

Transforming Language and Cultural Learning in Virtual Reality with 360-Degree Video Technology

**Rustam Shadiev^{1,*}, Mirzaali Fayziev², Narzikul Shadiev²,
Zhanargul Beisembayeva³, Fahriye Altinay⁴,
Elena Gaevskaia⁵ and Roza Zhusupova³**

¹Zhejiang University, China

²Uzbekistan-Finland Pedagogical Institute, Uzbekistan

³L.N. Gumilyov Eurasian National University, Kazakhstan

⁴Near East University, Turkish Republic of Northern Cyprus

⁵Saint Petersburg State University, Russia

Abstract

This research investigated the impact of integrating virtual reality (VR) based on 360-degree video technology into cross-cultural learning activities to enhance language skills, cross-cultural understanding, and communicative competence. Guided by the theories of cultural convergence and contextual learning theories, the study addresses the challenges of authentic cultural study posed by travel restrictions and language barriers. The research involved four sequential studies, each progressively enhancing the VR learning environment. Participants engaged in a series of cultural exchange activities, including personal introductions, cultural presentations, and reflections on foreign cultures, using educational technologies. The study's outcomes revealed significant improvements in the participants' language abilities, cultural understanding, and communication skills, highlighting the effectiveness of immersive, technology-supported learning environments. The findings underscore the potential of advanced educational technologies in overcoming geographical and linguistic barriers, promoting cross-cultural competence, and advancing the sophistication of technology-enhanced language learning methodologies.

*Corresponding Author E-mail: rustamsh@gmail.com

Keywords: Virtual reality, 360-degree video, Cross-cultural learning, Language skills, Cross-cultural understanding, Communicative competence.

Knowing and understanding cultural differences is essential in modern education and society (Çiftçi, 2016; Tarihoran, 2020; Wang & Zhang, 2022). Cross-cultural learning, guided by the cultural convergence theory – where individuals from diverse backgrounds exchange information to acquire cross-cultural knowledge and attitudes (Çiftçi, 2016; Shadiev & Huang, 2016; Wang & Zhang, 2022) – is crucial in this context. Contextual learning theory, which emphasizes learning within real activities, situations, and cultures, further supports this process (Hwang et al., 2021, 2022; Gu et al., 2017).

However, authentic cultural study faces challenges imposed by travel restrictions and language barriers (Çiftçi, 2016; Wang & Zhang, 2022). Language barriers often hinder communication and cultural exchange in cross-cultural programs, especially among participants with limited foreign language skills (Çiftçi, 2016; Wang & Zhang, 2022).

Emerging educational technologies offer solutions to these challenges. Virtual reality (VR) provides immersive cross-cultural learning experiences (Shadiev et al., 2021), while computer-aided translation tools facilitate communication for those with limited language skills (Lee, 2021). The integration of 360-degree video technology and translation tools in VR enables seamless communication and cultural exchange, transcending geographical and linguistic barriers (Akdere et al., 2021; Lee, 2021; Rupp et al., 2019; Steigerwald et al., 2022).

Despite these advancements, there is a scarcity of studies focusing on cross-cultural learning enhanced by technologies like 360-degree video and artificial intelligence-based translation tools. Our research aimed to fill this gap by developing language and cross-cultural learning activities supported by these technologies. Previous studies lacked interactive engagement among learners viewing 360-degree videos and did not utilize interactive elements within the videos' content. Our study addressed these limitations by facilitating simultaneous communication among learners watching 360-degree videos and incorporating interactive elements such as text, images, hints, and embedded questions to aid comprehension.

This research explored the impact of a learning design enhanced by 360-degree video technology and translation tools on the acquisition of language and culture. We focused on the development of language skills, cross-cultural understanding, and communicative competence in technology-supported cross-cultural learning activities. This paper details our exploration through four innovative studies, which were carried out sequentially.

In the first study, we developed a VR learning environment using 360-degree video technology. In the second study, we integrated artificial

intelligence-based translation to overcome language barriers, facilitating the exchange of information among participants. In our third study, we enhanced our VR learning environment's interactivity by incorporating tools for content creation, viewing, and real-time communication. In our fourth study, the participants created interactive VR content with multimedia materials, further enriching the environment's interactivity.

In the studies, we first recruited university students from China, Indonesia, Russia, and Uzbekistan. Demographic details about the participants can be found in the Appendix. They received instructions on the learning activities and the use of the technologies applied in our research. Subsequently, we assessed their prior language skills, cross-cultural understanding, and communicative competence before engaging them in cultural exchange activities. These activities were organized into three phases: personal introductions, cultural presentations, and reflections on foreign cultures.

Personal introductions: The participants introduced themselves, their hobbies, and daily life in 360-degree videos, which were uploaded to the activity's website (see the screenshot in the Appendix).

Cultural presentations: Each participant chose a cultural topic (e.g., handicrafts, buildings, markets, traditions) and provided the related history and information in a 360-degree video. They watched their partners' videos to learn about foreign cultures (see the screenshot in the Appendix).

Reflections on foreign cultures: After watching the videos, the participants video-recorded reflective reports comparing foreign cultures with their own and shared these reports with others.

During interactive online meetings, students watched each other's videos and discussed them, asking and answering questions about the cultural topics (see the screenshot in the Appendix). Following these activities, we conducted post-tests to measure language skills (speaking), cross-cultural understanding, and communicative competence. Additionally, interviews were conducted to gather further evidence to support our findings.

The intervention, which included personal introductions, cultural presentations, and reflections on foreign cultures using VR based on 360-degree video technology, was designed to enhance language skills, cross-cultural understanding, and communicative competence. These enhancements were assessed through language tests (see the Appendix) developed by the experienced EFL instructors, reflective reports (see the Appendix) (Shadiev et al., in press), a questionnaire (Fantini, 2000), interviews (see the Appendix), and video content analysis to measure the effectiveness of the technology-supported learning

activities. Two researchers undertook the process of data analysis. Language tests were analyzed using well-established evaluation rubrics in terms of fluency, pronunciation, vocabulary usage, and communicative effectiveness. Reflective reports, interviews, and video content underwent analysis through the open coding approach (Strauss & Corbin, 1990). Additionally, items on the questionnaires were scored using a five-point Likert scale.

Key technologies included Insta 360 cameras (<https://www.insta360.com>), Oculus VR head-mounted displays for viewing (<https://www.oculus.com/gear-vr>), IFlytek technology for translation (<https://global.iflytek.com>), Tencent Meeting for communication (<https://meeting.tencent.com>), and Wonda for creating interactive videos (<https://www.wondavr.com>).

The research yielded positive outcomes, indicating enhancements in language skills ($t = 6.015, p < 0.05$), cross-cultural understanding ($t = 4.583, p < 0.05$), and communicative competence ($t = 3.607, p < 0.05$).

During the interviews, many students reported that technology-supported learning activities effectively bolstered their language and cross-cultural learning, thereby enriching their speaking abilities, knowledge, understanding, competence, and communication skills. Several students highlighted the benefits derived not only from the content shared by their foreign partners but also from the immersive environments they provided, particularly in acquiring cultural knowledge. Additionally, students appreciated the utility of translation tools in mitigating the challenges of learning in English, enabling them to fully engage with and comprehend the video content.

The immersive experience offered by VR environments and interactions with foreign peers significantly contributed to cognitive growth and supported the cultural convergence theory. The participants reported that technology-supported learning activities improved their language skills, particularly their speaking abilities, aligning with our aim to enhance communicative competence through authentic, immersive environments.

Students highlighted that their interactions with foreign partners deepened their cross-cultural understanding, consistent with the contextual learning theory. These interactions facilitated meaningful exchanges, helping students acquire cultural knowledge and attitudes by engaging in real activities, situations, and cultures.

Regarding communicative competence, the integration of multimodal content and interactive scaffolds in 360-degree videos expanded learners' perspectives and comprehension. These tools streamlined the learning process, aiding learners in identifying key areas and granting them more control over their learning journey. The use of translation tools mitigated language barriers, enabling full engagement with the video content and enhancing overall communication skills.

In summary, our research indicated significant improvements in language skills, cross-cultural understanding, and communicative competence. These findings underscore the effectiveness of integrating cultural convergence and contextual learning theories in technology-supported cross-cultural learning activities, fulfilling our research objectives.

Our studies represent a significant innovation in computer-assisted language learning (CALL), revealing how modern technologies can forge learning environments that are more immersive, authentic, and interactive. This shift in CALL underscores a move towards embracing VR and advanced tools, evolving past traditional approaches. The research presented here underscores the transformative impact of VR and related technologies in developing language competencies, cultural understanding, and communicative skills, thereby marking a notable advancement in the sophistication of CALL methodologies.

On the basis of the positive outcomes of this study, we recommend incorporating intercultural learning activities within a VR interactive learning environment utilizing 360-degree video technology. This approach effectively facilitated the development of language skills, cross-cultural understanding, and competence. Encouraging active participation in language and cognitive interactions is crucial for enhancing these target skills. Our study highlights the importance of ample interaction within intercultural learning activities as an effective strategy to improve their efficacy. Therefore, we suggest that researchers explore various techniques or approaches to provide learners with increased opportunities for cultural interaction.

In terms of our research limitations, the sample size was relatively small and the duration of the study was short. Additionally, the majority of participants were female, which may affect the generalizability of our findings. These factors indicate the need for caution in interpreting the results. Furthermore, the absence of a control group may limit the strength of our conclusions.

References

- Akdere, M., Acheson, K., & Jiang, Y. (2021). An examination of the effectiveness of virtual reality technology for intercultural competence development. *International Journal of Intercultural Relations*, 82, 109–120.
- Çiftçi, E. Y. (2016). A review of research on intercultural learning through computer-based digital technologies. *Educational Technology & Society*, 19, 313–327.
- Fantini, A. E. (2000). *A central concern: Developing intercultural competence. About our institution*. SIT Occasional Papers Series. Palo Alto, CA: Spring

- Gu, X., Wang, H., & Mason, J. (2017). Are they thinking differently: A cross-cultural study on the relationship of thinking styles and emerging roles in computer-supported collaborative learning. *Educational Technology & Society*, 20(1), 13–24.
- Hwang, W. Y., Hariyanti, U., Chen, N. S., & Purba, S. W. D. (2021). Developing and validating an authentic contextual learning framework: Promoting healthy learning through learning by applying. *Interactive Learning Environments*, 31(4), 2206–2218.
- Hwang, W. Y., Guo, D. C., Hoang, A., Chang, C. C., & Wu, N. T. (2022). Facilitating authentic contextual EFL speaking and conversation with smart mechanisms and investigating its influence on learning achievements. *Computer Assisted Language Learning*, 1–27. <https://doi.org/10.1080/09588221.2022.2095406>
- Lee, S.-M. (2021). The effectiveness of machine translation in foreign language education: A systematic review and meta-analysis. *Computer Assisted Language Learning*, 36(1–2), 103–125.
- Rupp, M. A., Odette, K. L., Kozachuk, J., Michaelis, J. R., Smither, J. A., & McConnell, D. S. (2019). Investigating learning outcomes and subjective experiences in 360-degree videos. *Computers & Education*, 128, 256–268.
- Shadiev, R., & Huang, Y. M. (2016). Facilitating cross-cultural understanding with learning activities supported by speech-to-text recognition and computer-aided translation. *Computers & Education*, 98, 130–141.
- Shadiev, R., Wang, X., Chen, X., Gayevskaya, E., & Borisov, N. (in press). Research on the impact of the learning activity supported by 360-degree video and translation technologies on cross-cultural knowledge and attitudes development. *Education and Information Technologies*.
- Shadiev, R., Wang, X., Wu, T. T., & Huang, Y. M. (2021). Review of research on technology-supported cross-cultural learning. *Sustainability*, 13(3), 1402.
- Steigerwald, E. et al. (2022). Overcoming language barriers in academia: Machine translation tools and a vision for a multilingual future. *BioScience*, 72(10), 988–998.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Sage.
- Tarihoran, N. A. (2020). Using Facebook group as a blended learning medium in teaching cross-cultural understanding in Islamic higher education. *International Journal of Research in STEM Education*, 2(1), 13–25.
- Wang, J., & Zhang, S. (2022). Cross-cultural learning: A visualized bibliometric analysis based on Bibliometrix from 2002 to 2021. *Mobile Information Systems*, 2022, 7478223.

Appendix

Participants

Study	Country	Number	Age	Major
#1	China	10 females	20 to 25	Education science
	Uzbekistan	11 females	20 to 25	Education science
#2	China	11 females	20 to 25	Education science
	Russia	13 females	20 to 25	Education science
#3	China	15 females	20 to 25	Education science
	Indonesia	15 females and 1 male	20 to 25	Education science
#4	China	20 females	20 to 25	Education science
	Indonesia	20 females	20 to 25	Education science

VR Tools

Insta 360 Camera



Oculus Head-Mounted VR Display



VR Screenshots

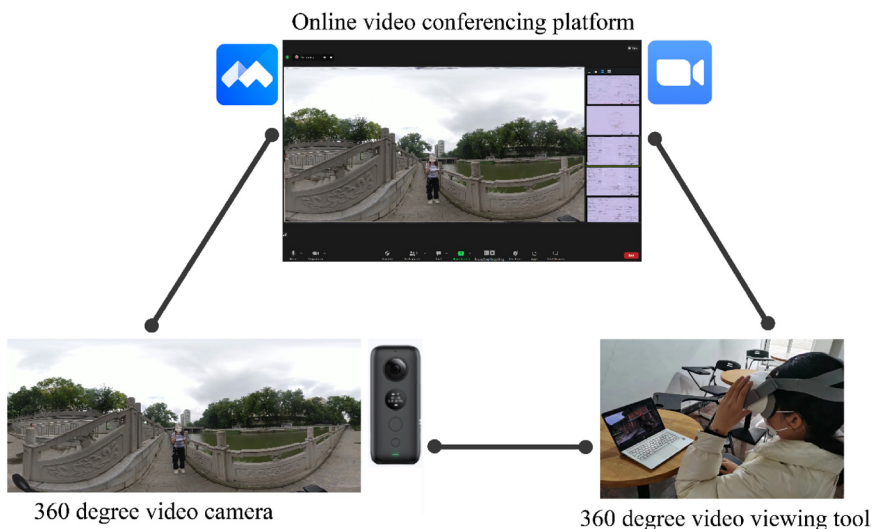
Personal Introduction



Cultural Presentation



Interactive Online Meeting



Language Test (Speaking)

You will have the opportunity to introduce one of your favorite traditional festivals from your country. Your description should last between 3 to 5 minutes and cover the following aspects:

Introduction of yourself: Begin by briefly introducing yourself. You can mention your name and perhaps a little about where you are from or your background.

Introduction of the festival: Next, provide details about the festival you have chosen. Include its name, when it typically takes place, and some basic information about what happens during the festival. Talk about the traditional foods people eat, the activities they engage in, and what the festival means to the people who celebrate it. If you have any interesting stories or anecdotes related to the festival, feel free to share them.

Why you want to introduce this festival and why you like it: Finally, explain why you have chosen this particular festival to introduce. Share what makes it special to you personally and why you enjoy it. This could include fond memories, cultural significance, or simply the joy it brings to you and your community.

Remember to speak clearly and confidently, and try to maintain a natural pace throughout your description. You will have plenty of time to cover all the

points, so take a deep breath and enjoy sharing about this festival that holds meaning for you.

Reflective Report

This reflective report is designed to capture your journey and growth in language learning, development of EFL speaking ability, and cross-cultural understanding. Please take your time to provide detailed insights into each section.

Language Learning Experience

Reflect on your language learning journey, with a focus on the role of technology. Consider the challenges you encountered in utilizing technology for language learning, the strategies you employed to overcome these challenges, significant milestones achieved through technology-mediated learning, and the impact of technology on your language learning.

Development of EFL Speaking Ability

Detail the evolution of your EFL speaking ability. Describe how your speaking skills have progressed over time, citing specific examples or experiences that highlight improvements in fluency, pronunciation, vocabulary usage, and communicative effectiveness. Additionally, explain how learning activities and technology have been beneficial in facilitating these advancements.

Cross-Cultural Learning Experience

Share your experiences in cross-cultural learning. Discuss interactions with individuals from different cultural backgrounds, exposure to diverse perspectives, and any cultural challenges encountered. Reflect on how these experiences have broadened your worldview and enriched your understanding of cultural diversity.

Development of Cross-Cultural Knowledge and Understanding

Examine the development of your cross-cultural knowledge and understanding. Reflect on how your interactions with people from diverse cultures, cultural immersion experiences, and formal learning opportunities have contributed to your cultural competency. Discuss any changes in attitudes, beliefs, or behaviors as a result of your cross-cultural learning journey. How were cross-cultural learning activities and technology useful to facilitate your cross-cultural learning experience?

Development of Communicative Competence

Explain the evolution of your communicative competence by providing a detailed account of its progression over time. Describe how your skills in communicative competence have advanced, citing specific examples or experiences that highlight their development. Additionally, discuss how cross-cultural learning activities and technology have been instrumental in facilitating these advancements and enhancing your proficiency in communication skills.

Interview Questions

Pre-Interview

- (1) Before this project, did you have any experience of cross-cultural learning? Any experience in using 360-degree video and AI-based translation technologies for learning? If yes, please tell us the details.
- (2) Have you been exposed to or studied the target culture before this learning activity? If yes, please tell us the details.
- (3) What is your knowledge and understanding of the target culture?
- (4) What is your cross-cultural competence?

Post-Interview

- (1) Please describe your overall learning experience.
- (2) Have your language skills (speaking) changed through your experiences in this activity? Please tell us more details.
- (3) Have your knowledge and understanding about the target culture changed through your experiences in this activity? Please tell us more details.
- (4) Has your cross-cultural competence changed through your experiences in this activity? Please tell us more details.

