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Article

Experimenting with a Multi-User Virtual Environment for Collaborative Online International Learning: A Case Study from Ireland and Norway

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Abstract

This study applies Computer Supported Collaborative Learning (CSCL) as an analytical lens to explore the extent to which a Multi-User Virtual Environment (MUVE) platform could facilitate collaboration

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within the context of the Collaborative Online International Learning (COIL) framework. Students from University of Limerick (UL) and Oslo Metropolitan University (OsloMet), used the OpenSimulator MUVE platform for collaboration. The students were divided into four groups comprising a mix of students from both universities. Methodologically, this case study is informed by pre- and post- survey data, screen recordings from two plenary sessions, as well as a final oral presentation and discussion in OpenSimulator. Findings show mixed experiences by the students and point to three pillars of project design that can facilitate CSCL: the platform, the international dimension, and opportunities for collaboration. While students reported that being represented as an avatar had some positive affordances over other video-based platforms, students also faced usability challenges with the platform. In terms of internationalisation and collaboration, students valued working with peers from another country, with their interactions mediated by a platform they otherwise would not have used. Overall, findings show that factors such as time, the usability of the MUVE platform, the assigned task, and the international dimension, are all essential considerations when using a MUVE to facilitate COIL projects.

Keywords: Collaborative Online International Learning (COIL), Multi-User Virtual Environment (MUVE), Computer Supported Collaborative Learning (CSCL), higher education

Introduction

Collaborative online international learning (COIL) is a “teaching and learning paradigm” (Rubin, 2017, p. 33) where instructors design projects that enable students in different countries to collaborate online. Originated and developed by the State University of New York (SUNY), COIL provides a framework for students and instructors to collaborate, learn and discuss across cultures and physical boundaries (SUNY COIL Center, n.d.). The COIL model thus “enables faculty and students to collaborate with global peers through co-taught, culturally focused online learning environments to achieve intercultural awareness, knowledge in discipline-specific content, and skills in communication and group collaboration” (Vahed & Rodriguez, 2021, p. 596). When designing COIL projects, instructors need to agree on common learning outcomes, manage a project within the constraints of different academic calendars, and orchestrate a valuable learning experience (Rubin, 2017; Vahed, 2022). As such, COIL is a unique methodology as it involves educators co-designing and co-teaching collaborative learning activities with an emphasis on intercultural competence development and curriculum content learning. Students may find COIL projects demanding due to the challenges of working on a shared task while navigating time differences, busy schedules, technology (Appiah-Kubi & Annan, 2020; Flammia et al., 2016; Vahed, 2022), trust (Jarvenpaa & Leidner, 1998), behaviour (Anawati & Craig, 2006), and possibly language barriers (Vahed, 2022).

Nevertheless, research suggests that the many benefits of participating in these projects more than compensate for the challenges. A key benefit is facilitating internationalisation at home, a concept that has become important for universities, where students remain in their home institution while learning with an institution abroad (Mittelmeier et al., 2021; Mittelmeier & Yang, 2022). COIL projects enable international and intercultural experiences in situations where physical mobility would not be possible, e.g. for financial reasons, sustainability, lack of space for an exchange semester in the study programme (Rubin, 2017), or because of family commitments (Ceo-DiFrancesco & Bender-Slack, 2016). Several studies indicate that COIL projects are an effective means of improving intercultural understanding (Hackett et al., 2023; Vahed & Rodriguez, 2021), and indeed they may lead to better project outcomes (Appiah-Kubi & Annan, 2020). In addition, COIL projects are administratively manageable, as students receive credit for participating from their home institutions.

In autumn 2023, teacher education students from OsloMet collaborated with technical communication and e-learning students from UL, using a Multi-User Virtual Environment (MUVE) platform. The aim of this COIL project was to develop the students' intercultural competence and enable them to engage with the curriculum through collaborative learning activities. Set within this context, we designed a research study to explore this question: to what extent does a MUVE platform facilitate collaborative online international learning? This study focuses on student activities when using the platform for interaction and collaboration, as well as their feedback and reflections about using such a platform for international online collaboration. We used Computer-Supported Collaborative Learning (CSCL) to inform project design and analysis.

The next section describes research on MUVEs before introducing CSCL. We then describe the project and research design, discuss our key findings, and outline the implications for future research, and recommendations for similar projects.

Multi-User Virtual Environments in Education

As distinct from most virtual reality (VR) technologies, where users interact with the environment through special glasses, a Multi-User Virtual Environment (MUVE) is a type of metaverse that is mostly computer-based. A MUVE is configured as a three-dimensional (3D) environment in which individuals, represented as avatars, navigate and interact with people and objects in the virtual environment using a computer with a keyboard, mouse, microphone, and speaker. Examples of MUVE platforms include OpenSimulator (the subject of this paper) and Second Life. A distinct feature is that MUVEs enable users to modify the appearance of their avatars in the environment.

When signing up for these services, the user goes through a setup process where they are asked to choose gender, age, skin colour, hair colour, and clothing. Much like role-play, individuals can choose to portray themselves as close to, or quite distinct from, their sense of their personality (see Figure 1).

Figure 1. Selection of different student avatars

Educators have used MUVEs for online teaching in higher education for many purposes, from teaching to professional preparation (Wang & Burton, 2013). MUVE environments enable instructors to create authentic learning activities that incorporate collaboration, simulation and role-play (Mørch et al., 2016). Virtual environments in education have the potential to offer a semi-realistic preview of equivalent real-life situations by enabling users to handle challenging scenarios in a virtual setting. This method approximates certain aspects of real-life situations that might otherwise be impractical, costly, and/or risky to perform in person. MUVEs amplify the sense of 'being together' because avatars 'move' through the virtual environment supported by non-verbal signals (Allmendinger, 2010; Wang & Wang, 2008).

Some pioneering work from the early 2000s deals with creating online communities for pre-service teacher training and for in-service professional development (Bronack et al., 2006; Bull et al., 2004; Schlager et al., 2002). The findings from these studies show that underlying pedagogy is vital, and that such systems must mirror existing professional physical contexts to foster professional development. MUVEs have also been used in education to support students' understanding of history (Squire & Jenkins, 2003), explore mathematical concepts (Elliott, 2005), and strengthen

students' engagement in scientific inquiry (Clarke et al., 2006). Findings from these studies show that MUVEs can provide powerful learning experiences by motivating and enabling students to employ their creativity. In one recent study, MUVEs were used to facilitate problem-based learning among student teachers by comparing the video-based teaching platform Adobe Connect with Second Life (Mørch et al., 2016). The authors concluded that Second Life was less intimidating for shy students who could conceal aspects of their real-life personality behind avatars. A study by Espitia et al. (2021), investigating the use of Second Life for teaching veterinary medicine, highlighted that the students became more engaged in critical thinking and problem-solving, hence strengthening their interpersonal communication and professional competence. Pasfield-Neofitou et al. (2015) investigated the potential for virtual environments to broaden the understanding of embodied and extended cognition in the context of language learning. They identified characteristics of the combination of mind, avatars, and virtual environment, and concluded that students do not make a sharp distinction between their avatar and real identity and that the boundaries between the virtual representation and real life were highly permeable. Tlili et al. (2022) undertook a systematic review of the use of metaverses in education, examining types of metaverses, disciplines, and learning scenarios where they are used, how students' digital identities are represented, and the impact and challenges of using them. According to Kuznetcova and Glassman (2020), research concerning MUVEs has emphasized the evaluation of students' emotional and motivational reactions, as well as their accomplishments across a wide spectrum of fields. However, there is little (if any) research on using MUVEs for collaborative online international learning.

Computer Supported Collaborative Learning

Computer Supported Collaborative Learning (CSCL), the analytical lens applied in this study, is an umbrella term for various educational approaches involving students' collaborative learning and how collaboration processes can be mediated by computers in diverse contexts and at different scales (Steier & Davidsen, 2021). The common denominators for studies and approaches connected to CSCL are that learning is a fundamental social process, and meaning-making among peers occurs through talk and interaction in specific situations that include other learners, digital tools or digital infrastructure (Dillenbourg, 1999; Laal & Laal, 2012; Stahl et al., 2014). Contextualised within CSCL, learning is supported through content, self-regulation, social regulation, and the design of digital tools or digital infrastructures (Ludvigsen & Steier, 2019). Digital tools and/or infrastructures play a pivotal role in this scenario as mediating instruments, akin to language, wherein interactions among learners and artefacts emerge as a central focus. At the same time, educational designs, such as group composition, students' roles, and the framework for communication

(synchronous/asynchronous, face-to-face/online), are equally important in supporting learning activities (Koschmann, 1996; Mørch et al., 2016).

Stahl et al. (2014) emphasised five basic, often overlapping activities connected to CSCL: 1) information sharing; 2) interaction; 3) negotiation; 4) establishment of joint meaning-making; and 5) construction of common artefacts. These five activities can frame a learning narrative among a group of learners, mediated by technology (Engen et al., 2018; Mørch et al., 2018). These activities support successful Communities of Inquiry (CoI), as a CoI necessitates not only teaching presence but also learners' cognitive and social presence, which are mediated using technology (Garrison et al., 2000; Hernández-Sellés et al., 2019). While a large proportion of research related to CSCL involves a shared physical environment and a small group focus, e.g. learners sharing one screen, some interventions move beyond face-to-face arrangements towards online platforms (for an overview, see Steier & Davidsen, 2021). This study aims to address a dearth of research exploring Collaborative Online International Learning (COIL) mediated by a multi-user virtual environment (MUVE), using CSCL as the analytical lens.

Methodology

This section describes how we designed the COIL student project, the types of data collected, and the steps followed when analysing the data.

COIL Student Project Design

In autumn 2023, 31 master's students (22 from UL and 9 from OsloMet) participated in a COIL student project. In this four-week project, the UL students were taking a core module in Learning and Collaboration Technologies and were required to participate in the project as part of their coursework. The OsloMet students, who were taking a course on Multimodal Design, were strongly encouraged to participate. The students were divided into four groups, ensuring two or three students from OsloMet, and five or six students from UL in each group. Although we would have preferred a more even distribution of participants from both sites, we had to work with the enrolment numbers in both groups. We did not ask students to state their genders so did not factor gender into the group formations. Table 1 shows the demographics of each group.

Table 1. Demographics of Project Teams

UL	OsloMet	Total
22 students	9 students	31 students
Course: Learning and Collaboration Technologies	Course: Multimodal Design	
Programme: MA in Technical Communication and E-Learning	Programme: Digital Learning Design	
Five or six students in each group	Two or three students in each group	Four groups in total

Because the UL students were studying how to develop training content and communicate online, and the OsloMet students were in-service teachers focussing on digital learning design, there was some natural crossover in the programme content as they all shared a common interest in learning, usability, and collaboration in digital environments.

We designed a COIL project with the goal of enabling students to collaboratively develop a presentation (the COIL task) about their experiences using a MUVE platform for international collaboration. The MUVE platform we used, OpenSimulator, is an open-source, low-cost platform, which is not part of the standard IT infrastructure at either institution—however, the instructors at OsloMet managed the platform, which was designed to look like a university campus (see Figure 2).

Figure 2. OsloMet Virtual Campus in OpenSimulator

The project, by design, incorporated the five CSCL activities of information sharing, interactions, negotiations, joint meaning-making, and the production of common artefacts.

As COIL modules typically comprise several phases (SUNY COIL Center, n.d.), we incorporated those phases into the project, as outlined below:

1. A kick-off meeting, where students were introduced to one another, to the OpenSimulator platform, and to the project itself. The students interacted to complete some group formation tasks within the platform (these tasks will be discussed in the 'Findings' section).
    - The purpose of these activities was to facilitate icebreaking, information-sharing, and negotiations to agree a common understanding about the project task. Such preliminary discussions are also essential for COIL projects to succeed.
2. Over the next three weeks, students interacted with their own group without instructor intervention in OpenSimulator to research the usability of the platform and develop a presentation.
    - During this period, students engaged in the joint meaning-making tasks of collaboration, application of knowledge, creation, and discussion.
3. In the final week (week 4), students delivered their presentation (the common artefact) in OpenSimulator.
    - Presentations were followed by a group discussion reflecting on their experiences.

While information sharing and interactions were facilitated in the formal live sessions at the start and end of the project, and could therefore be recorded, negotiation and joint meaning-making also occurred privately, as individual groups developed their presentations**.** Attending the live sessions and collaborating on the presentation formed part of the assessment for both programmes. While attendance was noted, students did not lose marks if they could not attend due to an unforeseen personal event or technical issue, but all students were expected to contribute to the development of the presentation. An extract from the COIL task is provided in Figure 3. As all the students had studied usability, we asked them to research one sub-topic of usability and refer to relevant theory when describing their experiences.

Figure 3. Excerpt from the Assignment Brief Outlining the COIL Task

COIL Task

You will be assigned to a group before the project begins.

In your group, select one or more topics from the list below.

Prepare a 10-minute presentation, analysing how your experience of Open Simulator relates to the topic(s) you explored. Consider these questions:

- In what ways did your experience mirror the theory?
- How did your experiences differ from the theoretical position(s)?
- How can your experiences extend the theory?
- How could a simulated environment be improved/ enhanced to better reflect the theory?

Refer to relevant readings in your presentation.

Suggested Topics

- Emotional design
- Feature/function creep
- User experience
- Minimalism/minimalism heuristics
- Design principles
- Information processing
- Cognitive load
- Schema theory and memory formation
- Usability
- Non-human agents/AI
- End-user development

Data Collection

To respond to the research question on the extent to which a MUVE platform facilitates collaborative online international learning, we collected qualitative data from various sources. The

project design was approved by the ethics committees in UL and OsloMet and all students consented to participate in the project.

The instructor-led activities that took place in OpenSimulator were screen recorded by one of the instructors. These recordings encompassed all the activities where the whole group was attending, including the introductory session in week 1, the student presentations in week 4, and a final reflective discussion in week 4, where students discussed their experiences of the project and platform. Because we did not want to interfere with group dynamics, and we had designed opportunities for negotiation and interaction into the first and final live sessions, we chose not to record individual group sessions in the intervening weeks.

Immediately after the first session in OpenSimulator, we shared a pre-survey link with the students. Nineteen of the 31 students responded across the four groups (five from Group 1, four from Group 2, five from Group 3, and five from Group 4). Students were asked which group they were in; their initial impressions of the platform; their expectations for the project; their impressions of the icebreaker activity; and any other thoughts and reflections.

After the final group session, a post-survey asked their location; which group they were in; their impressions of the COIL project as a whole; what they liked most/liked least most about the platform; what they thought of other groups' presentations; the most valuable learning outcome from the project; and any other thoughts and reflections. Twelve of the 31 students responded to this survey (two from Group 1, three from Group 2, five from Group 3, and two from Group 4). For both surveys, questions were open-ended and qualitative.

Data collection and analysis used the following process:

1. We recorded the two live sessions in OpenSimulator. The week 1 live session was split into two recordings; week 4 was also split into two sessions—one for the student presentations and the second for a reflective discussion, resulting in four recordings in total.
2. The recordings were transcribed using computer-assisted qualitative data analysis software.
3. Each COIL instructor (n=4) took responsibility for reviewing one transcript and video recording, first to assure the quality of the transcript and second to search for evidence of CSCL in students' comments. One instructor also took responsibility for reviewing the pre- and post-survey feedback for evidence. While CSCL activities also occurred within individual group sessions, as those sessions were not recorded, we did not have access to that data.
4. In searching for evidence of CSCL, we each thematically coded the transcripts and survey data based on students' descriptions of their experiences and processes.
    - During the coding phase, students were assigned pseudonyms (ISx refers to UL students and Nx refers to OsloMet students).
5. We then discussed our coding processes and interpretations of the data, thereby strengthening validity of our interpretations through researcher intersubjectivity.

Findings

In this section, we present the findings in chronological order, according to the sequence of COIL activities in our project. Evidence of CSCL activities (Stahl et al., 2014) is embedded throughout the narrative, followed by interpretative comments.

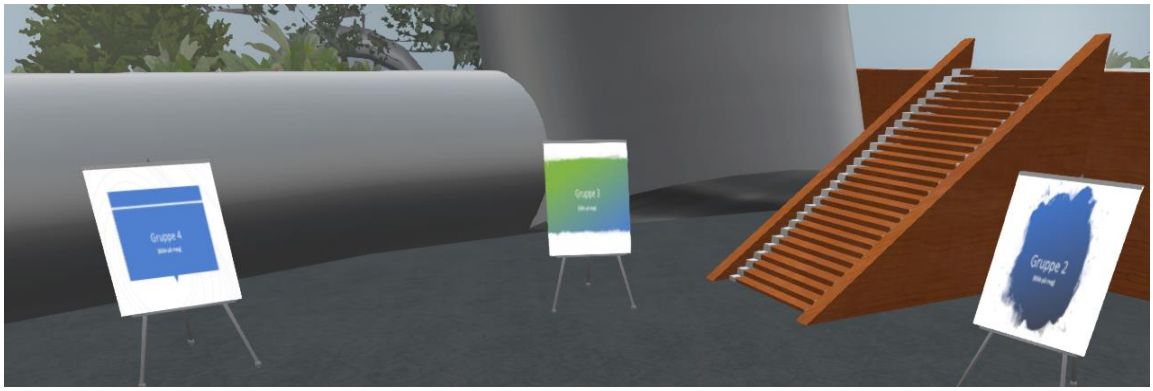
Kick-off Meeting

Before the initial kick-off meeting on OpenSimulator, students received written and oral instructions on how to access OpenSimulator and the dedicated virtual campus, because most of them had no prior experience using a MUVE. In the first 18 minutes of the first 45-minute session, we instructed students on how to use the platform—how to move around, use the microphone, sit on chairs, etc. Although students had been encouraged to prepare for the technical aspects of the virtual world before attending the first session, few seem to have followed the recommendation. By the time most students had reached the virtual lecture theatre, and the instructors had started to introduce the project, a handful of students were still struggling to reach the lecture hall, others had audio-visual problems, and others were unable to sit down. Several times, the presentation was interrupted by students who needed help, which limited the time available to explain the assignment. We bring these various challenges to attention to highlight the dual, if not triple, level of complexity for the students—they needed to interact and communicate in a virtual (technical) world, understand the project requirements, and get to know students from another country/culture. For the OsloMet students, a further level of complexity was added because all communication was in English.

Undertaking Initial Tasks

In the second hour of the kick-off meeting (following a 15-minute break), we introduced students to the first task, with the aim of facilitating information sharing and interactions. We sent the student groups to dedicated locations across the virtual campus to ensure groups remained isolated from each other (as would be the case if they were attending a real campus) and to ensure audio feedback from different groups did not prove distracting. This intervention contrasts with video-based teaching platforms like Microsoft Teams and Zoom, which have inbuilt functionality for group breakout rooms. The students were instructed to mouse click on a virtual flipchart corresponding to the group number to which they belonged (see Figure 4).

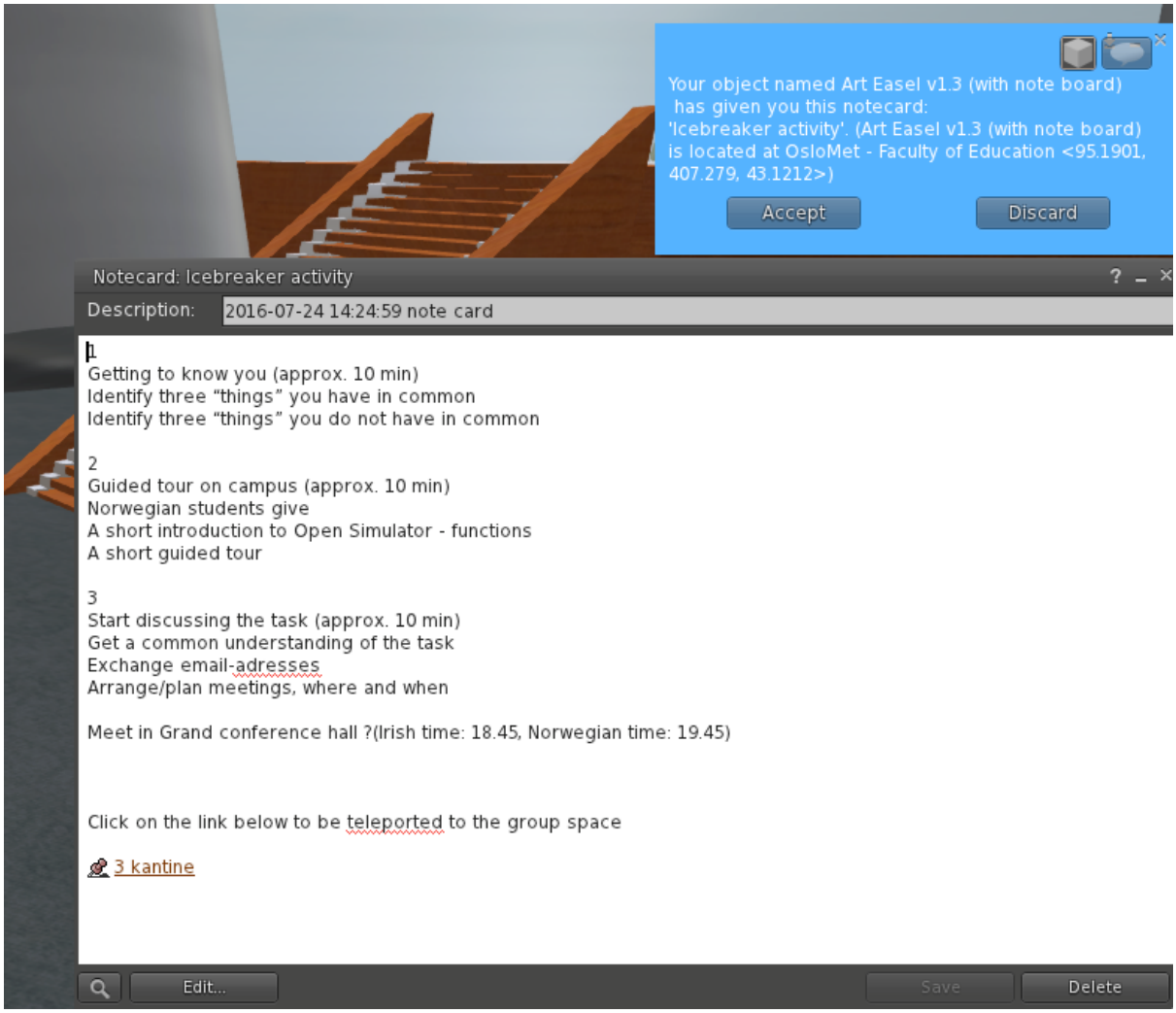
Figure 4. Flipcharts for selecting group tasks



The flipcharts enabled students to accept a note card connected to their individual avatar. The instructors had to provide a lot of support to make sure that all students picked the right note card and fully understood how to proceed, thereby adding to the technical complexity of the project from the instructors' perspectives.

The thirty-minute group task was divided into three activities (see Figure 5). In the first 10-minute icebreaker activity, students had to identify three things they had in common and three things they did not have in common. This activity was followed by a 10-minute activity where the OsloMet students, who had more experience of the platform, would demonstrate the platform to the UL students. The final 10-minute activity required students to consider the project requirements and how they might meet the project goals by the deadline. Our aim for these activities was to encourage and facilitate information sharing, interactions using the platform, and negotiations about the project itself (CSCL activities 1-3).

Figure 5. Note card for the icebreaker activity



After thirty minutes, the students were called back to the lecture hall for a summary. We checked that students had understood the project requirements, exchanged contact information, and made appointments for further work.

Summarising the First Session

The students were asked to summarise their group experiences. Group one had technical challenges, mostly with audio, so they did not have much time to discuss the task, as explained in this quote from NS1:

> We didn't have time to talk about it. I think we had some issues with the microphone. [...] Well, we talked a little, but it was mostly about technical stuff. So nothing to share, actually.

Group two had a more productive project discussion, as NS4 explained:

> Yeah, we talked through all three tasks. Found something we have in common and something we don't. We have exchanged contact information, made a Google Drive to collaborate. And we had a very short mini tour. So pressed for time. It was just get back here as fast as possible.

IS11 summarised group three's activities as follows:

> Luckily, we were able to chat a bit and we did identify three things we have in common and also three things that we don't. We didn't do a tour, but we did exchange details and arranged a time to meet and everything. So we got to know each other.

Finally, group four also succeeded in completing the task:

> Yeah, we had a good chat. We found the three things we had in common. We're all students. We all like technology. We all like reading. And things we don't have in common. We all have different jobs, we're all different ages. And we all live in different countries (IS18).

Following the group summaries, we asked students if they had questions or overall impressions. Due to the technical challenges some students encountered, one instructor demonstrated key navigation features again (how to open URLs, how to fly, how to open a web page via an interactive display, and how to zoom). We concluded this session by reminding students of the guest lecture in OpenSimulator the following week, and where they should convene for that session. We advised them to familiarise themselves further with the environment, and to use it as much as possible for collaboration. We also advised them to practice their presentations within OpenSimulator, as it is different to video-based platforms, especially in terms of presentation dynamics (e.g. where to stand beside the presentation whiteboard). We concluded with some final technical observations relating to the platform.

Pre-survey Feedback

The survey data indicate that students' initial impressions of the platform were mixed—some were interested in its potential, but others found it "clumsy", "convoluted", and "very tricky and awkward to figure out". Others felt it might take time to learn to use it. Respondents who noted the interaction and information sharing aspects of the project were positive: "Get to interact with students from Ireland!", "I'm looking forward to the collaboration between the group members", and "[l]earning from others who are taking a completely different course. Getting different perspectives". Other positive responses focussed on culture, saying "...perhaps learn more about education in another country", "collaborating and learning across national borders and culture. Practice my English a bit 😊 ", and

> I expect to learn a lot from this project and to gain insight from the other students perspectives and to observe our differences and what we have in common when it comes to working on this project.

As some groups could not participate in the icebreaker activities for technical reasons, we received less useful feedback about those activities. The following responses relate to time and expertise using the platform: “Good activities but far too little time. We as guides have too little experience and knowledge of the platform beforehand” and “Quite okay, it was more of a “we have to do this”. Maybe instead an icebreaker that focused more on introducing each participant in the group”.

Finally, when asked for other thoughts or reflections, those who responded tended to focus on the technology and time challenges, as evidenced here:

> A lot of time is spent figuring out technical things for many of the participants, and this can lead to a lot of waiting and downtime. I’m reflecting on whether the utility of OpenSim outweighs the challenges and frustration that come with it. (I haven’t concluded yet!).

This comment was more hopeful: “I hope that we learn how to use the platform quickly so that we can get optimum use out of it”.

We can conclude from the first session and the pre-survey feedback that due to the various technical issues, students focussed on solving practical issues first and, in doing so, they interacted and shared information. Some also expressed positive expectations about the project. However, some groups did not successfully complete all the prescribed tasks. The lack of sufficient time for the tasks, which was already emerging as a theme in the first session, is a consideration for future projects.

Final Session

The final session in the fourth week of the project was for group presentations and a wrap-up discussion. This session began with some confusion, as one group of students and instructors met outside the Grand Conference Hall building while another group gathered inside the building. This situation was rectified quickly, and the session began after 5 minutes with a brief welcome. Then, the groups assembled in the building where the students' presentations were displayed on whiteboards (see Figure 6). After 11 minutes, everyone was present, and the session started. In retrospect, we recognise the need for clarity about meeting locations to avoid wasting time. In this kind of virtual environment (unlike others such as Teams or Zoom meetings), instructors need to be even more explicit about the meeting place, as students could end up in many different locations.

Figure 6. Students attending a group presentation

Group Presentations

The task of developing the presentation (the common artefact) was designed to engage students in all five CSCL activities. The presentations began with Group 1 after 13 minutes. It should be noted that this group had reported the most problems in the initial kick-off meeting and survey. The first presenter had some audio issues; only some people could hear her. Another group member spontaneously volunteered to present her part of the presentation, possibly indicating that the students felt a collective ownership of the presentation. Further supporting this interpretation was the presenter's use of first-person plural and active verb expressions, like "we examined", "we were trying to look at", "we explored" and "to our experience", which suggests that a joint meaning-making activity must have taken place. For example, when analysing the usability of the platform, the presenter (NS3) said: "In our experience with the platform, we found ... the point click feeling in the simulation to be inefficient." NS3 also said "[a]s a group we found it difficult to remember how to perform certain tasks when returning to the program, like teleporting for example."

Group 1 provided a thorough and insightful analysis of OpenSimulator's usability based on the readings they chose as a group. Their analysis was quite negative on the usability issues of the platform. Some participants in this group could not get the sound to work properly, thus reporting limited interaction in OpenSimulator. The students also compared the use of OpenSimulator with their experiences of net-based video conference systems, with one student (NS3) stating that:

> The simulation seems more prone to errors than the alternatives we've used, albeit we haven't tried any simulations in this form. We're referring to Zoom and Teams and other complementary simulations instead of the interaction ones.

The Group 1 presentation was followed by some intriguing comments from the group members, when prompted by the instructor to reflect on their experiences of using the platform. The students highlighted that they had mostly used the platform to watch PowerPoints and listen to lectures, which was challenging because they had to position themselves right and angle their view to see the presentations properly. One of the students (NS3) suggested an even more creative and interaction use of the platform:

> I would be thrilled to try the platform with another perspective or some other tasks, like try to construct something or interact with the world in another way than just moving around and watching presentations.

Group 2 conducted a similar analysis, also using the course literature on usability, presenting a thorough academic analysis of OpenSimulator. They too demonstrated negotiations and a common understanding of the platform referring to what the group had “discussed”, “talked about” and “found”. They were also quite negative but had more balanced critical commentary. For example, they reflected on how the platform facilitates communication (information sharing) and interaction between participants. The presenter (IS8) said that it: “[f]elt that users were encouraged to interact and participate more than they would be on other communication platforms.” This student also noted that: “It allowed for students who wouldn’t normally cross paths the opportunity to interact, to learn, and even to teach each other.”

IS8 also commented on how the difficulties of using the platform actually encouraged communication within the group and between instructors and students: “The need to collaborate and to work together to work around any issues certainly served as an icebreaker.” This group member also said that “[s]tudents and lecturers were forced to interact to support each other.”

Finally, another student from Group 2 (NS4) explained how they experienced the platform and emphasised the use of alternative platforms:

> We didn't see that this gave us something more than Teams did. We had some conversations on Teams, too. So if ... maybe this program has been a bit updated, we ... have a little bit less difficulty using it without issues. [...] But using Teams and everything is just smooth and you can collaborate using office programs and so on.

Group 3 presented a discussion of usability, user experience, and design principles. The first presenter, a UL student, explained how they had approached the presentation. This group split the task, so that each team member analysed their experiences of the platform with respect to one or

two design principles. Splitting the task in this way indicates that they negotiated on an organisational level.

After the first speaker's piece, one of the OsloMet students was assigned to continue the presentation but when it came to his turn, we discovered that he was not in the meeting. After a brief pause, another UL student stepped in and continued the discussion, exploring how they perceived affordances, signifiers, mapping, feedback, and discoverability on OpenSimulator. Again, this willingness to take on the responsibility of presenting, when another team member could not, suggests a shared ownership of the presentation. By the end of the presentation, the OsloMet student who should have presented arrived at the meeting and was welcomed by the whole team. His showing up, even late, also demonstrates a commitment to the project and team consistent with the CSCL ethos.

The content of the Group 3 presentation was a largely negative appraisal of the platform's usability, though the presenters did comment that they could imagine using OpenSimulator for teaching.

Group 4 delivered a presentation on user experience and minimalism in the platform. By this point, there was a sound problem in the platform and some background ringing was audible. Two UL students delivered this presentation, again focusing on usability features, and again with largely negative evaluations of the platform's usability. There was clear evidence throughout this presentation that students had negotiated while planning the presentation content and structure. Each team member reviewed and analysed a different usability affordance, covering topics such as discoverability, error prevention, and constraints. Throughout the presentation, this presenter referred to 'our team' and 'my teammates', demonstrating the perceived joint nature of the task.

Students' Reflections

The students had two further opportunities to reflect on the project and its impact and potential. The first was a reflective discussion at the end of the final session. After the presentations, students "sat" together to discuss their experiences of the platform and the project. We moved to an open seating area beside the space where the groups' presentations had been displayed (see Figure 7) and had a 13-minute open discussion. The second reflection opportunity was a post-survey.

Figure 7. Students participating in a reflective discussion with the instructors

Because the students had already highlighted problematic usability features of the platform in the pre-survey and presentations, we used the reflective discussion and survey to gather data on positive features. All students attended the discussion. Apart from Group 1, where both respondents (both from UL) had largely negative perceptions of the project and platform, responses from participants in other groups were mixed. Survey respondents had mostly positive impressions of the COIL project, citing collaboration with peers (n=6) in another country (n=4) and trying a novel platform (n=4) as particular benefits.

Discussion

Our findings demonstrate how a MUVE platform can both enable and hinder collaborative online international learning. Through interacting and negotiating to jointly understand the task, student groups collaborated to develop presentations. Our findings point to three pillars of project design that can facilitate and challenge a COIL project: the platform, the international dimension, and opportunities for collaboration.

Looking at the students' voices and reflections, some issues emerge. The first relates to the platform. During the first session, students reported challenges accessing the platform and managing basic tasks such as moving their avatar around in the virtual landscape, getting their microphone to work, and hearing fellow students and instructors. A large proportion of instruction time was used supporting individual students with technical difficulties while the rest of the group

was on hold. As highlighted by Tlili et al. (2022), the complexity of MUVE platforms can hinder usability and they stress the importance of training and guidance. Hence, in retrospect, we were somewhat naïve in expecting students to prepare and train on their own before the project started. As evidenced throughout this article, the platform's usability issues and technical glitches were a distraction to the tasks, specifically the tasks of joint meaning-making and the construction of each group's common artefact. Some students did not like anything about the platform. In this context, however, we acknowledge that the shared task—to explicitly reflect on and research usability aspects of the platform—could have amplified their awareness of and focus on usability, thus perhaps leading them to disregard more positive platform affordances.

Despite the usability issues, some affordances enabled the students to interact in ways they would find difficult in-person. Previous research has shown that MUVEs may feel less intimidating for shy students (Mørch et al., 2016). We found that some OsloMet students, who did not have English as their mother tongue, were more comfortable speaking in English through OpenSimulator than in person, because they were less self-conscious when communicating through their avatar. Likewise, some students found it easier to present on the platform than in person. As such, being physically represented as an avatar created a safe environment to perform and participate in subject-related discussions, thus supporting international collaboration.

Echoing Wang and Wang (2008), features that mimic physical embodiment (e.g. the university campus and avatars) can combine to make the platform more engaging than video-based platforms. In this context, three survey respondents explicitly mentioned how the avatars deepened their sense of engagement. During the reflective discussion, one student commented that the physical movement required in this platform, e.g. to 'walk' from viewing one presentation to the next, demands more engagement than would be required when viewing presentations in video-based platforms. The use of avatars made the sessions feel more personal and amplified the sense of being present in a classroom rather than on a Zoom call interacting through a screen, thus raising the engagement level among the students and supporting interaction. As such, using a MUVE can promote a sense of embodied engagement that is missing in other platforms (Pasfield-Neofitou et al., 2015).

Facilitating internationalisation at home is a key benefit of COIL projects (Mittelmeier & Yang, 2022). Students' reflections indicate that this aspect was a valuable cultural experience. Several students emphasised that meeting peers from another country was a fantastic opportunity to learn collaboratively—interestingly, this had been highlighted as a potential benefit by some students in the pre-survey. As one student said in the post-survey: "I found it educational and fun to collaborate

with students from another country. Communication was a bit challenging at the beginning, but it got better over time." Our data on internationalisation are somewhat limited because the task was not sufficiently oriented around internationalisation. While the focus of the task did not have an international dimension and was not explicitly about sharing international experiences, the incorporation of students from UL and OsloMet implicitly fostered internationalisation through interaction across cultures.

Students reported that the MUVE fostered novel and diverse modes of interaction and collaboration in contrast to more familiar (e.g. video-based) platforms. The use of avatars was underlined by several students as a key feature that lent a more personal and interactive ambiance to the sessions. This was viewed as a distinct advantage over platforms such as Zoom or Teams where video can be disabled, obscuring physical presence. The capacity to manipulate the viewing angle, for example by panning left or right, was an appreciated feature. Furthermore, the COIL project was identified as a unique opportunity for forging connections with peers who may otherwise remain outside one's usual social or educational circles. The reflective discussion further highlighted the novelty of trialling a different platform. Despite initial communication challenges, participants observed an improvement over time. Interestingly, the environment was found to be conducive to participation, even for students who would typically resist public speaking, offering a safer space for these individuals to engage more fully. These findings echo Hernández-Sellés et al. (2019) and illustrate the potential for a MUVE platform to support essential CSCL activities such as negotiation, shared meaning-making, and, ultimately, the development of common artefacts. Engaging with "strangers" was less intimidating in the avatar-represented format, and the language barrier was perceived to be less of an obstacle. One student disclosed that the ability to "hide" behind their avatar provided a sense of security and comfort. This further illustrates the potential of MUVEs to foster an inclusive and supportive collaborative learning environment.

Conclusions and Wider Implications

Our study has shown that COIL projects executed through a MUVE have the potential to facilitate and/or complicate information sharing, interaction, negotiation, joint meaning-making and the development of a shared artefact. However, such COIL projects need to be carefully orchestrated for success. Factors such as time, the usability of the MUVE platform, the assigned task, and the international dimension, are all essential considerations.

From the first session through to the post-survey, students reiterated that more time to complete tasks, and a dedicated training period would have improved their experiences with the platform and

are important for future project iterations. Usability came up as an issue in every group session and—because it was the subject of the group presentations—it was highlighted during their presentations also. While we believe that more time experimenting with the platform before tasks commence will help students in future project iterations, some technical issues may be difficult to reconcile, such as Firewall and personal audio issues. Nonetheless, we will explore the impact of a longer project duration and more robust training on perceived usability and satisfaction, to address many of these issues.

Despite the usability challenges, students appear to have enjoyed the project overall, especially the international dimension, and all groups succeeded in completing the task within a short timeframe. This project, and the MUVE in particular, gave students an opportunity to share information (relating to the project), interact, negotiate, and establish joint meaning-making (to complete the project tasks), and construct common artefacts (the final presentation). Therefore, we conclude that, notwithstanding any usability issues, a MUVE has some unique affordances for collaborative online international learning. For example, our data suggest that, when represented as avatars, students feel less pressure as their personal attributes are not under scrutiny.

One limitation of our project is that we did not record the individual group meetings. Therefore, we do not have evidence regarding how they made sense of the task. Nonetheless, students obviously successfully negotiated and engaged in joint meaning-making to produce a common artefact—they worked in groups to research an aspect of usability, analysed the MUVE to determine if/how it adheres to those usability guidelines, and developed a joint presentation documenting the group's findings. While the quality of the presentations is not the subject of this study, we would like to highlight that the presentations were critically reflective and insightful. The presentations demonstrated that, for students of teacher education and instructional design, COIL projects can provide inspiration, and a window into possible pedagogical and design approaches they can adopt in their future careers.

Building on the findings and limitations of our study, future research could record and analyse the collaboration within groups, students' use and perceptions of avatars for learning, as well as the impact of platform usability on online collaboration.

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