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Application and Innovation of VR Technology in Foreign Language Teaching From the Perspective of Cognitive Linguistics

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Against the backdrop of rapid digital transformation, virtual reality (VR) technology has emerged as a transformative force in foreign language education. Grounded in the perspective of cognitive linguistics, this study integrates constructivist learning theory and cognitive load theory to systematically analyze the application value, implementation paths, and limiting factors of VR technology in foreign language teaching. By retrieving and sorting out 474 relevant literatures from Web of Science and CNKI databases, the study finds that VR technology can effectively enhance foreign language learning effects through immersive situational experience, multi-sensory social interaction, and real-time learning feedback, and verifies the practical feasibility of VR-assisted language learning with typical cases such as Duolingo and Rosetta Stone. Meanwhile, the popularization of VR teaching is still restricted by multiple factors. Looking forward, the deep integration of VR with artificial intelligence and 5G communication technology will further optimize personalized learning experience, reduce cognitive interference, and provide broader development space for innovative foreign language teaching.

Keywords: virtual reality, foreign language teaching, cognitive linguistics, constructivism, cognitive load

Introduction

In the era of rapid digital development, virtual reality (VR) technology is being deeply integrated into foreign language education, bringing revolutionary changes to the traditional language learning mode. Since 2016, widely regarded as “the first year of VR”, China’s VR industry has developed rapidly, but also faces problems such as talent shortage and unbalanced application development (Zeng, 2022). As an innovative teaching tool, VR features core properties of immersion, interactivity, and imagination (Li, 2024). It breaks the physical boundaries of classrooms and constructs realistic three-dimensional virtual learning environments.

In foreign language teaching scenarios, learners wearing VR devices can be immersed in simulated real-life contexts, such as street conversations in French-speaking regions, restaurant ordering scenarios, and airport check-in procedures. These situational settings turn abstract grammar and vocabulary into vivid

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perceptual experience, provide learners with timely pronunciation and grammar feedback in oral practice, and help them intuitively experience the cultural connotations behind the target language.

Theoretical Framework

Constructivism Calls for Context and Collaboration

Constructivism is a core theoretical foundation of educational research, covering three core dimensions: knowledge view, learning view, and teacher view. The theory adheres to the student-centered principle, holding that learning is a process of active knowledge construction rather than passive reception, and emphasizes the role of situational construction, peer collaboration, and interactive dialogue in the learning process. From the constructivist perspective, teachers should act as facilitators of learning, and promote students' knowledge internalization and thinking development by creating learning situations and organizing cooperative activities.

Constructivism attaches great importance to situational creation and learners' subjective initiative. Traditional teaching mostly relies on textbooks and learners' imagination to construct situations, with limited authenticity. VR technology provides a technical solution: It can create highly simulated virtual situations across time and space, making up for the deficiency of offline teaching in environmental interaction. Constructivism advocates for the learners' active chiseling of wisdom through their dynamic interplay with surrounding stimuli (Song & Shi, 2023).

Cognitive Linguistics in Education

From the perspective of cognitive linguistics, language learning is a complex cognitive processing process, and cognitive strategies are the intentional thinking operations adopted by learners to improve language mastery. Cognitive load refers to the mental resources consumed by learners in information processing, which is affected by content complexity, learners' prior knowledge, and teaching design.

Cognitive load is divided into three types: inherent load, extraneous load, and germane load. Inherent load is the unavoidable cognitive difficulty determined by the nature of learning content, such as complex French tenses and esoteric English grammar. Extraneous load is unnecessary cognitive burden caused by improper teaching design, which is the key object to be optimized. Germane load is the cognitive investment for constructing knowledge schemas and forming long-term memory, which should be appropriately increased in teaching.

In VR-assisted foreign language learning, the complexity of virtual scenarios may bring excessive extraneous load to beginners and distract their attention. Therefore, teaching design should clarify learning goals, screen redundant scenario information, and reduce unnecessary cognitive interference. Meanwhile, designers can increase germane load by integrating key language points into daily dialogues, combining pronunciation training tools with accent discrimination, and providing real-time error feedback, to help learners consolidate language knowledge and form stable cognitive schemas.

Data Collection

This study takes VR-enabled foreign language teaching as the research object, and collects relevant literatures from Web of Science (SSCI) and CNKI (CSSCI) databases. English retrieval keywords include three categories: (1) VR technology terms: VR (Virtual Reality), Virtual Environment, Virtual Worlds; (2) language

education terms: Language, Second Language, Foreign Language, Second Language Acquisition, EFL (English as a Foreign Language); (3) theoretical terms: constructivism, cognitive load theory. Chinese keywords include "VR technology", "virtual reality", "constructivism", and "foreign language teaching". Finally, 461 English literatures and 13 Chinese literatures were retrieved for analysis.

Research Analysis

Application of VR in Education

With the reduction of equipment cost and technological progress, VR has gradually expanded from military, aviation and medical fields to education, with its core value in building experiential learning environments. Comprehensible and contextually embedded language input is widely recognized as the core condition for effective second language acquisition (Smuts, Gardner, Callaghan, & Gutierrez, 2019).

Studies have shown that immersive foreign language environment can improve learners' cross-cultural competence, and sustained language exposure can also enhance analytical ability, memory, and multi-task processing ability (Lin, 2023). Theoretically, Vygotsky's sociocultural theory emphasizes that social interaction is the core driving force of cognitive development, and virtual scenarios expand learners' social participation space and present cultural differences in communication. Krashen's affective filter hypothesis points out that relaxed emotional experience can reduce learners' affective filter and promote language absorption. VR-assisted learning conforms to the above theoretical logic, creating favorable conditions for language acquisition. At present, virtual teaching in China's foreign language education is still in the initial stage (Du & Hu, 2021).The introduction of AI+VR technology can provide students with realistic oral English training environment, stimulate their learning interest and improve their oral expression ability (Lu Xu & Xu Jianguo, 2024).

The Specific Aspects of VR to Promote Learning Effect

First, immersive situational learning experience. VR creates visual and immersive foreign language teaching scenarios, simulates real communication contexts, allows learners to participate in situational learning as the main body, and enhances their perceptual experience of language use. Different from abstract textbook descriptions, VR scenarios present language knowledge in the form of situational interaction, helping learners establish the connection between language, concept, and context.

Second, social interaction and collaborative learning. VR provides a carrier for collective collaborative learning: Learners can interact with virtual characters or peers in virtual scenarios, realizing dual interaction of language symbols and physical perception (Xia et al., 2021). Meanwhile, the real-time interaction mechanism of VR enables timely correction of pronunciation and grammar errors, and learners can get immediate feedback after communication, thus enhancing learning motivation and consolidating effects (Li, 2024).

Influencing Factors Restricting VR Teaching

At present, large-scale popularization of VR teaching still faces multiple constraints. First, high hardware cost: high-end head-mounted displays and supporting controllers are expensive, making it difficult for many schools to purchase equipment on a large scale. Second, insufficient technical stability: Some VR devices have problems such as stalling, crashing, and picture delay when running complex scenarios or multi-person

interaction, which interrupts teaching and reduces learning effect. Third, teachers' technical literacy needs to be improved: Effective integration of VR into daily teaching requires teachers to redesign teaching plans and master corresponding technical capabilities.As for using VR in foreign language teaching, this is still a relatively new technology and not commonly practiced by language educators mostly due to the need of advanced technical knowledge or the high cost of VR devices (Gliazova & Paulova, 2022). Practical knowledge and past experiences of incorporating VR in teaching were crucial determinants of teachers' positive beliefs, showing that teachers were motivated to adopt VR technology in their classrooms if they had previously used it (Rakowski, 2023). In the spoken English course of junior high school supported by VR technology, teachers should not only use VR technology as a tool for students to master the target knowledge and skills of English, but also reflect the nature of the instrumental course (Huang Shicong, 2024). VR technology helps English teaching develop rapidly. English teachers should actively learn and understand the new generation of information technologies such as VR and artificial intelligence, and observe and learn the application of these technologies in teaching (Sun Min, 2024).

Research on the Practical Application of VR in Teaching

Duolingo and Rosetta Stone are typical representatives of VR language teaching applications. Duolingo focuses on gamified design, simulating scenarios, immersing learners in mini-game interactive scenarios, and providing targeted difficulty adjustment and real-time pronunciation feedback according to learners' language levels.Through virtual VR technology, various scenes in different cultural environments of different countries can be simulated and rebuilt.(Liao Maozhen,2023) Rosetta Stone pays more attention to realistic situational experience, integrating vocabulary, grammar, pronunciation, and cultural knowledge into a unified curriculum, and providing learners with immersive cultural experience with speech recognition technology.

The two have different positioning: Duolingo is more interesting, suitable for beginners to stimulate interest; Rosetta Stone focuses on situational authenticity and cultural integration, more suitable for systematic language ability improvement. Both have verified the feasibility of VR technology in language teaching from the practical level.

Conclusion

In the future, VR technology can be combined with AI (artificial intelligence) technology, and AI can be used to accurately analyze and evaluate students' learning progress, language level, and learning habits, so as to customize personalized VR language learning programs for each student. Students' learning progress, language level, and learning habits are accurately analyzed and evaluated, so as to customize a personalized VR language learning program for each student. It can also collaborate with 5G technology: The high speed and low delay characteristics of 5G will enable the high-definition virtual scenes and real-time interaction functions in VR language teaching to be realized more smoothly, reducing the phenomenon of delays and delays, and improving the learning experience of students. Students can access rich learning resources more quickly, such as high-definition virtual travel scenes, real-time online language communication activities, etc.

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