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Fostering Interdisciplinary Intercultural Citizenship with Virtual Reality in a World Language Virtual Exchange Project

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Abstract

Intercultural dialogue is an essential component of intercultural citizenship, i.e., students' ability to address complex societal issues. With more interconnected problems comes an increased need for students to communicate and collaborate with people from differing backgrounds. This pilot study combined the framework of Intercultural Citizenship (ICit), and the United Nations' Sustainable Development Goals (UN SDGs) related to the environment with Virtual Reality (VR) and Virtual Exchange (VE) to investigate the students' application of ICit. Fifteen learners of German, consisting of university students of German in the United States and international students studying at a German university, met in dyads or triads in VR over six weeks and worked on independent projects, each focusing on a societal environmental issue of their choice. Analyses of the data (pre-project and post-project surveys, weekly journal entries, project presentations) revealed that participants applied their intercultural competence. Some students showed a shift of emphasis: While at the beginning they were more concerned with linguistic elements of the German language they were focused on the topic of their project toward the end of the project. Finally, participants appreciated the VR setting for building relationships, communicating, and applying intercultural competence in an authentic setting.

This study underscores the potential of advancing ICit and intercultural communicative competence through a VR-VE format, emphasizing VR-VE's potential in fostering relationship-building between students. This format offers students practical experience in navigating and appreciating the complexities of intercultural communication.

Keywords: intercultural citizenship (ICit), social virtual reality, virtual exchange (VE), sustainable development goals (SDGs), intercultural communicative competence (ICC)

Data Availability Statement: *All relevant data are within this paper.*

Introduction

The United Nations issued an "urgent call for action by all countries" to address the challenges of today and establish the 2030 Agenda for Sustainable Development, "a plan of action for people, planet and prosperity" (UN, 2015, p. 5). Education plays an important role in nurturing active citizens. Language education is well-positioned to impart the knowledge, skills, and attitudes necessary for students to engage in intercultural dialogue and address complex problems, including the UN Sustainable Development Goals (SDGs), alongside individuals from different backgrounds, thereby acting as intercultural citizens (Byram, 2008). Several international and national collaborative projects have demonstrated promising outcomes in utilizing frameworks like Intercultural Citizenship (ICit), Human Rights, and Social Justice Education (Byram et al., 2017; Byram & Rauschert, 2022; Wagner et al., 2019). Simultaneously, research has highlighted the effectiveness of employing Virtual Reality (VR) in addressing Human Rights and Social Justice issues (Raz, 2022; Wang et al., 2023). However, to our knowledge, VR, sustainability and ICit have not been combined in a Virtual Exchange (VE) project. This pilot study explores the integration of teaching and learning for Intercultural Communicative Competence (ICC) (Byram, 2021/1997) and Intercultural Citizenship (Byram, 2008) within a VR – VE project, and investigates students' perceptions of the usefulness of VR in discussing environmental issues and sustainability.

Review of the Literature

While national curricula often emphasize the goal of educating good citizens, Byram (2008) argued that language educators have a unique role in fostering the development of intercultural citizens. Byram (2008) conducted an analysis and comparison of the knowledge, skills, and attitudes required for ICC as described in his earlier work (Byram, 1997) and the competences necessary for acting as a democratic citizen, as outlined by Himmelmann (2006). The result of this analysis was the formulation of the framework of ICit, which combines ICC with the skills of democratic citizenship. Through this framework, students acquire the necessary knowledge, skills, and attitudes to engage in meaningful intercultural dialogue and effectively apply their ICC to address societal issues in the present.

ICC encompasses linguistic components, including linguistic, sociolinguistic, and discourse competence, along with various skills, knowledge, and attitudes associated with intercultural competence. These elements are described below Table 1.

Intercultural citizenship education combines ICC and aspects of citizenship education, i.e. where learners engage in collaborative efforts to achieve a common goal; analyze and reflect on the experience and consider the potential for additional social and/or political involvement. This should result in cognitive, attitudinal, and behavioral changes in the individual's learning process and lead to a shift in self-perception and improved relationships with individuals from diverse social groups (Byram et al., 2017).

The ICit framework has been applied in various contexts by researchers and practitioners. Byram and colleagues (2017) published several projects that combined ICit with a developmental model of criticality (Barnett, 1997) in international collaborative projects. Rauschert and Byram (2017) effectively implemented ICit in service-learning projects and demonstrated that learners did not view civic engagement as an extra load, but rather as an opportunity for valuable learning, experiencing a sense of self-efficacy, and effecting change in their world. Furthermore, the findings showed that students developed an international group identity, achieved varying levels of criticality and engaged in self-reflection.

Table 1 *ICC (Byram, 2021, pp. 62–67)*

Attitudes:	This refers to having a sense of curiosity and openness, being willing to suspend one's own beliefs about other cultures and having an open-minded approach.
Knowledge:	It involves possessing specific knowledge about social groups, their products, and practices in one's own country and the country of the interlocutor. It also includes having a general understanding of societal and individual interaction processes.
Skills of interpreting and relating:	This entails the ability to interpret and explain documents or events from other cultures, as well as establishing connections between them and documents from one's own culture.
Skills of discovery and interaction:	This refers to the capacity to acquire new knowledge about cultural practices and effectively apply knowledge, attitudes, and skills in real-time communication and interaction.
Critical cultural awareness/ political education:	This involves the ability to critically evaluate values present in one's own culture and other cultures and countries.

Kong and Spenader (2023) documented multiple ICit projects across diverse contexts. Wagner et al. (2019) expanded ICit to include interdisciplinary ICit and presented sample projects that integrated standards from different subjects across various levels of language proficiency (from novice to advanced) and educational levels (middle school, high school, college). While these projects had different focuses, most of them utilized Virtual Exchange to connect students with peers from different national or international contexts. Learners' application of ICit in a VR environment in the context of a VE project has not been explored yet. Therefore, this pilot study examines how students apply knowledge, skills and attitudes of ICC and actions of ICit in VR and students' perceptions of the usefulness and impact of VR in discussing environmental issues and sustainability.

Virtual Exchange

The data collected for this pilot study comes from a VE project. VE involves "the sustained engagement of groups of learners in online intercultural interaction and collaboration projects with partners from other cultural contexts or geographical locations as an integrated part of their educational programmes" (O'Dowd et al., 2020, pp. 146–147). Therefore, such online (language) learning international collaboration opportunities need to be teacher-mentored and are typically offered in secondary and post-secondary school environments. VE projects aim to foster participants' intercultural and pragmatic competence, digital literacies, and additional language skills (O'Dowd & Dooly, 2021; O'Dowd & O'Rourke, 2019). They traditionally take place via videoconferencing. Recently, however, VE projects have been carried out in VR with VR headsets to offer a more immersive learning experience.

Virtual Reality

VR can be defined as a "computer-generated 360° virtual space that can be perceived as being spatially realistic, due to the high immersion afforded by a head-mounted device" (Kaplan-Rakowski & Gruber, 2019, p. 552). VR has been utilized in interdisciplinary foreign language teaching and learning, as demonstrated in examples such as Business Chinese and Italian literature and history (Tiboni-Craft & Yu, 2023). Using VR headsets, users can immerse themselves in virtual spaces and experience simulations of real-life events.

The affordances of using VR include embodiment, i.e., the personal experience of utilizing and possessing a body (Blanke & Metzinger, 2009) in VR, a sense of presence, i.e., "the illusion of being there,

notwithstanding that you know for sure that you are not" (Slater, 2018, p. 432) and agency. Additionally, VR is recognized for its potential in fostering empathy (Shin, 2017), with studies demonstrating its effectiveness in training empathic skills across cognitive, emotional, and behavioral domains (Gerry et al., 2022). VR enables the creation of realistic and engaging learning environments, promoting authenticity (Di Natale et al., 2020) and facilitating genuine interaction among users.

Language scholars are actively exploring the potential benefits and limitations of VR in various language learning domains, including language teaching and learning (Dhimolea et al., 2022; Legault et al., 2019), reading (Kaplan-Rakowski & Gruber, 2024) and pragmatics (Taguchi, 2022). Research on VE in VR has been exploring the impact of VR on participants' conversations, students' engagement, language use, students' use of semiotic resources and willingness to communicate (e.g. Canto et al., 2023, Chen & Sevilla-Pavón, 2023; Dooly et al., 2023; Gruber et al., 2023). Overall, these studies have found that using VR can be engaging, motivational and conducive to learning.

Social VR applications like Engage (https://engagevr.io/) and vTime XR (https://vtime.net/) offer virtual environments specifically designed to facilitate interaction and collaboration. vTime XR is a cost-free social network which can be accessed with a VR headset and enables users to create private rooms accommodating up to four people in diverse locations, such as a cave, a rooftop bar in Paris or a virtual office (see Figure 1), where they can engage in conversation. These virtual environments are designed with 360° sounds, and they feature dynamic elements like moving animals and objects. In vTime XR, while users cannot interact with objects and are limited to changing seats within the destination, the primary focus is on oral interaction. Studies in vTime XR (Kaplan-Rakowski & Gruber, 2021; Liaw, 2019; Thrasher, 2022) showed that language learners sustained their motivation and that vTime XR assisted students in managing foreign language speaking anxiety.

Encounters within social VR applications such as vTime XR allow for experiential and situated learning, offering opportunities for meaningful engagement within real-life scenarios. Recent research suggests that VR may serve to promote social connectedness when face-to-face interactions are not feasible (Barreda-Ángeles & Hartmann, 2022), and that social interactions in immersive media can have positive effects on user well-being (van Brakel et al., 2023).

Research on educational intercultural encounters in social VR has demonstrated that the virtual environment can impact learners' choice of conversation topics and their level of anxiety (Ahlers et al., 2020; Gruber et al., 2023). Social VR app spaces (see Figure 1) can be considered as "spatium francium",

Figure 1 *Interaction Between Three Avatars in vTime XR.*

analogous to lingua franca, indicating that VR-specific interactional patterns and norms are likely to emerge and influence one another (Ahlers et al., 2020).

Regarding environmental and economic sustainability, VR has been utilized to immerse citizens in environmental issues, such as climate change, enabling them to personally experience these issues (Markowitz & Bailenson, 2021). For example, a large-scale study using immersive VR for educating about climate change and ocean acidification found that VR enhanced students' interest in the topic and their motivation to further engage with the issue (Markowitz et al., 2018). Moreover, a recent study (Kleinlogel et al., 2023) comparing different formats, including print, video, and VR, for conducting pro-environmental promotional campaigns found that receiving information through VR resulted in a greater adoption of energy-saving attitudes and changes in the use of products and appliances at home.

The use of VR to practice ICit may offer students an experience where they can apply their knowledge, skills and attitudes in an immersive environment. The development of ICit in VE projects carried out with videoconferencing tools has been explored for some time (e.g. Byram et al., 2017; Porto, 2014; Rauschert & Cardetti, 2022). However, ICit has not yet been examined in VE projects in VR. This pilot study aims to address this research gap. In the project, learners of German investigated environmental and societal issues in an international and interdisciplinary VR-VE context. The project aimed to enable participants to use their ICit skills and develop solutions to authentic social and environmental problems. This study addressed the following research questions:

1. How do students apply knowledge, skills and attitudes of ICC and actions of ICit in a Virtual Reality – Virtual Exchange project?
2. What are students' perceptions of the usefulness and impact of VR in discussing environmental issues and sustainability?

Methods

This exploratory qualitative study applied the theoretical framework of ICit (Byram, 2008) to an international collaboration between the United States and Germany. We aimed to purposefully integrate ICC and ICit learning in our VR-VE project. The study involved students addressing one of the following UN SDGs related to the environment: 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), and 13 (Climate Action) (United Nations, 2015).

Participants and Context

The study involved a total of eight students from a German language classroom in the United States and seven students from Germany. The age of the participants ranged between 18 and 23 years old. Additionally, two students from the United States granted permission to publish all materials related to the ICit project, but they did not give permission to analyze the surveys. All participants in the project were learners of German, with three participants in the US identifying German as a heritage language. In Germany, the participants consisted of students from various countries including Andorra, China, Egypt, Nigeria, Syria, Turkey, and the US. These participants were enrolled in a range of bachelor's and master's programs at the university.

Of the participants, 61.11% identified as male, 33.33% identified as female, and one person reported being non-binary. The German language proficiency level of the participants varied, ranging from Intermediate-High to Distinguished on the ACTFL Proficiency Scale.

In the United States, the VR component of the project was optional, but the ICit collaboration was a mandatory part of the course and contributed to the students' final grades. For the students' learning objectives, the ICit objectives were at the center. Since students had not used VR headsets before and since some users encounter problems, such as headaches and dizziness, it was not mandatory for students registered in the course in the United States to use the headsets. The course was a capstone course, which normally is the last course students take in the German major. However, due to the Covid-19 pandemic, more than half of the participants took the course out of order, before their study abroad experience. All students in the United States voluntarily chose to be part of the VR experience.

To recruit participants in Germany, the project was advertised through students' newsletters to all international degree-seeking students at a German university. Those who expressed interest in participating were invited to a brief online interview with one of the researchers. The proficiency level of the participants in Germany was informally assessed by an experienced German instructor who was part of the research team. The selected students in Germany earned one European Credit Transfer and Accumulation System (ECTS) credit upon successful completion.

The necessary permissions to conduct the study were obtained from the review boards of the respective institutions. Prior to participation, students were informed about the potential risks associated with engaging in VR settings. All participants, both in the United States and Germany, completed a letter of consent granting permission to use specific data of their choice. It is important to note that the researchers were unaware of which students in the US were part of the study until after grades had been recorded. The students completed pre-project and post-project surveys, maintained weekly journal entries, and delivered project presentations and essays.

The participants were provided with either an Oculus Go headset or an Oculus Quest 2 (Figure 2) for the entire duration of the project. Detailed instructions on setting up the headsets and using the vTime XR platform were provided to the students by the researchers. In the United States, the use of the headset was also discussed during class sessions. It is worth noting that 68.75% of the participants had prior experience using a VR headset, having tried it once or twice before the start of the project.

The project was conducted during the spring semester of 2022, spanning a period of six weeks from March 2022. The participants were organized into international dyads and triads, and they had a minimum of five scheduled meetings throughout the project. Prior to the start of the project, all groups were provided with a detailed schedule and task outlines, which were shared online (for further information, please refer to Appendix A).

Figure 2 *Student Engaged in Activity with an Oculus Quest 2 (left); Oculus Go (right).*

Figure 3 *Space in Gather.town.*

The first whole group meeting occurred in March 2022, utilizing the digital customizable space of Gather (https://www.gather.town/) (Figure 3). Gather enables participants and researchers to meet virtually and navigate their avatars to tables and chairs, where they can sit down using the keyboard. The platform also offers the option to use a web camera, similar to traditional video conferencing tools. The researchers specifically chose Gather for its ability to facilitate spontaneous interaction without the need for creating breakout rooms.

Tools like Gather have the potential to enhance participants' social connection and to play a more active role because some features that give learners more agency (e.g. learners can decide if and when to join or leave a group. Prior to the meeting, participants received instructions on how to use Gather on their PCs. During the meeting, the researchers provided an overview of the project and its goals, allowing participants to ask any questions they had. Following this, participants met with their respective partner(s) in vTime XR, using their VR headsets. Participants scheduled weekly meetings in vTime XR with their partner(s) outside of class time. At the end of the project, a final meeting was conducted on Zoom, where all groups presented the outcomes of their action projects.

The groups were instructed to choose among the following UN SDGs related to the environment: 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), and 13 (Climate Action) (United Nations, 2015).

The groups were asked how they could contribute to positive change in their own environment through independent research and collaboration, while also getting to know students living in Germany/America and understanding their contexts. Students in the United States had been applying the knowledge, skills, and attitudes of ICC to a number of topics. The group in the United States also discussed what ICC means and how one can use it to address issues. In the first meeting with students in Germany and in the United States, we also went over the goals of the project, including how we envision ICC can be helpful. We reviewed the weekly plan (see Appendix A), including what the project participants were expected to do and hand in. The plan was designed in a way that students were asked to find information and interpret it, interact with each other and people in their contexts to learn more about the topic of their choice. Finally, students were asked to apply what they learned to their contexts and propose possible solutions to the problem of their choice.

Data Collection and Analysis

The data consists of a pre-project survey, a post-project survey, weekly journal entries during the project, and project presentations and project reports. The pre-project survey contained questions regarding participants' background, their experience with VR, their views on online learning, intercultural

communication, VR, and Community of Practice. It featured Likert scales and contained questions (e.g., 'How often have you worn a Virtual Reality headset (VR glasses) so far?') and statements (e.g., 'I can handle situations well in which cultural differences are evident.') in the target language. The post-project survey contained the same questions as the pre-project survey with the added inquiry about what students felt they learned in the project (see Appendix C).

The surveys were administered online using Qualtrics and students were instructed to generate unique codes to facilitate the researchers in matching each participant's pre-project survey with their corresponding post-project survey. Although most students completed the surveys, we were allowed to use only 8 pre-surveys and 7 post-surveys due to the specific consent given by students. Out of all the surveys, only three pre-project and post-project surveys could be linked with codes. The other students could not be linked to doing both surveys.

Regarding the reflective journals, the participants were asked to add an entry to their online reflective journals after every meeting. The instructors provided participants with reflection prompts in the form of questions, e.g. In your opinion, how did the environment contribute to a relaxed atmosphere during the exchange or to smooth communication? (for reflection prompts see Appendix B). Participants reflected on new content they learnt when discussing different topics with their partners, compare different perspectives and make judgments.

A total of 12 journals from the United States and seven journals from Germany were analyzed, with some journals consisting of an entry each week (up to five) and others missing one to three entries. The students had the freedom to choose whether they wanted to write their entries in English or German. The participants completed a project report after their last meeting with their partner(s), which consisted of a table of contents (1 page), an introduction (½ page to 1 page), background information (1–2 pages), results (1–2 pages), discussion (including their action) (1–2 pages) and a bibliography (1 page).

Additionally, each group produced a video presentation in which they discussed their findings and proposed solutions for their specific problem related to their SDG. Furthermore, some collaborators from Germany joined their partners in the last meeting of the German course in the US on Zoom to collaboratively present their final projects and engage in question-and-answer sessions.

The researchers independently generated data-driven codes for the journal entries of all participants using the data analysis software package MAXQDA. They then conducted a thematic analysis, searching for common themes. In a collaborative process, the researchers cross-checked the constructed themes and reached an agreement on those that were aligned with the research questions.

Findings

Applications of Components Related to ICC

For research question 1 ('How do students apply knowledge, skills and attitudes of ICC and actions of ICit in a Virtual Reality – Virtual Exchange project?'), we analyzed the students' use of knowledge, skills, and attitudes in ICC and their ICit projects. We decided to share the number of incidents of each ICC element although the number per se is not important. However, it might provide the reader with an impression of how often students reflected on issues related to ICC elements. As such, we provide the numbers as evidence that the references exist and are not isolated cases.

Regarding ICC, the agreed-upon most frequent coding for the journal entries is presented in the following tables. Table 2 displays the frequency of instances where students addressed components of

Table 2 *Frequency of Instances of Components of Intercultural Communicative Competence*

Codes related to ICC (Components of Byram's model)	Instances
ICC: I&R, K (Interpreting and Relating, Knowledge)	15
ICC D&I (Discovery and Interaction)	12
ICC AT (Attitudes)	11
ICC KN (Knowledge)	27
ICC CCA (Critical Cultural Awareness)	10

Table 3 *Instances of Planning Actions and Discussing the Actions Themselves*

Codes related to Action Component (ICit)	Instances
ICC PL (Planning project)	20
ICC AC (Action Component)	13

Table 4 *Three Additional Codes*

Codes related to affordances through ICC	Instances
ICC LA (Language Awareness)	30
ICC MA (Meta Awareness)	17
ICC RE (Relationship)	20

Intercultural Communicative Competence (ICC) as defined by Byram (1997, 2021). The components include Attitudes (AT), Knowledge (KN), Interpreting and Relating (I&R) — which always appeared alongside Knowledge (KN), resulting in a total of 42 mentions for KN — Discovery and Interaction (D&I), and Critical Cultural Awareness (CCA). Table 3 presents the instances where students engaged in planning actions and discussing the actions themselves. The combination of the action component with applications of ICC indicates that students participated in intercultural citizenship. The analysis of journal entries revealed two additional codes, which are listed in Table 4. Among these, the code "Meta-awareness" (MA) emerged with 17 instances. This theme reflects the students' understanding of their learning processes of ICC, showcasing their active engagement with ICC. Additionally, students reflected on aspects related to their language(s). We do not use language awareness (ICC-LA) as a technical term but rather as a term referring to instances when students shared thoughts about concerns about their language proficiency, their ease with the language, for example. Finally, students also reflected on getting to know their partners' contexts and relating to them and their backgrounds. We coded these statements as "Relationship" (RE).

The analysis of the journal entries revealed that students applied all components of ICC during their collaboration.[1] As mentioned before, we did not conduct quantitative analyses concerning the number of instances of the specific codes. Rather, we coded the data to be able to compare the different contexts in which the codes occurred and to check whether the code was present for most or all participants. We now share examples to illustrate how students applied their ICC.

Students mentioned the knowledge (KN) they acquired and discussed how they interpreted and related (I&R) information from each other's and other contexts to their own. Eric's[2] journal entry from the 4th week below, for example, demonstrates the use of knowledge and skills in interpreting and relating information. The student learns from their collaborator about their cultural context and compares it to

[1] Please note that all quotes in the findings section were translated by the authors.
[2] Pseudonyms were used for all students.

their own, gaining new knowledge about the topic. The reflection on what is interesting and the curiosity about another culture indicate attitudes of curiosity, open-mindedness, and perhaps even tolerance of ambiguity.

Etwas das ich diese Woche interessant gefunden habe ist, dass es anscheinend bessere öffentliche Verkehrsmittel in China gibt. Die [name of collaborator] sagte, dass die chinesische Regierung viele Initiative erstellte, um mehrere Züge aufzubauen. Deswegen kostet eine Reise zwischen Nanjing und Shanghai (ca. 400km) nur ~130 Renminbi (ca. €18,50). Das machte mir besonders eifersüchtig, weil ich gerade den Zug von New Jersey zurück nach Connecticut namm, und das kostet fast $200.

Translation: Something I found interesting this week is that apparently there is better public transportation in China. The (name of the student) mentioned that the Chinese government has implemented various initiatives to develop more trains, resulting in lower transportation costs. For example, a trip between Nanjing and Shanghai, which covers a distance of about 400 km, costs about 130 Renminbi (approximately 18.50 Euro). This made me particularly envious because I recently took a train from New Jersey to Connecticut, and it cost me nearly 200 dollars.

Another student, Rita, reflected in week 2 about the ways in which she would like to research their topic which pertains to skills of discovery. She also makes the connection between learning more about a topic and finding it interesting as well as having fun with it, as can be seen below.

Ich glaube die beste Lösung für das ist erst unsere rechasierung sehr umfangreich zu lassen, so dass wir so viel wie möglich über das Thema lernen können. Nach wir ein besseres Wissen haben, können wir uns herausuchen worauf wir uns konzentieren möchten und was uns am meisten konzentriert. So können wir auch sicher gehen, dass wir mehr lernen über was wir am meisten interesse haben und am meisten Spaß haben.

Translation: I think the best solution for this is to first let our research be very extensive so that we can learn as much as possible about the subject. After we have a better knowledge, we can pick out what we want to focus on and what concentrates/concerns us the most. This way we can also make sure that we learn more about what we are most interested in and enjoy the most.

The students also shared their experiences of interacting with each other to discover new information and perspectives (D&I) (e.g., 'Wir denken dass, Windenergie kein gute Option ist, weil der Wind viel Sand enthalten würde, der Turbinen schaden könnte.' ('We think that wind energy is not a good option [in the Sahara] because the wind would contain a lot of sand that could damage turbines') (Charles, week 3). In doing so, they demonstrated their attitudes, in this case openness and curiosity (AT) (e.g., 'Es war sehr interessant, [name of their partner]s Meinung zu hören.' ('It was really interesting to hear [name of their partner]'s opinion') (Charles, week 3). When asked about the collaboration in her group, Rita, for example, mentioned in week 3 that they can compare the information they have about the two countries and cultures, i.e. the US and Germany: 'Wir beide haben viele Information über beide Länder und Kulture und können oft vergleichen was wir erlebt haben und wie es anders ist.', ('We both have a lot of information about both countries and cultures and can often compare what we have experienced and how it is different').

In preparation for their action project, the students critically analyzed the knowledge and planned their actions (AC) based on the information they acquired. They made judgments using evidence and logical reasoning to determine how they could address their problem. This critical analysis demonstrated their critical cultural awareness (CCA). Many students provided comments on these aspects when

responding to the weekly journal questions. Additionally, two students used the journal to document their conversations with their partners and outline their project plans (PL). They provided detailed descriptions of the steps they took to acquire the necessary knowledge for completing the project. For example, Sami explained in week 4, 'Ich habe die alternativen Lösungen kennen gelernt, die unsere Aktionspläne haben können. Ich habe erfahren, was Gesellschaften, die sich für grüne Energie einsetzen, zur Bekämpfung dieser Probleme tun.' ('I learned about the alternative solutions that our action plans can have. I learned what green energy societies are doing to combat these problems').

As mentioned earlier, ICC consists of linguistic competences such as linguistic, sociolinguistic, and discourse competences, which are typically taught in language courses. In week 4, a student (Eric, week 4) from the US wrote the following entry in their journal:

Ich denke, dass es jetzt ein bisschen leichter ist, Grammatikfehler zu machen, weil wir über etwas komplizierter diskutierten. Doch erkenne ich an, dass diese Fehler ein Teil der Prozess meiner Bildung ist.

Translation: I think that it is now a bit easier to make grammatical errors because we discuss something uncomplicated. But I also recognize that these errors are part of my educational process.

The quote above indicates that the student reflected on and demonstrated language awareness and an understanding of what it means to learn a language. At the beginning of the project (week 1), Eric reflected on language and the fact that German, in his collaboration with his partner in Germany, served as the language they had in common, as his partner did not speak English. The quote below demonstrates an awareness that despite making grammatical errors, they felt comfortable communicating, and the shared learning of the language enabled them to come up with "interesting circumlocutions." Finally, this experience also resulted in the student realizing that his German language skills were better than he had previously believed.

Ich lernte, dass Sprachen ganz kräftig sein könnten. [Name of partner in Germany] kann kein Englisch, deswegen könnten wir nur auf Deutsch reden, eben mit unseren Grammatikfehler. Ich fühle mich ja bei meinem Partner wohl und entspannt – und auch begeistert. Ich finde es ganz interessant, dass ich auch mit ein Fremdsprachiger bin. Unsere Umschreibungen während des Gesprächs war interessant und hat mir gezeigt, dass mein Deutsch viel besser ist, als ich dachte.

Translation: I learned that languages can be rather "strong". Since [Name of the partner in Germany] doesn't speak English, we could only communicate in German, despite our grammatical errors. I felt comfortable, relaxed, and excited while working with my partner. It was fascinating to discover that I am also a language learner. Our use of circumlocutions during our conversations was intriguing and it revealed to me that my German skills are much better than I had previously thought.

In the reflection below, Eric wrote in week 2 in response to the journal question about the usefulness of technology for applying their intercultural competence:

Heutzutage gibt es so viele neue Technologie, um uns einander verbunden zu halten. Dieser Fakt schafft neue Erfahrungen, um über Kulturen unserer Welt zu lernen. Trotz wir verbunden mit Technologie, gibt es so viele Unterschieden, besonders beim Normen, Werte, oder Traditionen. Die Nutzung dieser Technologie würde zu einem besseren Verständnis unserer kulturellen Unterschieden unserer zunehmend globalisierten Welt führen.

Translation: Nowadays, there are numerous new technologies that keep us connected. This fact creates new opportunities to learn about cultures around the world. Despite our interconnectedness, there are

still significant differences, particularly in terms of norms, values, and traditions. The utilization of these technologies would contribute to a better understanding of our cultural differences in an increasingly globalized world.

The student demonstrates attitudes of curiosity and open-mindedness towards learning about other cultures. It can also be inferred that there is an expectation of acquiring more knowledge to develop a better understanding, which is an essential aspect of intercultural competence. Furthermore, the reflection indicates meta-awareness (MA) regarding the connection between technology and intercultural competence but also regarding their reflections on intercultural competence. For instance, one student remarked, "The use of this technology would lead to a better understanding of our cultural differences in our increasingly globalized world". Here another student ponders whose experiences are important and reliable when taking different perspectives into account, again showing meta-awareness, in this case about evaluating information:

Im Alltag wird Kultur erlebt und verkörpert – die einzigen Menschen, die eine solche Erfahrung vollständig erklären können, sind diejenigen, die unter diesen kulturellen Normen, Werten und Traditionen leben. Deswegen würde ich sagen, dass es wichtig ist, kulturelle Berichte aus zweiter Hand zu untersuchen, aber Berichte aus erster Hand sollten wörtlich genommen werden.

Translation: Culture is experienced and embodied in everyday life – the only people who can fully explain such an experience are those who live under these cultural norms, values and traditions. Therefore, I would say that it is important to examine second-hand cultural accounts, but first-hand accounts should be taken literally.

The journal excerpt from a US-based student's third-week journal demonstrates how students reflected on their own and each other's experiences within their cultural contexts. This reflection process led them to determine the topic for their action project and develop solutions that consider the diverse contexts involved. Additionally, there are indications of critical cultural awareness as the students compare different perspectives and make judgments.

In the example below, Charles shares his analysis of nuclear energy. There is an indication of critical cultural awareness because the student uses reasoning and not only takes the other student's perspectives into account but emphasizes that people from different backgrounds might have different ideas. Finally, he and his partner arrived at the conclusion that sustainable energies are the better solution.

[Name of student] lebt in ein Land das nutzt keine Atomkraftenergie, und wir in eine land das es nutzen leben. Die Ideen hinter diese Thema sind anderen fur Menschen mit verschieden Hintergrunden. Aber wir sind uns alle einig, dass erneuerbare Energien die bessere Option sind.

Translation: [Name of student] lives in a country that does not use nuclear power, while we live in a country that uses it. The ideas behind this topic are different for people with different backgrounds. However, we all agree that renewable energies are the better option.

In general, the journal entries suggest that the students actively participated in interaction and engaged in the process of discovering new knowledge. They demonstrated their ability to interpret information and relate it to various contexts. In their action project, they utilized their collective cultural and intercultural experiences to analyze environmental issues and explore potential solutions based on their respective contexts. The aim was to apply these solutions to their current contexts and address environmental problems effectively. Eric remarked:

Meine Partnerin kommt aus China, und ich fand es interessant, wie sie diese interkulturelle Erfahrung zwischen beide Deutschland und ihr Heimatland hat. Sie sagte, wie sie über Amerika schon hörte,

dass sich Amerikaner wie Chinesen um die Umwelt kümmern. Auch tun Politiker beiden Ländern so, als würden sie sich nur darum kümmern, mehr Stimmen zu bekommen. Nächsten Mal könnten wir vielleicht ein bisschen mehr über spezifische Maßnahmen und Beispiele diskutieren. Das ist ja was wir planten.

Wir legten für unsere Aktionsprojekt an ein Thema über. Wir werden über deutsche, amerikanische, und chinesische Kultur bezüglich der Umwelt diskutieren, auch die Maßnahmen darstellen, und dann was man selbst in diese andere Umgebungen machen kann, Klimawandel zu bekämpfen. [Eric, week 4]

Translation: My partner is from China, and I found it interesting to learn about her intercultural experiences between Germany and her home country. She mentioned that she had heard about Americans, like the Chinese, caring for the environment. However, she also noted that politicians in both countries often prioritize environmental issues for the sake of gaining public support. In our future discussions, we plan to delve deeper into specific measures and examples related to environmental conservation. We have chosen a topic for our action project. We will explore the cultural perspectives on the environment in Germany, America, and China. Additionally, we will present existing measures and discuss what we can individually do in these different contexts to combat climate change.

The following Table 5 shows that there seems to be a shift in some students' understanding, recognizing that the practical application of language and their project work holds more importance than the formal aspects of the language itself.

Action Components Related to ICit

In addition to the journals and the surveys, the teams also worked on collaborative Google documents in which they collected information and discussed next steps. These documents serve as evidence of students' analysis of information. They included the sources and evaluated the information based on different perspectives and the evidence they found in other sources as well as their respective experiences. Their suggested solution is based on often rather extensive analyses. In other words, the collaborative work in these documents also provides evidence of the students' application of CCA. Finally, the example below from the final report shows the conclusions Claire and her partner drew in their analysis of problems concerning access to clean water (SDG 6), showing evidence of ICit:

Der Zugang zu Wasser ist ein weltweites Problem. Es ist auch teuer, langfristige Lösungen zu finden. Dass heisst, dass die meisten Lösungen für den Durchschnittsbürger schwer zu bewältigen sind. Die Wurzel der Probleme liegt in der schlechten Infrastruktur, und das ist nicht einfach oder schnell zu beheben. Es ist nicht etwas, was Menschen in den USA oder in Deutschland jeden Tag in ihrer Gemeinde sehen, und wenn sie es nicht sehen, denken sie wahrschein-lich auch nicht darüber nach. Wir dachten, dass eine Socialmedia Kampagne dem Durchschnittsbürger helfen könnte, die Wasserkrise zu bewältigen.

Table 5 *Shift in Students' Understanding.*

Participants	Pre-Survey Response	Post-Survey Response
Participant 2	"Through the experience of other views, we can broaden our horizons as well as become even more environmentally conscious."	"Got to know American culture better."
Participant 3	"I want to improve my German and that can only happen if I practice it more."	"I have learned that meat production and consumption are not sustainable at all. We need new alternatives to reduce our meat consumption."

Translation: Access to water is a global problem. It is also expensive to find long-term solutions. This means that most solutions are difficult for the average citizen to manage. The root of the problems lies in poor infrastructure, and that is not easy or quick to fix. It's not something that people in the US or Germany see every day in their community, and if they don't see it, they probably don't think about it. We thought that a social media campaign could help the average person deal with the water crisis.

As can be seen in the example above, the students' use of ICC to engage in action to address a societal problem of their choice and the actions proposed clearly demonstrate that the current project successfully achieved the goal of fostering ICit in the VR-VE project. To complete the assignment, i.e., plan their action project and also present it and write a report on it, students had to explain how they interpreted the information they gathered. Because students from different backgrounds collaborated with each other, and because they were also instructed to take different viewpoints into account, they had to use their reasoning to make judgments based on specific evidence.

The following are the problems the students chose to address:

- What can each one of us do for climate protection? (Was kann man individuell zum Klimaschutz tun? Perspektiven in China, den USA und Deutschland.)
- Energy for remote African communities (Energie für Abgelegene afrikanische Gemeinden).
- Sustainable Cities (USA, Germany) (Nachhaltige Städte (USA, Deutschland)).
- Sustainable Cities (China, Germany, Sri Lanka).
- Sustainable consumption and production patterns in the global meat industry (Nachhaltige Konsum- und Produktionsmuster in der weltweiten Fleischindustrie).
- Clean and affordable energy in the USA and Germany (Saubere und bezahlbare Energie in den USA und Deutschland).
- Clean water and sanitation (Sauberes Wasser und Sanitäreinrichtungen).

Some students had already taken action in relation to their projects by the end of their six-week collaborations. For instance, one group organized and executed an event at their university in the US focused on promoting sustainable cities by reducing carbon footprint. They designated a section of their university campus and arranged activities like biking, skateboarding, and walking. They provided campus maps, conducted walking tours, invited guest speakers to talk about biking in a nearby city, and awarded prizes such as electric bikes. Another group had initiated the planning of an app that aims to create awareness about the lack of access to clean water in certain communities. Another group conducted a survey on the consumption of meatless products as substitutes for meat to assess the awareness of such products among members of their community. All groups demonstrated thorough consideration of how to address their chosen SDG. They gained insights from diverse perspectives and engaged in outreach activities, which formed the action component of their projects. Applying their ICC constitutes ICit, i.e., addressing a societal issue in the here and now.

Regarding research question 2 ('What are students' perceptions of the usefulness and impact of VR in discussing environmental issues and sustainability?'), several students commented that the atmosphere was relaxed when they talked with their partners, which can be conducive to facilitating interactions. Some students suggested that meeting in VR aided their interaction with their partners. One student felt that "the [VR] environment facilitates communication." Another student felt that "it was useful to develop your ideas and to get to know other cultures".

The survey results indicate that 11 out of 13 participants who completed the survey felt that VR was useful for their ICC. One student commented that using VR made it easier for them to meet new

people and discover different cultures. Another student reflected, “It helps me learn about several cultures.” Furthermore, one student pointed out that while VR may not directly support intercultural competence, it was generally “very helpful in the sense of debates, discussions and the research behind them.” Another student remarked that meeting up felt less like a meeting and more like a conversation.

The researchers selected a participant’s journal entries to explore the perceptions of the usefulness and impact of VR for discussing environmental issues and sustainability. A student in the US, Terry, submitted a total of four journal entries. Terry’s entries indicated that he appreciated the good relationship with his partner and was also, at the same time, highly focused on the outcome of their collaborative work. In his third journal entry, Terry shared that things were going well, that VR was still “very, very, very new,” and that he was gradually getting used to it. Terry explained his motivation in his third entry, mentioning that he was part of an interest group at his university that focused on advocating for more infrastructure for public transportation. He expressed that the choice of topic for the presentation with his partner aligned well with his work for the interest group. In Terry’s first journal entry, he identified the shortcomings of VR and shared his and his partner’s plan to use VR to “say hello” and discuss certain aspects that could be addressed without relying on notes, due to the technical restrictions of the VR tool they were using. Terry mentioned that they would then switch to Zoom for a more detailed discussion, collaboration on Google Docs, internet research, and working on their presentation. Interestingly, in Terry’s last entry, he mentioned encountering a technical issue with his laptop, which prompted him and his partner to switch back to VR for their discussion. This suggests that Terry had become accustomed to VR and perceived it as a valuable alternative to communicating via Zoom.

One student, Sami, describes the usefulness of VR for feeling connected (week 4): ‘VR hat uns geholfen, eine entspannte Atmosphäre zu schaffen, während wir unser Projekt besprachen. Das war etwas anderes als die Videoanrufe, die wir gewohnt waren. Die Gespräche fühlten sich an, als ob wir uns im selben Raum befänden. ’ (‘VR helped us to create a relaxed atmosphere while discussing our project. It was different from the video calls we were used to. The conversations felt like we were in the same room’).

Discussion and Conclusions

This study aimed to explore students’ intercultural encounters in VR with a focus on the students’ application of ICC to engage ICit in a VR format. Additionally, the study explored students’ perceptions of the usefulness and impact of VR videos in discussing environmental issues and sustainability. The results revealed that in the VE projects using VR, students applied their ICC. To our knowledge, this is the first project that extends VE collaborations in VR with a focus on intercultural citizenship. Research on traditional VE collaborations has shown their benefits for fostering ICC (e.g., Byram et al., 2017). This project confirms that VE in VR has the potential to foster ICC and ICit. As demonstrated in the results, the comments in the journals, as well as the products such as presentations and reports, provide evidence of attitudes of openness, curiosity, and tolerance of ambiguity among the students. Additionally, students actively engaged in skills such as interpreting and relating, as well as discovery and interaction, which allowed them to demonstrate and acquire knowledge throughout the process.

Finally, to develop solutions for the problem chosen in their final project, students needed to apply their critical cultural awareness. They demonstrated the ability to suspend judgment, gather information from different perspectives and various sources, and use specific evidence and logical reasoning to make informed judgments. These elements are crucial components of critical cultural awareness (Byram, 2021). This provides a tentative response to research question 1 (‘How do students apply knowledge, skills and attitudes of ICC and actions of ICit in a Virtual Reality – Virtual Exchange project?’). The fact that students had different cultural backgrounds, hailing from seven different countries

(Andorra, China, Egypt, Nigeria, Syria, Turkey, and the United States), potentially offered additional opportunities for students to encounter and reflect on differing perspectives, thereby potentially positively impacting their intercultural awareness. Additionally, in some groups, German was indeed the only common language. This provided an authentic opportunity for students to communicate in the target language. As we shared in the results, some students commented on aspects of language in their journal entries. Byram (2012) emphasized that

> "language and culture education and citizenship education can and should complement each other; the former bringing an international and intercultural perspective, while the latter bringing an emphasis on social agency to be realised in the here and now. Combining these two perspectives ensures that the 'here' is not just 'our community and country' but intercultural, and that the focus is on language and culture learning for 'now', and not just for some future application in the so-called real world." (p. 11)

While there is not enough data to discuss language awareness in more detail, there are indications that through the project students had the opportunity to consider the intersections between languages, cultures, identities, and social agency.

In response to research question 2 (What are students' perceptions of the usefulness and impact of VR videos in discussing environmental issues and sustainability?), the findings are encouraging because the VE in VR was perceived as a helpful environment for applying ICit, as evidenced by some participants' journal entries and surveys. The relaxed and enjoyable atmosphere in the virtual spaces used during the project appears to play an important role in facilitating interactions on their chosen environmental issues. Some students had mentioned the wish for the chosen VR environment to include the option of using interactive tools through which they could share their research. In the current tool, they had to take off their headsets to look at their notes. The researchers engaged in a similar project the following year and were able to locate a VR platform (Engage) that allowed the students to share their digital research notes during their meetings. The study, therefore, suggests that VR can be useful in a VE context focusing on sustainability and other topics. However, educators need to be aware that individual differences are likely to play an important role in this respect (Gruber et al., 2023).

Some answers indicate that students felt confident speaking the target language in VR. VR research has found that foreign language anxiety, which can be inhibiting for second language learners (Riemer, 2016), can be lowered in VR (Kaplan-Rakowski & Gruber, 2023; Thrasher, 2022). This may have contributed to students feeling more comfortable discussing their chosen topic in the target language. It is important to note that students mentioned that they enjoyed the casual atmosphere and that they felt comfortable with their partners. Although this was not a research question, the finding has the potential to shed light on the potential of VR and VE in helping students engage in authentic situations in language education.

Additionally, the responses of the three students who completed the pre-project and post-project surveys point to an interesting potential of such projects: When students were asked about their expectations regarding what they would like to learn, they focused on "language and culture" before the project. However, all three students then commented on the bigger takeaways, specifically concerning what they can do for their specific SDG. This could be indicative of a new understanding of what language education can achieve. In other words, it is not just about learning the language itself, but rather about utilizing the language to take action, which can become the primary focus.

This pilot study has some limitations. First, while the students in the United States were a cohesive class, the students in Germany were individual participants who were recruited for the project, which

could have influenced their level of engagement. Additionally, this study primarily collected qualitative data. To obtain potentially more generalizable findings, a larger sample size would be necessary. Second, the novelty effect, which refers to the tendency for individuals to show increased interest and/or performance when encountering a new phenomenon, such as the introduction of new technology (Tsay et al., 2020), may have positively influenced the students' level of engagement in the project. Therefore, longitudinal studies are desirable to examine student engagement and progress when novelty is no longer a factor.

Third, the researchers did not have access to video recordings of the conversations in VR. As a result, they had to depend on the students' perspectives gathered from multiple data sources during the analysis of the findings. The surveys, although used, were not as informative as desired due to incomplete participation in the pre-project and post-project surveys by some students. Furthermore, in certain survey results, there was a mismatch in the individual codes that students were supposed to create. This was intended to help researchers match pre-project and post-project surveys. The misalignment suggests that the chosen coding system might have been ambiguous or challenging for students to recall.

In the future, technological advancements such as synchronized full-body tracking combined with tactile and olfactory feedback could enhance users' VR experience during VE projects. These developments have the potential to refine how participants engage with each other in the virtual space, interact with materials on SDG topics, and collaboratively design VR content for their action plans. To substantiate these possibilities, further empirical research is essential. Moreover, incorporating a virtual character with artificial intelligence capabilities to provide learners with information on their selected SDG topics and assist in the learning process presents a promising avenue for exploration. Investigating the impact of such a virtual character on interactional dynamics in the context of a VE could yield valuable insights.

Future research, building on the current project, could also examine long-term collaborations between cohesive classrooms using VR to study students' ICC and ICit development. Video recordings of VR interactions, along with focus groups or interviews, would provide valuable insights into the direct impact of VR technology on students' linguistic development, intercultural pragmatic skills, and intercultural communicative competence.

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