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ORIGINAL RESEARCH

Using Social Virtual Reality in Teaching Intercultural Communication

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Abstract
In this study, we investigated whether intercultural communication can be learned as effectively through desktop-based social virtual reality (social VR) as it can through online study, and if social VR improves the motivation to gain cultural intelligence in distance learning. Two groups of international students attended a seminar called "Intercultural Communication"—one online via social VR rooms and videoconferencing, and one via videoconferencing only. The students then completed an online questionnaire and qualitative interviews regarding their experiences of learning intercultural encounters and development of intercultural communication skills through social VR. Based on our findings, social VR is an engaging complement to online study for learning intercultural communication competence. However, students claimed that it could not replace online or face-to-face study, and the quality of students' experiences depended on their technical equipment. The rapid development of virtual teaching methods, virtual reality hardware, and international Internet connectivity offers the hope that learning intercultural communication via social VR will become easier in the future.

Keywords Social virtual reality · Intercultural communication · Cultural intelligence · Intercultural communication competence · Intercultural competence · International students · Online study · Higher education

E-learning has proven beneficial for students in terms of flexibility, the integration of synchronous and asynchronous learning media tools, and partial student control of content and timing of their effort put into their studies (Coman et al., 2020; Dhawan, 2020). However, students and teachers face challenges with e-learning, including distractions, minimal interaction, and digital gaps among countries (Coman et al., 2020). For international students studying abroad, the main challenges of online distance learning are a lack of physical pres-

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ence in classrooms and missed opportunities to gain direct intercultural experiences, as was evident during the COVID-19 pandemic (Coman et al., 2020).

This study emerged from a project undertaken to integrate internationally oriented courses with social virtual reality (social VR) applications. "Intercultural Communication" was a compulsory course in a Media and Communication Sciences master program offered online to enable students across the world to attend classes without at Ilmenau University of Technology. This gave us the opportunity to compare an exclusively online group (the online group) with another online group that used social VR as a supplementary tool (the social VR group). We thus investigated whether intercultural communication can be learned as effectively through social VR as it can through regular online study that typically relies on synchronous videoconference tools or asynchronous learning management systems.

The success and challenges of using virtual reality (VR) applications for education has been addressed (Slater & Sanchez-Vives, 2016), but VR applications have typically been employed for Science, Technology, Mathematics, and Engineering (STEM) subjects. The COVID-19 pandemic motivated social science educators to use new technologies, including social VR, more extensively, but insufficient research has been conducted on the use of social VR (Oppermann, 2022). We conducted an exploratory study to shed light on a neglected combination of novel technology (VR) and social science (intercultural communication) content. Previous research (Shadiev et al., 2020, 2024; Song, 2019; Taguchi, 2023; Förster et al., 2021) has demonstrated that VR tools, such as 360-degree videos, effectively facilitate learning processes and enhance intercultural communication competence (ICC) in foreign-language learning and intercultural training contexts. These tools have proven valuable for training ICC, emphasizing the role of immersion in promoting realistic self-assessments and supporting intercultural learning.

In this article, we first discuss research on the topic of ICC and its teaching in virtual learning environments in higher education before describing the methodological design of our bipartite study, which consisted of an online questionnaire and six guided interviews. After presenting the results, we discuss their implications and prospects for future research.

1 Literature Review

1.1 Improving Intercultural Communication Competence

Byram (1997) and Deardorff (2006) considered the primary goal of intercultural learning to be the development of learners' ICC, which has been defined in various ways since the 1970s. Deardorff (2006) defined ICC as the "ability to communicate effectively and appropriately in intercultural situations based on one's intercultural knowledge, skills, and attitudes" (p. 247). Based on this definition, communication is central to improving ICC. As an important measure of ICC, cultural intelligence refers to "a person's capability to adapt effectively to a new cultural context" (Earley, 2002, p. 274). Cultural intelligence significantly contributes to international students' adaptations to new cultural contexts, and it has consequently attracted significant attention in intercultural training and educational settings as a pivotal factor influencing and reflecting cultural adjustment (Solomon & Steyn, 2017).

Thomas et al. (2008) subsequently developed a process-oriented framework based on cultural intelligence as "a system of interrelated knowledge and skills, mediated by cul-

tural metacognition, enabling individuals to adjust to, discern, and influence the cultural dimensions of their surroundings" (p. 126). Their framework is underpinned by the idea that fluid interactions among knowledge, skills, and metacognition yield behaviors that indicate cultural intelligence (Thomas et al., 2015). Cultural knowledge is "both declarative or content-specific knowledge and general process knowledge of the effect of culture on one's own nature or the nature of others" (Thomas et al., 2015, p. 1101). Cross-cultural skills are associated with "learning from social experience, appreciating critical differences in culture and background between oneself and others, relating successfully with culturally different others, and being able to adapt behavior appropriate to the particular cultural situation" (Thomas et al., 2015, p. 1102). Cross-cultural skills include cognitive and affective skills and the social competencies of empathy and perspective-taking (Busse & Krause, 2015).

Researchers have claimed that cultural intelligence is a strong predictor of successful intercultural communication in working environments (Yeke & Semercioöz, 2016). In higher education settings, beyond inherent individual characteristics and previous encounters, intercultural communication teaching coupled with experiential learning has the capacity to enhance cultural intelligence (Solomon & Steyn, 2017). Song (2019) introduced a 360-degree video-based curriculum for foreign-language classes, which revealed the advantages of VR in enabling students to gain first-hand intercultural experiences of South Korea and develop core ICCs, such as empathy, flexibility, perspective-taking, and ambiguity tolerance. Taguchi (2023) compared the VR pre- and post-task performance of 22 university students in the United States (US) using an intercultural conflict mediation scenario. The results showed that tasks based on 360-degree videos could evoke realistic emotions regarding conflict and thus prompt students to mediate conflict. Shadiev et al. (2024) designed cross-cultural learning activities supported by 360-degree video and translation technologies, which proved beneficial for the knowledge learning and attitude development of 24 university students in China. These studies provided evidence of the benefits of using VR technologies (mainly 360-degree videos) for foreign language learning and intercultural communication training. However, they were not experimental and thus lacked comparisons with control groups that did not use VR technology.

Following a review of the literature on intercultural learning via computer-based technologies, Çiftçi (2016) stated that learners typically express overall satisfaction with digital tools and that intercultural communication competence can be improved with the assistance of digital tools. However, the reviewer also pointed out the disadvantages of the dearth of stimulating contexts, a lack of in-depth analysis and detailed reports, and technical challenges (Çiftçi, 2016). To provide more stimulating contexts for practicing cross-cultural communication skills and learning cultural knowledge, we used a social VR platform for our course.

1.2 Three-Dimensional (3D) Virtual Learning Environments in ICC Classes

Computer-mediated communication (CMC), in various forms, is widely regarded as vital for initiating, developing, and maintaining interpersonal relationships (Walther, 2011). The advantages of VR are the communicative, anthropometric, and photographic realism that enhances remote communication (Bailenson et al., 2008). Here, we need to specify what we mean by VR, as the term and associated technologies have undergone rapid development over the years, leading to inconsistencies in the literature (Dörner et al., 2019). VR refers to

"immersive, interactive, multi-sensory, viewer-centered, three-dimensional computer-generated environments and the combination of technologies required to build these environments" (Cruz-Neira, 1993).

Hence, VR content can be experienced using various user devices and is not exclusive to the use of head-mounted displays (HMDs), although it can provide unique benefits to the experience. According to Witmer and Singer (1998) and DeWitt et al. (2022), head-mounted displays (HMDs) provide highly immersive and sensory-rich experiences that can improve engagement and understanding during intercultural interactions. By offering a first-person perspective, HMDs foster a stronger sense of empathy and connection with communication partners compared to desktop-based social VR. Additionally, HMDs allow users to recognize and interpret nonverbal cues in virtual environments, enhancing the overall effectiveness of intercultural communication.

A subset of VR for remote communication is social VR, which "invites multiple users to join a collaborative virtual environment and creates new opportunities for remote communication.… The goal of social VR is not to completely replicate reality, but to facilitate and extend the existing communication channels of the physical world" (Li et al., 2021). Social VR shifts the focus from isolated experiences to a collaborative medium, which we see as underrepresented in the social sciences.

A rich body of literature exists regarding the benefits of (often isolated) VR experiences, including the use of head-mounted displays (HMDs) and advanced tracking systems for teaching hard knowledge and soft skills in higher education (Burnett, 2021). Generally, enjoyment seems to have a positive impact on learning in on-site classes (Hernik & Jaworska, 2018). However, studies have shown that VR does not necessarily have a positive impact on learning and information recall (Pjesivac et al., 2021).

Morover, the vast literature on VR technology in higher education largely omits the role of social encounters in learning (Burnett, 2021; Radianti, 2020), for which social VR seems to be a promising novel technology over conventional communication tools for facilitating social interaction during distance learning. The beneficial characteristics of social VR for distance learning include 3D interaction possibilities and nonverbal communication cues, such as proximity, which can be included as social components (Maloney et al., 2020) and thus used in didactical approaches. Moreover, social VR supposedly increases the presence—the feeling of being in a virtual place (cf. Sheridan, 1992)—of participants through immersion in virtual spaces that allow students to actively control their avatars and prevent the purely passive reception of content, or "Zoom fatigue" (Lottin et al., 2021). "Zoom fatigue" refers to the "zoom academic fatigue" which describes a special form of exhaustion that is exacerbated by frequent use of videoconferencing tools due to, for instance, higher cognitive load (Lottin et al., 2021). Since social VR can lead to a higher degree of social presence, it enhances "the degree of salience of the other person in the communication and the consequent salience of the interpersonal relationships" among users (Short et al., 1976).

Given that VR is still rarely used in social science education, it is not surprising that only a few studies have been conducted on the use of VR for teaching and the development of ICC. For example, Förster et al. (2021) tested two prototypical learning scenarios with teacher education students and reflected on their learning experiences and media pedagogical implications in an intercultural setting. The findings highlighted the social dimension of VR, particularly the experience of social presence, influenced by sensory factors (e.g., visual representation, interactivity) and social context (e.g., proximity, social cues,

and task-related interdependence). The study demonstrated that intercultural learning in VR can foster social presence and a sense of safety when participants interact as avatars that obscure social cues, mitigating stereotyping. It also suggests the potential for VR to promote perspective-taking and empathy-building through avatars differing in appearance from their real-life counterparts.

Morover, Shadiev et al. (2020) designed an intercultural learning activity based on VR technology (i.e., asynchronous 360-degree videos using VR-HMDs) and investigated students' perceptions of the activity, VR technology, and ICC development. The results showed the advantages of intercultural learning supported by VR, including students' satisfaction with the VR facilitation of ICC development, the sense of presence, authentic learning contexts, and a high degree of immersion. Based on previous work, we identified a research gap regarding learning activities that support ICC development and their effectiveness in synchronous multi-user virtual environments.

The adoption of educational social VR applications, which accelerated during the COVID-19 pandemic, has persisted and continued to evolve and expand, including in the social sciences. Innovative use cases are constantly being developed across various fields and disciplines. For example, social VR has been effectively used in language learning courses (Alwafi et al., 2022) and has shown significant value for supporting virtual encounters and communication skills training across diverse contexts (Animashaun et al., 2024; Delgado-Algarra, 2020; Gruber et al., 2023; Moyón et al., 2024). This sustained growth underscores the ongoing potential of social VR as a transformative educational tool beyond the pandemic.

Besides VR applications, other media have been used successfully for intercultural training, such as the desktop-based online 3D virtual world Second Life, which has been shown to positively influence intercultural literacy by allowing participants to engage in cross-cultural encounters and gain greater awareness of other cultural perspectives and more openness toward them (Diehl & Prins, 2008). Typically, an avatar's appearance is constructed to reflect a cultural identity signified by skin color, facial features, hair type, and/or clothing. Conclusively, Second Life's "cross-cultural exchanges… [provide] its users with more opportunities to move in that direction [of intercultural literacy]" (Diehl & Prins, 2008, p. 101).

Coffey (2013) conducted a study to investigate how individual intercultural sensitivity was affected by a virtual environment compared to a web environment. Using a modified version of Chen and Starosta's (2000) Intercultural Sensitivity Scale (ISS), the researcher attempted to identify which of the five ISS dimensions had the greatest impact on intercultural sensitivity. The results show that willingness and effort to understand an intercultural interaction play the largest and most statistically significant role in intercultural sensitivity outcomes, and this effect is greatest when using a virtual environment channel.

Based on previous research, we formulated our main research question as follows:

To what extent can intercultural communication be learned in a synchronous social VR context in a way that is comparable to online study?

2 Research Design

For this research, we used a mixed-methods design. We distributed a survey to students to measure cultural intelligence and compared the differences between a social VR group and an online group. Thereafter, we conducted qualitative interviews with six students to obtain more detailed impressions of their experiences. We pretested the instruments with international students who were not part of the study sample.

2.1 Participants and Course Design

Between October 2021 and March 2022, 44 students from 16 countries enrolled in the compulsory Intercultural Communication course, which we designed for both online and on-site study. However, due to the impact of the COVID-19 pandemic, the course was delivered solely online. All students were enrolled in the Media and Communication Science master program that is a social science graduate program combining content from the fields of journalism, communication science, media technologies, media psychology, economics and law.

After seven lectures, we split the course participants evenly into one online seminar group that used a videoconferencing tool and one social VR-assisted online seminar group that used a videoconferencing tool supplemented with a social VR platform. Unlike the first seven lectures, the subsequent six seminars focused on interactivity and intercultural exercises (see Fig. 1). At the end of the course, students gave team presentations on their selected topics using the videoconferencing tool, which they preferred over the social VR platform due to their greater familiarity with its functionality.

2.2 Platform Characteristics

Affordances are the features, specifics, and options of technological tools used to attain desired outcomes (Evans et al., 2017). Thus, it is not sufficient to present lists of a tool's technological features because the possibilities for influencing actions, cognition, and emotions must also be considered. Therefore, we identified sets of affordances for different applications (see Table 1) and then linked them to the extent to which participants perceived these as present.

The social VR platform we used for this course was based on the open-source browser-based Mozilla Hubs software[1]. We chose this software for two reasons. First, considering our course's internationally dispersed students and their diverse technological setups, high degrees of accessibility and customizability (Burnett, 2021) via a platform conform with the EU General Data Protection Regulation (GDPR) were required. As a compromise to ensure the accessibility of our platform for users with low internet bandwidths while still providing immersive virtual environments, we allowed most students to enter the virtual environments using the two-dimensional (2D) desktop version via a browser. Table 1 summarizes the advantages and disadvantages of using desktop-based social VR compared to experiencing social VR via VR-HMDs and videoconferencing tools.

[1] https://hubs.mozilla.com/ (Accessed: 2022-12-22). Please note: As of 31 May 2024, Mozilla Hubs has been discontinued. It is now maintained by the Hubs Foundation https://hubsfoundation.org/ (Accessed: 2025-01-28).

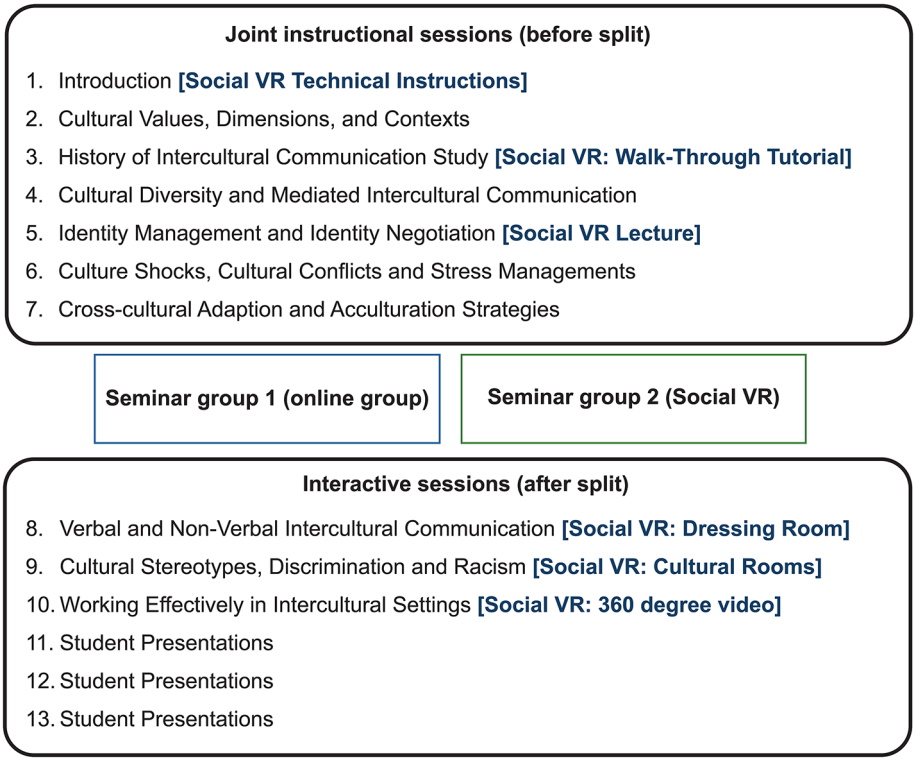

Fig. 1 Structure of the intercultural communication seminars (in the interactive sessions, Social VR and other immersive media content was only experienced in Seminar group 2)

Regarding affordances specific to intercultural training, desktop-based platforms have significant accessibility advantages. These platforms can include participants from regions with less stable and sophisticated Internet access or hardware who do not have the means or opportunities to experience new cultures by traveling, albeit at the cost of providing less immersive experiences (Steinicke et al., 2020). This option strikes a balance between highly immersive experiences, which can foster greater empathy and understanding through perspective-taking via HMD viewing, and the more 2D instructional designs typical of videoconferencing tools. One notable feature of desktop-based platforms is the use of avatars, which facilitate role-playing and perspective-taking during intercultural exchanges, as demonstrated in our study. The anonymity provided by artificial avatars, in contrast to the more personal and synchronous nature of camera feeds used for videoconferencing, could be leveraged in future applications to implement different tasks focusing on intercultural encounters. Although videoconferencing may offer greater authenticity and credibility, avatar-based platforms facilitate more creative instructional designs. The effectiveness of nonverbal communication cues also varies across platforms. For example, camera feeds in videoconferencing environments deliver the most natural depictions of facial expressions, whereas VR platforms (both desktop-based and HMD-based) replicate organic movement and proximity more effectively. Each platform, therefore, has unique advantages and disadvantages depending on the task and the required nonverbal cues. Ultimately, we decided

Table 1 Comparison of the advantages and disadvantages of desktop-based vs. VR-HMD-experienced social VR and videoconferencing tools

	Advantages	Disadvantages
Desktop-based Viewing	More accessible More cost-efficient Less likely to cause motion sickness Easier to use in large classes Easier for teachers to monitor Students can contribute pictures from their home countries	Less immersive Less empathetic Less enjoyable
Viewing with a VR-HMD	More immersive More empathetic Comprises more authentic and intuitive nonverbal cues	Likelier to cause motion sickness More effort involved in preparation
Videoconferencing Tools	More accessible Easier for students and teachers to handle Camera views of students; no abstract avatars Mostly, only the upper body is visible from a defined point of view	No spatiality and no organic movements in rooms Too familiar (i.e., "Zoom fatigue") Less engaging More likely to be experienced passively

that no single platform is superior for teaching intercultural exchanges and that the choice of platform should be guided by the specific instructional task and its requirements.

2.3 Functions of the Platforms

In Mozilla Hubs, each user is embodied by a 3D customizable avatar, which is essential for self-presentation and fostering others' perceptions in the virtual environment (Bailenson, 2008). Avatars can be moved smoothly within a virtual environment using either a traditional keyboard or move by jumping from one point to another via teleporting. Each avatar consists of a 3D model that may comprise several 3D objects (see Fig. 2). The appearance and name of an avatar can be completely or partially individualized to facilitate new didactic possibilities, including user representations.

Avatars can move in 3D spaces and exhibit audiospatial capabilities, which means that they perceive sounds that are closer to them as louder than those that are farther away. Similarly, depending on the distance from the user, the user's voice is perceived as louder or softer by others when the speech output is activated. Thus, users can interact synchronously with other students and educators. For the virtual environments in this study, we created cultural rooms to encompass the virtual activities. Figure 3 illustrates the processes and requirements underpinning the virtual environments. To underpin each room layout, we considered the common design elements of the social VR environments described in previous work (McVeigh-Schultz et al., 2019).

We used Webex as the videoconferencing tool because all students and teachers had access to it via their university network credentials under a university-wide license agreement, which eliminated concerns about data privacy issues for the study participants. The Webex service could be accessed via a browser or by installing client software. The Webex service provided artificial breakout rooms, live streaming of audio and video feeds, text chats, polls, and interactive emojis.

Fig. 2 An example of an avatar wearing clothing with a traditional Chinese pattern

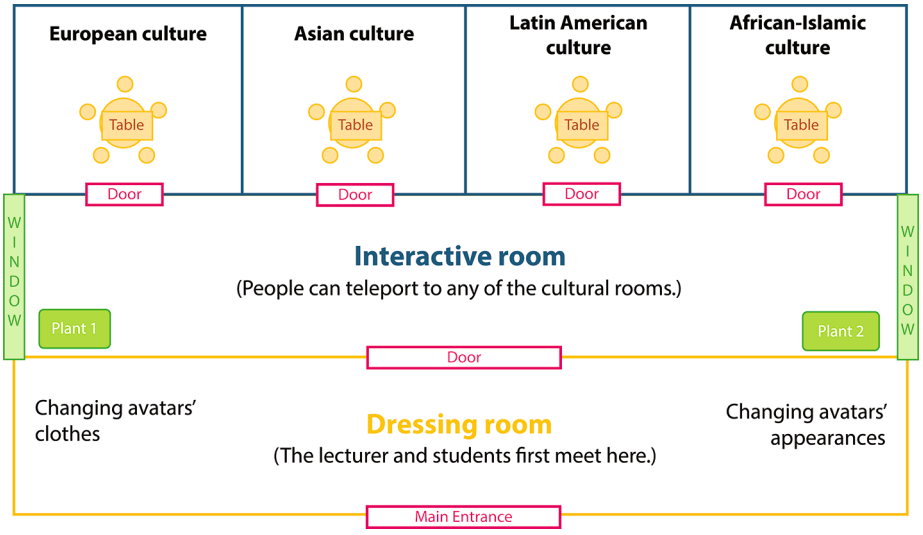

Fig. 3 Layout of cultural rooms for intercultural communication

2.4 Instructional Task for both Groups

In the online seminar group, the lecturer used only the online meeting platform to teach theory, with students participating in breakout meetings for group discussions. This form of learning was limited in terms of interpersonal communication and group interactivity. In contrast, the lecturer in the social VR group used both VR and an online meeting platform for teaching. These students' activities were more diverse, as they could (a) create

individual avatars by designing characters with ethnic appearances and clothes with special cultural characteristics, (b) observe and interactively discuss cultural stereotypes based on the visual images available in the four cultural rooms, and (c) experience different perspectives through storytelling in a meeting based on a 360-degree video.

We prepared optional 3D torso models with clothing that had culturally symbolic patterns so that the students could choose their avatars and their self-representations to other students. Aside from clothing, the avatars' hair colors and styles, accessories, and facial features could be customized.

McVeigh-Schultz et al. (2019) identified several factors that can shape prosocial behaviors in social VR environments. The researchers concluded that, among others, the onboarding process and a well-reasoned room architecture and structure are crucial for creating a welcoming atmosphere that enables users to acclimatize to their virtual surroundings. Regarding the structure of the virtual rooms, we also considered users' locomotion types, as continuous movement over large distances increase the likelihood of suffering from motion sickness. To reinforce the active participation of students and exploit the spatial features of the platform, we also considered spatial relations based on nonverbal communication cues, emphasizing the relevance of movement in our instructional and room designs.

Figure 3 illustrates the social VR room layout for an activity. Lecturers and students first entered a social VR dressing room, where they could design avatars or select default ones. Then, the interactive rooms allowed the students to interact as in the classroom. We created and decorated four cultural rooms based on the Inglehart–Welzel cultural map of the world (Inglehart, 2006) and the students' origins: European, Asian, Latin American, and African-Islamic. To avoid a heavy data load for students with a low Internet bandwith and slow Internet connections, we placed pictures on the walls displaying diverse typical sociocultural encounters (e.g., pictures of a marketplace, people praying, shopping, a family dinner, and a culturally representative building; see Fig. 4). We encouraged students to send us pictures from their home countries (e.g., of a typical African dish). Participants

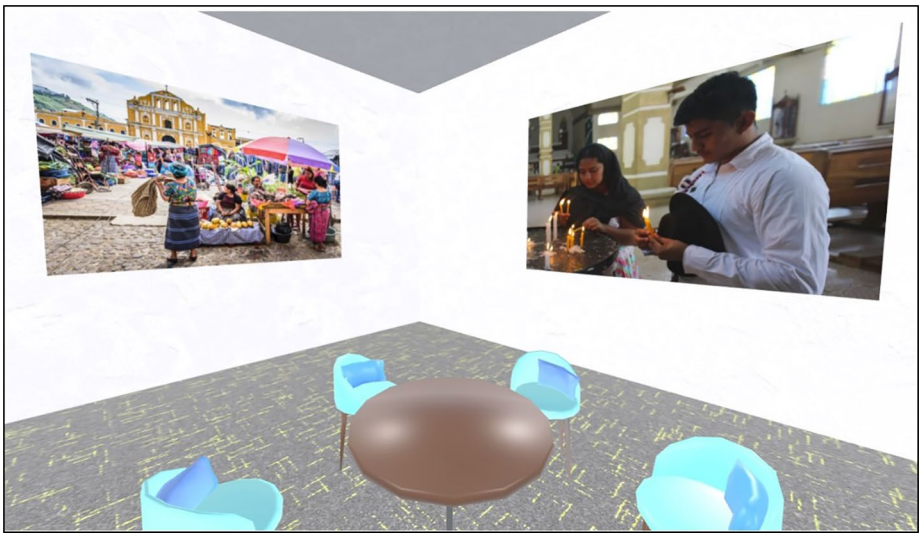

Fig. 4 Screenshot of the Latin American cultural room

could walk around in the rooms and sit as avatars at tables to discuss cultural similarities and differences.

It was interesting that, at the beginning, most students used default avatars, but they later became more creative and tried designing their own avatars. Since none of the participants had VR-HMDs at home, only the lecturers entered the rooms via HMDs; students used desktop social VR. We expected this to have no impact in terms of knowledge acquisition, since there was no such impact in previous comparisons of traditional serious games experienced with a 2D monitor and a VR hardware-experienced game (López-Fernandes et al., 2023; Pallavicini et al., 2019). However, we anticipated changes in enjoyment and motivation between the groups (Makranksy, 2021).

2.5 Quantitative Survey

2.5.1 Cultural Intelligence

At the end of the course, the students completed an online questionnaire comprising demographic questions and questions about cultural intelligence, digital literacy, and users' experiences of social VR. In this context, digital literacy refers to students' abilities to learn and communicate information through various digital media platforms. We selected items from the Cultural Intelligence Scale (Thomas et al., 2015) for this study because they are short and more communication focused than other measures (e.g., Ang et al., 2015; Chen & Starosta, 2000). The original scale was developed with input from participants in more than 14 countries and showed good reliability and validity (Thomas et al., 2015). The scale includes statements about one's experiences when encountering people from different countries to measure cultural intelligence, cultural knowledge, cultural skills, and cultural metacognition. We selected five items and asked the students to evaluate the statements using a five-point Likert scale ranging from "not at all" to "extremely well". The questions were as follows:

- I can give examples of cultural differences from, for instance, my personal experience or reading.
- I enjoy talking with people from different cultures.
- I sometimes try to understand people from another culture by imagining how something looks from their perspective.
- I can change my behavior to suit different cultural situations and people.
- I am aware of the cultural knowledge I use when interacting with someone from another culture.

2.5.2 Motivation

Motivation is an essential component of education that significantly affects students' levels of involvement and persistence throughout their academic journeys. When students are driven, they actively engage in their educational pursuits, establish ambitious objectives, and demonstrate a willingness to invest the required effort in achieving those learning objectives (Picciano, 2002). Moreover, motivation significantly influences students' perspectives on their learning encounters, affecting their overall satisfaction and enjoyment, especially

during distance learning (Georgiou & Kyza, 2018). In this context, motivation significantly influences students' dedication to online tasks, their completion of assignments, and their pursuit of further educational opportunities. The significance of motivation transcends mere involvement; it profoundly shapes students' attitudes toward learning and exerts a substantial influence on their academic achievements. Regarded as a multidimensional aspect of the educational experience, motivation is shaped by different factors, such as personal interest, perceived relevance of the content, a sense of proficiency, and the learning environment. Hence, promoting awareness of and nurturing students' motivation are crucial for establishing a conducive and efficient educational setting (Picciano, 2002).

In this study, we defined motivation as students' impetus or inclination to participate in classroom activities, reflecting their enthusiasm to engage with course material, peers, and educators. We sought to investigate the connection between students' motivation to participate and their tangible outcomes during the course. By adopting a new medium in addition to traditional video conferencing tools, our objective was to investigate the potential influence of this alteration on students' motivation. Therefore, we deliberately selected a concise questionnaire based on prior studies (Burnett, 2021; Picciano, 2002) rather than a more extensive instrument to avoid burdening students with a lengthy survey that could result in survey abandonment. This method enabled us to effectively evaluate the influence of motivation without overwhelming participants, ultimately facilitating a clearer comprehension of its importance in the context of our research.

To gain insights into the students' perceptions of social VR, we included questions regarding their motivation to engage with peers and classroom activities in comparison with on-site classes (Burnett, 2021) and open feedback questions regarding the user interface and functions, the avatars, and the virtual environment. We asked students to compare a traditional classroom setting to the one on the Social VR platform and rate their motivation to participate in classroom activities and to interact with other students in the class on a five-point Likert scale ranging from "strongly decreased" to "strongly increased." The questions were as follows:

- In comparison to a traditional classroom setting, on the Virtual Campus, my motivation to participate in classroom activities….
- In comparison to a traditional classroom setting, on the Virtual Campus, my willingness to interact with other students….

2.5.3 Qualitative Interviews

The qualitative element of this research consisted of guided interviews. We interviewed six international students, three from each group, and conducted approximately 30-minute online interviews via videoconferencing tools about their experiences in their seminar groups. The students volunteered to participate in the interviews with the instructors. We created the interview guideline using Loosen's (2016) method and included questions on the interviewees' personal backgrounds, general intercultural experiences, and (for social VR group members) the advantages and disadvantages of using social VR for intercultural communication training and the estimation of future developments of the implementation of social VR in distance learning. We conducted both the online questionnaire and the qualitative guided interviews in English, which was the course language. The coding and analysis

followed the steps described by Kuckartz and Rädiker (2019). We started with a deductive approach, creating a category system before reviewing the data and assigning the text passages to the appropriate categories. Furthermore, when working with the texts, we occasionally developed codes inductively according to the "open coding" method if it became apparent that the predetermined codes were insufficient.

3 Results

3.1 Online Survey

The seminar participants were surveyed for the first time at the start of the winter semester (pre-task survey) on 20 October 2021 (38 participants), and for the second time between 25 January 2022 and 19 February 2022 (post-task survey, 27 participants), using an online questionnaire. The first survey was compulsory for all students to complete; the second was voluntary at the end of the term, resulting in a smaller sample. The respondents were representative of the whole class in a geographical sense, coming from all four cultural areas represented by the social VR rooms (i.e., European, Asian, Latin American, and African-Islamic).

3.2 Descriptive Results of the Pre-Class Survey

In general, the respondents showed relatively good digital literacy ($N=38$, Min = 1, Max = 10, $M=6.89$, $SD=2.19$). In terms of previous experience with VR-HMDs, 2 students (5.3%) used VR-HMDs more than 15 times, 5 students (13.2%) used them between 5 and 15 times, 18 students (47.4%) used them less than 5 times, and 13 students (34.2%) had never used them. Regarding motion sickness during their previous VR experiences, 4 respondents (10.5%) had slight symptoms, 2 had medium symptoms (5.3%), and 1 had strong symptoms (3.6%). The rest of the respondents either did not experience motion sickness or did not know.

We selected the 5 out of 10 statements taken from the Cultural Intelligence Scale (Thomas et al., 2015) that were most suitable for our purpose and study scope to measure students' post-task ICC. The resulting Cronbach's alpha of 0.78 showed high reliability. Pre-task ICC generated a mean score of 3.84 on a scale of 1 to 5 ($N=38$, Min = 2.6, Max = 4.8, $SD=0.61$), which meant that the students exhibited relatively good ICC before attending the course. The results of the pre-task ICC were normally distributed, as assessed using the Shapiro-Wilk test ($p>.05$).

3.3 Descriptive Results of the Post-Task Survey

The post-task survey was completed by 14 participants from the social VR group and 13 from the online group (mean age = 26, SD = 3.36; 23 females, 4 males). Respondents almost universally considered themselves to have above-average digital media literacy: 25 of 27 respondents rated it as 5 or higher on a scale of 1 to 10 ($N=28$, $M=6.79$, $SD=1.97$).

We employed the same five statements from the Cultural Intelligence Scale (Thomas et al., 2015) to measure post-task ICC. The resulting Cronbach's alpha of 0.69 showed

Table 2 Descriptive and inferential statistical results for the quantitative data comparisons between the online and social VR groups

Measure		Online		Social VR				
	N	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*
Post-task cultural intelligence	Online (13) Social VR (14)	4.51	0.41	4.21	0.35	1.87	25	0.058
Change in motivation to participate in classroom activities	Online (11) Social VR (10)	4.09	1.7	4.72	1.35	-0.52	8	0.62
Change in motivation to interact with peers	Online (11) Social VR (10)	4.5	2.08	4.67	1.03	0.171	8	0.43

sufficient reliability. Post-task ICC had a mean score of 4.36 on a scale of 1 to 5 ($N=27$, Min = 3.6, Max = 5.0, $SD=0.41$), which meant that the students exhibited excellent ICC after attending the course.

3.4 Comparing Social VR and Online Groups

To answer the research question, we distinguished between the social VR group and the online group for the post-task ICC comparison. The mean score for the social VR group was slightly lower than the mean score for the online group (see Table 2). The results for post-task cultural intelligence were normally distributed, as assessed using the Shapiro–Wilk test ($p<.05$). We conducted an independent samples t-test to compare the two groups, which showed that the results were not significant, possibly due to the small sample size. Overall, the results confirmed that the course contributed to improving the participants' ICC, regardless of the platform used. However, the implementation of social VR elements did not lead to a significantly greater improvement compared to the purely online group.

Concerning the evaluation of the social VR platform itself, the students stated that, in comparison to traditional on-site classroom settings, their motivation to engage in classroom activities and/or with their peers did not change when they used social VR (see Table 2). The results for both questions were normally distributed, as assessed using a Shapiro–Wilk test ($p>.05$). There were no significant differences between the two groups either for a change in engagement in classroom activities or for a change in engagement with their peers (see Table 2).

In total, five replies to the open feedback questions concerned the environment, the features of the platform, and the avatars. Four of these mentioned the need for more practice in operating within the VR environment and changing the appearance of the avatars. Three replies indicated a positive attitude toward the platform in general and an appreciation of new tools for enhancing their motivation. For example, one participant stated, "I believe it was an innovative and creative idea for motivating students to study online so they could feel closer to their classmates while remaining in their own personal space.… Thank you!"

3.5 Qualitative Interviews

To evaluate the interviews, we developed a coding system to map the extent to which the use of social VR or online study was comparable for learning intercultural communication. Four of the interviewed students indicated that they had no prior experience with VR, and two indicated that they had prior experience with VR. Five students indicated that social VR

was a new experience. All respondents said that they were weary of studying online and not attending face-to-face events for a long time, which potentially indicated "Zoom fatigue" (cf. Lottin et al., 2021).

The participants commented very differently on the extent to which participation—that is, their active involvement in the seminar—changed, as follows:

> Actually, I didn't think I would be part of something like that for a class or for learning. Like, I just thought that virtual reality was something to have fun with, like games and stuff. So, I thought it was a cool experience.

> It was much more interactive; it was almost as interactive as the on-site classes, whereas Webex is not interactive at all. Even if you turn your camera on, and you can see each other's faces, you can't do much together. But in the VR room, you can form groups, and you can participate in activities and things like that. On Webex, you really can't.

> I compared the on-site class and this class. It was weird because in the onsite class, people participated much more than in the VR class.… I like on-site learning better because it's easier for me to talk to people, and, like, I can see that people are participating in real life.… I find it more difficult to interact with different people in the VR world.

In our sample, participation in the seminar was perceived to be more effective on-site, or at least better with social VR than via only the videoconferencing tool. The students stated that they saw social VR as an appropriate supplement to traditional course delivery. In addition, all interviewees saw social VR as an appropriate tool for considering intercultural encounters, especially first encounters:

> It's a good way to experience intercultural communication; it's safer. When people have face to face encounters, they may have strong body language, and it can cause verbal miscommunication. That's why I think it's a little safer.

However, almost all interviewees experienced technical problems. Five of the interviewees stated that they would need a more intensive introduction and longer acclimatization to the software to feel secure and autonomous in the virtual rooms and to understand how to handle unexpected technical issues if they occurred.

4 Discussion and Conclusion

This study contributes to the research gap by introducing social VR environments into a postgraduate course on intercultural communication. Notably, most participants said that intercultural communication could be learned better face-to-face than online. However, most students in both groups saw social VR as an opportunity to develop intercultural skills before traveling to a new country and as an appropriate complementary tool for studying intercultural communication and dealing with intercultural encounters. Thus, in a similar

way for both groups, social VR provided an opportunity to develop ICC despite the need to experience it more routinely. Therefore, we concluded that no one medium is superior for teaching intercultural communication to another or to face-to-face classrooms, but we shed light on social VR as a complement to existing classroom settings.

Moreover, most students in both groups believed that their motivation would increase in a seminar conducted using social VR compared to a purely online course. In terms of motivation, we also noted that our students exercised their initiative: two participants from the seminar seized the opportunity to exercise their creativity and media competence by designing their own virtual rooms. Motivated by a desire to enrich their cultural spaces, they crafted personalized environments on our social VR platform that reflected their unique perspectives and cultural backgrounds without being instructed to do so.

Our study has several limitations that must be considered when interpreting the results, which were based on the participants' personal assumptions rather than empirical evidence. Although the participants perceived the social VR experience as highly enjoyable, according to our qualitative findings, it was not clear how social VR influenced their learning outcomes. Generally, enjoyment seems to have a positive impact on learning in on-site classes (Hernik & Jaworska, 2018). However, for social VR environments, immersion, which is closely linked to enjoyment, does not seem to affect learning (Makransky et al., 2021). Studies have shown that VR does not necessarily have a positive impact on learning and information recall (Pjesivac et al., 2021) or lead to better learning outcomes (López-Fernandes et al., 2023; Pallavicini et al., 2019). However, in our sample, there were no significant differences in cultural intelligence or motivation, possibly due to the limitations of our study design.

Time differences may also have influenced the participants' online or social VR experiences and evaluations. The students lived in different geographical regions and therefore joined at different times and in different locations, which might have influenced their motivation and mood. Internet access and technical knowledge of the diverse devices they used to access the classes also affected their experiences adversely.

Given the limited use of VR technology, particularly social VR, for education, notably in the social sciences, we believe that a lack of familiarity with this platform may have represented a substantial obstacle for its confident implementation to teach intercultural communication. This challenge will be a key focus for exploration in future iterations of the course, particularly as participants become more familiar with social VR. We hypothesize that increased exposure to social VR may result in heightened recognition of its advantages in enhancing the learning of intercultural communication.

Furthermore, it is conceivable that immersive learning environments, such as those provided by social VR, as observed by Makransky (2021), may have the potential to enhance students' motivation or the likeability of a task rather than knowledge acquisition per se (López-Fernandes et al., 2023; Pallavicini et al., 2019), and may provide students with opportunities to engage in cross-cultural encounters rather than enhancing cognitive knowledge. Specifically for intercultural communication, since intercultural encounters require experience, practice, openness toward other cultural perspectives, and empathy (Busse & Krause, 2015), this leads us to ponder the relative importance of cognitive versus affective training, particularly in the context of ICC development. As our results indicate, there was no significant improvement in cultural intelligence between the two groups, so we assume that our task, although more motivating than videoconferencing alone, according to our

qualitative feedback, required more cognitive resources than affective resources from our students. Alternatively, the affective component may not have been persuasive enough, possibly because the students could not experience the environment from a first-person perspective with an HMD, which may have impeded their ability to take another's perspective.

Witmer and Singer (1998) and DeWitt et al. (2022) found that HMDs can facilitate more immersive and sensory-rich experiences, thereby enhancing engagement and comprehension during intercultural interactions. The first-person perspective offered by HMDs is likely to cultivate a greater sense of empathy and connection with conversational partners than desktop-based social VR experiences. Furthermore, HMDs enable users to perceive and interpret nonverbal cues in virtual settings, thereby enhancing intercultural communication experiences.

In an ideal scenario, the next step in assessing our task's effectiveness would involve observing students of our sample engaging in cross-cultural encounters in face-to-face settings, allowing for a holistic evaluation of their cognitive understanding and practical application of skills within social VR environments. By immersing students in intercultural interactions facilitated by social VR, we can promote not only their cognitive grasp of intercultural concepts but also their ability to apply and practice these skills in real-world scenarios.

Moreover, exploring the long-term use and evolution of these virtual spaces would offer an intriguing avenue for investigation. Drawing inspiration from Diehl and Prins's (2008) observations regarding Second Life, we could adopt a macro perspective to examine how avatars, behaviors, and rooms evolve over time as students engage with them autonomously in the same virtual space. It would be fascinating to observe whether certain rules or norms emerge organically within these virtual environments, reflecting the participants' collective experiences and interactions. This could be studied, for instance, by opening the virtual space to students outside scheduled synchronous seminar sessions to enable them to change rooms without instructor supervision.

Another interesting use case for an instructional design to evaluate ICC would be the co-creative design of a social VR workshop in which students of different cultures could build specific models out of the default 3D models under the supervision of an instructor.

Overall, we see social VR as a valuable complement to regular online intercultural training to either provide intercultural classes of students with common rooms for exchanges and understanding, or to provide classes with interesting stimulation (cf. Çiftçi, 2016) to ignite cultural exchanges and hopefully motivate further cultural discussions depending on the overall learning objective. Additionally, taking into account the topics that students discuss in these virtual spaces may provide important insights into their problems, interests, and dynamics of cross-cultural interaction. By analyzing the topics of conversations and interactions within virtual rooms, we can gain a deeper understanding of how students engage in intercultural communication in digital contexts and how these interactions contribute to their overall learning experiences.

In conclusion, our research shows that intercultural communication can be as effectively learned through social VR as through pure videoconference-based learning, thus serving as a valuable complement to online study, even with only desktop-based viewing (as similarly observed regarding Second Life by Diehl & Prins, 2008). To ensure the acceptance and smooth implementation of social VR, a meticulously planned introduction and guided tour of the environment, along with clear communication of technical requirements, are

essential for mitigating potential technical issues during lectures. We aimed to strike a balance between accessibility for students without state-of-the-art hardware and robust internet connections while still providing an immersive collaborative virtual environment. Despite our efforts to anticipate and address technical challenges through introductory classes and beginner-friendly software, longer acclimatization and an introductory phase are necessary for systematic implementation of social VR.

Our study highlights social VR's potential to enhance traditional intercultural communication education, particularly in distance-learning contexts, compared to relying solely on videoconferencing tools. To optimize the effectiveness of social VR for teaching intercultural communication, widespread access to HMDs for all participants is crucial, alongside the use of 3D models rather than 2D pictures to enrich cultural representations. Additionally, future researchers should delve deeper into factors such as motivation, presence, and usability, exploring their impact on the efficacy of intercultural communication training in virtual environments.

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Data Availability The questionnaires and interview guidelines used for the study are available in the OSF repository at https://osf.io/nw4af/?view_only=007b5ee87d4b495bb6c7cde27df5f846.

Declarations

Informed Consent Informed Consent was obtained from all individual participants included in the study.

Competing Interests The authors declare that they have no competing interests.

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