility of others observing their interactions and asking questions and the opportunity for peer-to-peer teaching and learning. This social interaction enhanced the learning experience and facilitated language practice in a collaborative setting (Shih & Yang, 2008). Also, participants noted that the virtual environment aided language acquisition by providing a visual and interactive context for learning new words. They found it easier to remember and understand words when they were linked to objects within the virtual environment, mirroring the way native speakers learned their language. This supported the findings that the VR application enhanced vocabulary acquisition by creating virtual environments enriched with multimodal support (Tai et al., 2022) and that interactive elements in VR can enhance task comprehension and engagement in contextualized learning (Dooly et al., 2023). Moreover, some participants mentioned feeling relaxed and less nervous when interacting with objects in the virtual environment, which is confirmed by many research findings that VR can help reduce learners' anxiety (Enkin, 2022; Grant et al., 2013; Thrasher, 2022).

In addition, our study showed the task-based role-play speaking activities designed based on the third design principle of teacher-based timely scaffolding and feedback can help students overcome communication barriers and build their confidence. The success of role-play speaking activities in teaching a foreign language significantly depends on the teacher's support throughout all stages of the activity, including the preparation, initiation, progression, and conclusion (Waluyo, 2019). Participants highlighted the importance of teacher support and guidance in their language learning journey which indicates scaffolding and meaningful social interactions in a natural and authentic condition is an effective learning approach for

EFL learners (Kaplan & Gruber, 2021). They appreciated teachers correcting pronunciation mistakes, providing real-time feedback, offering reminders and hints, and giving guidance on expanding conversations. This support helped students overcome communication barriers and enhanced their confidence in expressing themselves in English. Participants emphasized the importance of feedback in their learning process. They found feedback provided by instructors helpful for identifying areas of improvement in their spoken English and increased their awareness of their strengths and weaknesses in spoken English. The feedback prompted self-reflection and motivated students to actively work towards improving their language proficiency. In addition, participants acknowledged the role of teachers in helping them build confidence in speaking English. Through patient guidance, encouragement, and constructive feedback, the instructor empowered students to overcome language barriers and feel more comfortable expressing themselves in English (Kaplan & Gruber, 2021). This confidence-building aspect is crucial for their ongoing language-learning journey.

Although students expressed positive feedback on the learning experience in eight task-based role-play speaking activities, there are some limitations in the design. For example, the role-play speaking activities were designed to follow the chronological order of real-life events. However, less consideration was given to the difficulty of the tasks. We did not conduct a thorough analysis of the learners' prior knowledge or experience with the topics. As a result, many students found the first two tasks—checking in at the airport and going through security—very difficult to complete. The next iteration of design should take task difficulty and learners' prior knowledge into account.

Students also mentioned that it was challenging for the learners to engage in task completion immediately after the task was assigned because the students barely knew each other. In the next iteration of the design, it is suggested that some small talk activities be designed to create a social bonding community as a supportive community can establish environments to promote communication and foster oral language development (Kuhl, 2006).

A key strength of this study is the creation, implementation, and evaluation of task-based role-play speaking activities based on three instructional design principles aligned with TBLT pedagogy and VR affordances. By evaluating these activities from the students' perspective, our research provides valuable evidence and insights on effectively designing task-based role-play speaking activities that adhere to these principles and leverage VR capabilities. These principles serve as guidelines for designing and assessing speaking activities in VR environments, ensuring that educational practices are both pedagogically sound and technologically enhanced.

Limitations

Although the findings of this study provide rich insights, the study also has some limitations. First, the study spanned ten weeks, which may not be sufficient to capture long-term effects or changes in language proficiency. Longer-term studies could provide insights into the sustainability of the observed benefits over time. Second, the study may have been limited by resource constraints, such as access to a stable internet connection, technical support, or instructional expertise as the instructor had no teaching experience in VR environments. These constraints could impact the implementation and scalability of VR-based language learning initiatives in real-world educational settings. Third, the study only collected data from the students which lacks a comprehensive understanding of the effectiveness and feasibilities of VR-enhanced learning.

Future Research

Future research could involve longer-term studies spanning several months or even years to assess the sustained impact of VR-based language learning activities on language proficiency. Longitudinal studies would provide insights into the persistence of learning outcomes over time and the potential for continued improvement in language skills. Addressing resource constraints is crucial for the successful implementation and scalability of VR-based language learning initiatives. Future studies should prioritize securing adequate resources, such as stable internet connections, technical support, and instructional expertise. In line with the arguments put forth by Lowell and Yan (2024), institutions and researchers could collaborate to establish dedicated support systems and training programs for instructors to enhance their proficiency in utilizing VR technology for language teaching. In addition, to gain a comprehensive understanding of the effectiveness and feasibility of VR-based language learning, future studies could involve multiple stakeholders, including students, instructors, administrators, and technical support staff. Collecting feedback and

insights from various perspectives would enable researchers to address diverse needs and challenges associated with implementing VR technology in educational settings.

Conclusion

Research has highlighted a common trend in VR environments that learning activities often lack adequate consideration of pedagogy and VR affordances. In response, this design-based research sought to rectify this gap by establishing three design principles rooted in TBLT pedagogy and leveraging two key VR affordances—authenticity and interaction—to design task-based role-play speaking activities. The three design principles are authentic tasks with authentic materials in authentic contexts, interaction among the learners through the context, and teacher-based timely scaffolding and feedback. These principles were put to the test in a study involving sixteen Chinese undergraduate students, who engaged in eight task-based role-play speaking activities within the VR application, Immerse. Through the collection and thematic analysis of data from semi-structured interviews with six students, our findings revealed that activities structured according to these design principles were perceived as effective tools by students in developing their speaking proficiency within the VR environment.

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Appendix A

Interview Questions

1. What do you think of the Immerse VR learning environment to develop conversational speaking skills?
    - Do you think Immerse provides an authentic context for developing conversational speaking skills that reflects how the things you are learning will be used in real life?
    - Are there any strengths of Immerse for learning conversational speaking skills?
    - Are there any weaknesses of Immerse for learning conversational speaking skills?
    - Do you think these tools are useful for students to improve their conversational speaking skills?
    - How do you feel about interacting with objects in Immerse can help improve conversational speaking skills?
    - How do you feel about interacting with the instructor in Immerse can help improve conversational speaking skills?
    - How do you feel about interacting with peers in Immerse can help improve conversational speaking skills?
2. What do you think about the learning activities you completed in Immerse? Are they similar to the activities you engage in your daily life?D
    - Do you feel the activities were difficult or easy to complete? Can you elaborate?
    - Do you think the activities you completed in Immerse were suitable for collaboration with other students to develop conversational speaking skills? Can you elaborate?
3. In each class, the instructor reads the sample dialogue with the student, or the instructor asks the students to read the sample dialogue before practicing on their own. This is called Modelling. The instructor tries to set an example of good task completion. What do you think of this modeling? Is it good for developing conversational speaking skills?
4. Do you think through collaborating with your peers, you have the opportunity to express different points of view in role-playing?
5. Do you think the learning tasks help you and your peers learn together to improve conversational speaking skills? How did you collaborate with your peers in completing the tasks?
6. Do you think after completing the tasks, you are better at understanding the topic than before?
7. The words "coaching" and "scaffolding" refer to observing students while they carry out a task and offering hints, feedback, modeling, reminders, and providing assistance

when activities seem particularly difficult for the student(s). Do you think the teacher provided coaching and scaffolding at the right time?
8. What suggestions do you have for a teacher if they want to use VR to teach conversational speaking skills?
9. What suggestions do you have for students if they want to use VR to improve their conversational speaking skills?

Declarations and Compliance with Ethical Standards

- The authors declare they do not have competing interests.
- The authors declare they did not receive support from any organization for the submitted work.