Revolutionizing Language and Culture Education through Immersive 360-Degree Video and Artificial Intelligence

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Abstract: *This study explores the influence of incorporating virtual reality (VR) supported by 360-degree video and artificial intelligence (AI) technologies into cross-cultural learning initiatives to improve language proficiency, intercultural understanding, and communication skills. The research addresses the difficulties associated with authentic cultural engagement, often hindered by language barriers and limitations on travel. A series of sequential investigations was conducted, each refining the VR learning experience powered by 360-degree video and AI tools. Participants took part in cultural exchange activities such as self-introductions, cultural sharing, and reflective discussions on foreign cultures, facilitated by innovative educational technologies. Results indicated notable advancements in participants' linguistic skills, cultural awareness, and communicative abilities, emphasizing the value of immersive, technology-enhanced learning environments. The findings highlight the capacity of cutting-edge educational tools to bridge geographical and linguistic divides, foster intercultural competence, and enrich technology-mediated language learning strategies.*

Keywords: Virtual Reality, 360-degree video, artificial intelligence, cross-cultural education, language learning.

1. Introduction

Recognizing and understanding cultural differences are vital components of contemporary education and society (Çiftçi, 2016; Tarihoran, 2020; Wang & Zhang, 2022). Cross-cultural learning, underpinned by cultural convergence theory, where individuals from varied cultural backgrounds exchange information to gain knowledge and develop intercultural attitudes (Çiftçi, 2016; Shadiev & Huang, 2016; Wang & Zhang, 2022), plays a critical role in this realm. This approach is further supported by contextual learning theory, which emphasizes the importance of situating learning within real-world activities, contexts, and cultures (Hwang et al., 2021; Hwang et al., 2022; Gu et al., 2017).

However, authentic cultural learning is often impeded by challenges such as travel restrictions and language barriers (Çiftçi, 2016; Wang & Zhang, 2022). Language obstacles, in particular, can significantly hinder communication and cultural exchange in cross-cultural programs, especially when participants have limited proficiency in foreign languages (Çiftçi, 2016; Wang & Zhang, 2022).

Innovative educational technologies offer promising solutions to these challenges. VR enables immersive and engaging cross-cultural learning experiences (Shadiev et al., 2021), while artificial intelligence facilitates the creation and enhancement of content and supports communication for individuals with limited language abilities (Lee, 2021). By integrating 360-degree video technology with AI tools in VR environments, seamless interaction and cultural exchange

become possible, overcoming both geographical and linguistic barriers (Akdere et al., 2021; Lee, 2021; Rupp et al., 2019; Steigerwald et al., 2022).

Despite these technological advancements, there is a noticeable gap in research exploring the role of 360-degree video and AI tools in enhancing cross-cultural learning. This study seeks to address that gap by designing activities that support language and cross-cultural learning through these technologies. Earlier studies often lacked interactive features within 360-degree video content and did not facilitate collaborative engagement among learners. In contrast, our research incorporated interactive components, such as text, images, hints, and embedded questions, within the video content and enabled real-time communication among participants viewing 360-degree videos.

This study investigates the impact of educational designs integrating 360-degree video and AI tools on language acquisition and cultural learning. It examines how technology-enhanced cross-cultural learning activities can foster language development, intercultural understanding, and communicative competence. This paper presents the findings from four sequential studies, each showcasing innovative approaches to cross-cultural education.

2. Methodology

In the initial study, we developed a VR learning environment leveraging 360-degree video technology. The second study introduced AI tools, such as translation systems, to bridge language barriers and facilitate participant interaction. The third study further enhanced the VR environment by adding features for real-time communication, content creation, and interactive viewing. In the fourth study, participants contributed by creating interactive VR content using multimedia elements, significantly improving the interactivity of the platform. Finally, in the last study, generative AI (GAI) was utilized to inspire content creation, identify and address issues or language challenges, and enhance understanding of the material.

Participants in the studies were university students from China, Indonesia, Russia, and Uzbekistan. They were provided with detailed instructions on the learning activities and technologies used. Before commencing the activities, we evaluated their baseline language proficiency, intercultural understanding, and communicative abilities. The cultural exchange activities were divided into the following distinct phases: *Personal Introductions.* Participants created 360-degree videos to introduce themselves, their hobbies, and daily routines. These videos were uploaded to the activity platform for sharing. *Cultural Presentations.* Participants selected cultural topics, such as traditional crafts, architecture, markets, or customs, and provided historical and informational content in 360-degree videos. They then viewed their partners' videos to gain insights into other cultures. *Reflections on Foreign Cultures.* After viewing the cultural presentations, participants created video-recorded reflections comparing the foreign cultures they had learned about with their own. These reflective reports were shared among the group. Interactive online meetings facilitated further discussion, where students viewed and discussed each other's videos, posed questions, and exchanged ideas about the cultural topics. Following these activities, we conducted post-tests to evaluate language skills (focused on speaking), intercultural understanding, and communicative competence. Interviews were also conducted to gather additional qualitative evidence supporting the findings.

The intervention was designed to develop language proficiency, enhance cross-cultural understanding, and improve communicative abilities through activities like personal introductions, cultural presentations, and reflective reports, all supported by VR supported by 360-degree video and AI technologies. To measure its effectiveness, various tools were used, including language proficiency tests crafted by experienced EFL instructors, reflective reports (Shadiev et al., in press), a questionnaire (Fantini, 2000), interviews, and video content analysis. Data were analyzed by two researchers. Language tests were evaluated using standardized rubrics assessing fluency, pronunciation, vocabulary, and communicative effectiveness. Reflective reports, interview transcripts, and video content were analyzed using open coding (Strauss & Corbin, 1990). Questionnaire responses were assessed on a 5-point Likert scale. Key technologies employed in the studies included Insta360 cameras (https://www.insta360.com) for recording, Oculus VR head-mounted displays for viewing (https://www.oculus.com/gear-vr), IFlytek translation tools

(https://global.iflytek.com), ChatGPT as a generative AI tool (https://chatgpt.com/), Tencent Meeting for communication (https://meeting.tencent.com), and Wonda for creating interactive video content (https://www.wondavr.com).

3. Results and discussion

The study demonstrated favorable outcomes, showing significant improvements in language proficiency ($p<0.05$), intercultural understanding ($p<0.05$), and communicative competence ($p<0.05$).

In interviews, numerous participants expressed that the technology-supported activities effectively enhanced their language abilities and cross-cultural learning. They reported improvements in speaking skills, cultural knowledge, comprehension, competence, and communication. Some students noted that the value of the immersive environments extended beyond the shared content, particularly in acquiring cultural insights. Translation tools were also praised for addressing language-related challenges, enabling participants to fully engage with and understand the video content. Generative AI proved valuable in offering creative inspiration, delivering feedback on created content, and enhancing the understanding of cultural materials shared by foreign peers.

The immersive VR environments, combined with interactions with peers from diverse backgrounds, significantly contributed to participants' cognitive development, aligning with the principles of cultural convergence theory. Many participants remarked on the benefits of these activities in enhancing speaking skills, thereby meeting the objective of fostering communicative competence through authentic and immersive learning experiences.

Students also emphasized that their exchanges with foreign peers deepened their intercultural understanding, consistent with the contextual learning theory. These interactions provided meaningful experiences, enabling them to acquire cultural knowledge and develop attitudes through engagement in real-world contexts, activities, and environments.

Regarding communicative competence, the integration of multimodal content and interactive elements in 360-degree videos enriched learners' perspectives and comprehension. These features streamlined the learning process by helping learners focus on key areas while offering greater autonomy in navigating their learning paths. Translation tools further supported participants by reducing language barriers, thereby enhancing their engagement with video content and improving overall communication skills.

In summary, the findings indicated significant advancements in language proficiency, cross-cultural understanding, and communicative competence. This underscores the efficacy of incorporating cultural convergence and contextual learning theories into technology-enhanced cross-cultural learning activities, achieving the study's goals.

4. Conclusions

Our research introduces an innovative approach to language and culture learning, demonstrating how modern technologies can create more immersive, authentic, and interactive learning experiences. This evolution in technology-assisted learning signifies a shift towards utilizing VR and AI tools, surpassing traditional methods. The results highlight the transformative potential of VR and AI technologies in advancing language skills, cultural understanding, and communication abilities, marking a significant step forward in the evolution of technology-assisted learning methodologies.

Based on the study's positive outcomes, we recommend embedding intercultural learning activities within VR-based interactive environments supported by 360-degree video and AI technologies. This approach proved effective in fostering language skills, intercultural understanding, and communicative competence. Promoting active engagement in language and cognitive interactions is essential for developing these skills. The study underscores the importance of ample interaction within intercultural activities to enhance their effectiveness. Researchers are encouraged to explore diverse strategies or methods to provide learners with increased opportunities for cultural engagement.

However, the study faced certain limitations. The sample size was relatively small, and the duration was short, which may affect the generalizability of the findings. Additionally, a gender imbalance, with most participants being female, could influence the outcomes. These factors warrant cautious interpretation of the results. Furthermore, the lack of a control group limits the robustness of the conclusions.

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