Integrating Multi-User Virtual Environments in Modern Classrooms

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Chapter 7

Creating Contexts for Collaborative Learning in a 3D Virtual World for Distance Education

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ABSTRACT

The purpose of this chapter is to explore the contexts that teachers can create to promote collaborative learning in 3D virtual learning environments. The authors report on the findings of a case study using the 3D virtual world Second Life in a preservice teacher distance education program. Two types of contexts are identified: social interaction (social context) and instructor's scaffolding (pedagogical context). The anonymity represented by avatars in the 3D environment allowed learners to engage in social interaction and practice collaboration skills. Scaffolding involved several stages: scaffold the students' learning of the new technology, plan the course structure, implement the procedures during the lesson, and facilitate transitions between activities. The study also identifies the potential for a third context (emotional context), as the participants—both the instructor and the students—report a need to express emotions in many situations, but the environment does not seamlessly support this mode of communication.

INTRODUCTION

Second Life (SL) is a multiuser virtual environment (MUVE) configured as an online world in which individuals interact as avatars with people and objects in three-dimensional (3D) space. Avatars are visual representations of a user by an animated 3D figure controlled by the user through customization and movement. MUVEs offer educators new opportunities to design authentic learning experiences that would not be possible in a traditional classroom (Dieterle & Clarke, 2007). Educators have used SL for online instruction in colleges and universities in a variety of disciplines, from academic content to professional preparation (Wang & Burton, 2013). A specific building block in the SL environment used by developers and instructors for constructing buildings and disseminating content is the "box." This tool was also used by the students in the case we report from.

Previous research for using SL in different subject domains has found that collaborative activities in virtual learning environments can encourage empathic interaction between peers or team members working together (Miller & Wallis, 2011), and students often blur the distinction between themselves and their avatars when they immerse themselves in the 3D learning environment with the effect of making 3D virtual worlds as potential sites for embodied and extended cognition (Pasfield-Neofitou, Huang, & Grant, 2015). In a study of language teaching and learning in SL, examining the teacher's facilitating role, it was found that the teacher played important technical and social roles in the early phases of a learning activity to counterbalance the threshold of advanced technology and ensure the establishment of a collaborative learning environment (Wang, 2015).

However, to the best of our knowledge the previous research in 3D virtual worlds lacks best practices and examples of the specific teaching conditions that can promote collaborative learning. We address the discrepancy by exploring a case study in a preservice teacher distance education program at a southern university in United States where 34 students participated in the study, using SL as the learning environment. Faculty members have been teaching in SL for six and a half years, and it has been the educational platform for six online graduate courses at both master's and doctoral levels. It has also been incorporated into undergraduate, campus-based courses for role-play simulation. Since the use of SL was first piloted in 2011, over 1,000 students have used SL in their teacher preparation courses.

The use of a 3D virtual immersive environment, such as Second Life, offers students and faculty the illusion of being together in a classroom on campus, an experience quite different from that of engaging in asynchronous forums and information-sharing portals. Everyone interacts live in real time while viewing a visual representation (an avatar) of one another. The learning space is designed to look like a classroom, yet there are artifacts and tools in SL that cannot be found in any traditional classroom. Our working hypothesis, based on comments from previous course evaluations of the online teacher preparation program, is that it is possible to create a learning community in SL that is comparable to a campus-based classroom. However, it requires advance preparation of a skilled instructor and the use of the technology's unique features to create learning contexts appropriate for an online learning environment. For example, users in virtual worlds relate to one another based on presence, look, and feel, and they position themselves at a certain distance from each other while communicating, not unlike in the real world. When presenting new material during a lecture or when students ask for assistance, an instructor in a virtual world will glean information from students' movements, gestures, and verbal behavior. Moreover, developers and instructors need to be conscious of the decisions they make when either replicating or transcending conventions in face-to-face (f2f) communication for online environments.

Both strengths and limitations are associated with f2f communication, and these should be leveraged or avoided as appropriate (Hollan & Stornetta, 1992).

Therefore, we address the following research question in this chapter: "What contexts can the instructor create to promote collaborative learning in an online teacher preparation program in Second Life?" We explore two types of contexts judged important from a sociocultural perspective on learning and instruction: (1) Social context: Presence and awareness of others in the environment (e.g., the ability for an avatar to see other avatars and get a feel for their communicability), and (2) Pedagogical context: Techniques instructors use to scaffold learning activities (e.g., lecture, display board, note cards, adaptive feedback).

We consider these contexts enactive and dynamic rather than static and passive, and we refer to them as designed contexts, meaning they must be planned for and modifiable during a course (Mørch, Hartley, Ludlow, Caruso, & Thomassen, 2014). The rest of the chapter elaborates on these contexts and is organized as follows: First, we describe theoretical perspectives, followed by a survey of related work on using Second Life for teacher education and an overview of Second Life and the virtual campus adopted for our case study. We then describe the qualitative research method and present representative data extracts, and we analyze the findings. Finally, we discuss the research question, the implications for design, and suggestions for future work.

THEORETICAL PERSPECTIVES

Social Presence Theory and Model

Short, Williams, and Christie (1976) proposed the concept of social presence to describe the mediated sense of others' presence in remote communication, arguing this was a property of the medium itself. Applied to video conferencing, Berge's Instructor's Roles Model (Berge, 1995) posited four key roles for the instructor in distributed learning environments: pedagogical, social, managerial, and technical. One study of multiple online courses using Berge's model (Liu, Bonk, Magjuka, Lee, & Su, 2005) found that students rated instructors as effective in the pedagogical, managerial, and technical roles but did not emphasize enough the social role and in maintaining social presence. Berge (2008) has suggested that the four instructor roles were intensified when teaching in virtual worlds such as Second Life, which emphasize student exploration, interaction, and collaboration. A qualitative study of online instructors using virtual reality applications (Keskitalo, 2011) found that some were moving toward using more student-centered and problem-based pedagogy, but others were trying to replicate classroom conditions in the online environment rather than taking advantage of the new opportunities that the online environment offered in terms of exploration, interaction, and collaboration.

Focusing on the social role, Gunawardena (1995) applied the concept of social presence, suggesting that verbal and nonverbal behaviors to establish relationships with and among students were critical to successful online instruction. More recently, a large body of research has documented that social presence is an important predictor of student satisfaction with online courses. Jarmon (2008) suggested that users report heightened social presence in SL, which she termed an "embodied sense of social presence" (p. 1) and attributed to the ability to move avatars through space in real time. Dede (2009) has argued that the individually created SL avatars enhance the sense of social presence because they embody personal representations of each individual. Allmendringer (2010) suggested that the sense of social presence in

virtual worlds might also be related to nonverbal signals made by avatars. Bulu (2012) suggested that social presence might be more important than immersion in predicting student satisfaction in virtual worlds. Furthermore, the relevance of the learning activity and flexibility in creating them might be more important than the accurate rendering of a real-world phenomenon, which could explain why some crudely rendered 3D worlds attract much interest if well designed (e.g., block-building games such as Minecraft).

Sociocultural Learning Theory: The Zone of Proximal Development

The sociocultural perspective on learning entails two levels: the first level is the social process between people supported by collaboration and instruction, and the second is an internal process of development through individual learning (Vygotsky, 1978). A key concept in Vygotsky's theory is the zone of proximal development (ZPD) that provides a bridge from individual learning to instruction. The ZPD refers to the potential for learning that is realized when new knowledge interacts with what a person already knows in a process that is mediated by artifacts, tools, and interaction (Wertsch, 2007) while being guided by instruction (e.g., feedback from teachers, parents, and more knowledgeable peers).

This implies that both verbal and nonverbal activity and physical things in the environment contribute to scaffold interaction. Thus, they should be considered during analysis of the collaborative learning process in f2f and distributed settings (Ludvigsen & Mørch, 2010; Säljö, 2010). Moreover, researchers studying collaborative learning in virtual worlds should be aware of both virtual and real influences that may affect learning in positive or negative directions. Educators preparing to teach in Second Life can anticipate and plan for these influences, supporting the positive and avoiding the negative (Mørch et al., 2014).

Scaffolding

Scaffolding is a concept and technique that can be traced back to Vygotsky's seminal research on the ZPD and variations of the technique according to different metaphors are in use today, including evolutionary growth and control (Vygotsky, 1978), cooperative problem solving (Wood, Bruner, & Ross, 1976), and cognitive apprenticeship (Collins, Brown, & Newman, 1989; Lave, 1988).

Wood, Bruner, and Ross (1976) coined the term "scaffolding" to explore the types of support provided by an adult for children who are learning how to carry out a task they could not perform alone. It builds on the knowledge children already have and adds new knowledge that adults and more knowledgeable peers bring to the situation to help the child learn. This suggests instructional feedback as a method for tutoring, keeping the students on track during problem solving. Two types of feedback are showing (direct intervention) and telling (verbal guidance), providing directions toward a solution, highlighting critical features, and giving examples of partial solutions along the way (Wood, Bruner, & Ross, 1976). Effective feedback is necessary not only to enrich students' learning experience (Hattie & Timperley, 2007; Price, Handley, Millar, & O'Donovan, 2010) but also to help students develop their self-regulated learning competence (Van den Boom, Paas, Van Merrienboer, & Van Gog, 2004).

The adult role in pedagogical practice is now often referred to as the skilled master, whereas the child or student is considered the learning apprentice through an educational process often termed "cognitive apprenticeship" (Collins, Brown, & Newman, 1989). Cognitive apprenticeship has roots in situated learning theory, and it is based on the idea that we learn most naturally when learning forms a

relationship with the social situation in which it occurs (Lave, 1988). Furthermore, Dennen and Burner (2008) suggested that learning by cognitive apprenticeship has the great advantage of making visible the practices of skilled practitioners that may not be easily explained in a traditional lecture. In the context of SL, the environment and instructor assume a relevant role to support cognitive apprenticeship and effective feedback by providing the students with visible learning strategies (Hattie & Timperley, 2007) that create opportunities for collaborative learning.

ZPD, scaffolding, effective feedback, cognitive apprenticeship, and related concepts have stimulated educational technology developers over many years to build intelligent support systems and adaptive educational technology, including domain-specific critiquing systems (Fischer, Lemke, Mastaglio, & Morch, 1991; Mørch, Engeness, Cheng, Cheung, & Wong, 2017) and collaborative learning environments (Mørch, Dolonen, & Nævdal, 2006; Soller, Martinez, Jermann, & Muehlenbrock, 2005; Stahl, Koschmann, & Suthers, 2006).

In this study, instructional feedback involves a combination of technological tools, tasks, and instructor' scaffolding to support preservice teachers in practicing collaboration skills by making the learning process more visible through the virtual environment. Furthermore, the study aims at creating a new dimension of ZPD in the SL learning environment, drawing on the affordances and constraints of mediated interaction in virtual worlds. Finally, it explores to what extent an instructor can create social and pedagogical contexts and integrate them with an SL distance education course. We firmly believe that collaborative learning is not something that runs by pushing a button; it must be carefully planned and stimulated throughout the entire activity to be effective.

SECOND LIFE AND ROLE-PLAY IN TEACHER EDUCATION

Although the body of literature concerning SL practice in teacher education is limited (Muir, Allen, Rayner, & Cleland, 2013), researchers have suggested that 3D virtual worlds can be integrated throughout a teacher education program to provide preservice teachers with the experiences needed to apply teaching skills in real school settings. Based on these premises, Cheong, Yun, and Chollins (2009) used Second Life as an educational platform to guide 160 preservice teachers in practicing teaching skills collaboratively. The findings showed that SL seems particularly well suited as an experimental teaching method compared with traditional classroom-based methods.

Indeed, several studies have noted that this virtual environment provides a platform for collaborative learning activities by supporting social interaction, collaboration, and role-play (Muir et al., 2013; Vasileiou & Paraskeva, 2010). For example, in a mixed-methods study adopted for an education course (Gao, Noh, & Kohler, 2009), researchers compared role-playing in a face-to-face format and in SL, collecting quantitative and qualitative data on student perceptions and conducting an analysis of recorded transcripts of the exercises. Results showed no significant differences in the amount of communication in the two environments, but transcript analysis showed that students took more conversational turns in SL, but each turn was shorter than in the f2f environment. Furthermore, the students found the SL environment more interesting and less formal (Gao, Noh, & Kohler, 2009). In a pilot study of a distance education program (Caruso, Mørch, Thomassen, Hartley, & Ludlow, 2014), it was found that users of a 3D world feel less self-conscious and find it easier to familiarize themselves with social concepts, such as collaboration and knowledge sharing.

A distance education literature course was organized in SL to teach role-playing, and 15 primary and secondary school teachers participated (Vasileiou & Paraskeva, 2010). The 3D environment showed a positive influence on learner engagement and motivation, and it was found to be especially well suited for socialization and collaboration among the participants. It favored communication and collaboration, lowered the threshold for exposure, and made learning in groups more effective in a friendly atmosphere (Vasileiou & Paraskeva, 2010).

Role-playing instruction is a strategy broadly used in various educational settings in which participants assume different professional roles in a collaborative environment according to a given scenario. Given this premise, a well-designed role-playing game provides a platform for developing both social skills and professional knowledge, by which participants use the former to collectively reflect on their learning process (Dabbagh, 2005; Vasileiou & Paraskeva, 2010).

The aforementioned studies suggest that virtual role-play allows learners to become active participants, partly through increased motivation and encouragement of play and social interaction (Morse, Littleton, Macleod, & Ewins, 2009). Furthermore, role-playing in collaborative and distributed environments can be an effective way to develop and encourage empathic interaction not only between users but also between peers or team members working together (Miller & Wallis, 2011). However, outside of role-playing, these studies lack some of the key aspects involved in organizing educational courses in virtual worlds, as seen from a sociocultural perspective (e.g., instructor's scaffolding). This study aims to fill this gap and apply a broader range of sociocultural concepts in the analysis.

Second Life and the Virtual Campus

In SL, the college owns a private island (virtual land on which to build smaller worlds like a group of buildings, or a small town) and there are two virtual campuses on that island. Public transportation—via scripted teleporting—is available to take students between campuses. Each faculty member who teaches in SL has a main classroom for whole-group instruction, small-group buildings for collaborative group work, and office space for office hours. In the island's design, the small-group buildings were created to provide a place for students to work collaboratively without hearing their classmates' conversations. While there are other ways to meet this goal within SL, the faculty preferred this method when designing the campus. Therefore, all group buildings are 60 meters apart to create a sound barrier (Figure 1).

The main classrooms were designed for interactive lecture and individual activities. Therefore, there are display boards with presentation slides around the classroom, and the class walks from one display board to the next during the interactive lecture. Although it is possible to show a presentation without physically moving one's avatar from one display board to another, the faculty found that physically moving their avatars increased students' engagement during the interactive lecture.

All buildings are fully furnished, allowing the environment to feel like a professional classroom environment. The buildings have windows to prevent the feeling of claustrophobia when students and faculty are inside the buildings. In addition, every wall is set to "phantom," and there are no doors. In SL, when an object is set to phantom, one can walk through it. There are also no stairs on the island. Although an avatar can navigate stairs, doing so is cumbersome and unnecessary.

Figure 1. Bird eye's view of two buildings on the virtual campus in Second Life. The distance between buildings prevents noise interference and overhearing. Avatars can fly in and out of buildings.

The outside area of the campus is landscaped to create an inviting feeling for users. There are trees, flowers, bushes, and outside lounge seating (Figure 1). There is a tutorial skill practice area on one of the campuses, where students can view display boards of how to perform the skill (Figure 2) and practice the skills needed for class sessions. There is also a graduate student lounge where students can meet outside of class.

Figure 2. Pedagogical scaffolding in Second Life by display boards, used here for explaining how to use the box tool for sharing educational material

RESEARCH DESIGN AND DATA COLLECTION

A qualitative research method was the main approach to data collection, classification, selection and analysis, combining case study (Yin, 2003) and Internet ethnography (Hetland & Mørch, 2016). We examined the use of SL a graduate-level special-education preservice teacher preparation course, held at a Southern University in the United States. The course was arranged after working hours for full-time teachers and used SL as the primary educational platform. Thirty-four students took part in seven one-hour class sessions, each held online and divided into interactive lectures of theoretical concepts (15 minutes), individual activities (5 minutes), small-group activities in separate rooms (30 minutes), and role-play activities (10 minutes). All sessions were observed online and video-recorded with screen capture software. Afterward, we conducted interviews with students and the instructor (Caruso et al, 2014; Mørch et al., 2014). Interview guides are presented in the Appendices.

To collect and manage the data (spoken utterances, chat logs, and interviews) totaling 15 hours of raw video data, each session and interview were stored in a separate file and transcribed in their entirety using linguistic conventions according to interaction analysis (Jordan & Henderson, 1995). Interaction analysis was chosen because it is concerned with turn-taking in verbal communication (textual or oral), as well as how verbal communication interacts with body language–like intonation, gestures and movement, and nonverbal symbols used in chat (smileys and emotional abbreviations).

We categorized the interaction data into recurring themes, combining top-down (theory informed) and bottom-up (data-driven, open coding) classification processes. The initial categories were informed by our theoretical perspectives, which served as a lens for zooming in on the corpus. We initially grouped data into categories using an iterative, thematic coding technique inspired by Grounded Theory (Strauss & Corbin, 1998). Then we extended and adjusted the categories as we identified new instances of data (Caruso et al, 2014; Mørch et al., 2014). We present three of the categories below: (a) allowing for social interaction, (b) expressing emotions in SL, and (c) instructor's scaffolding. Illustrative examples of each of the three categories are reproduced below (Excerpts 1–10) and are critically examined in the subsequent section.

DATA PRESENTATION

We have reproduced 10 excerpts of interaction and interview data that we deemed representative of the three categories, and we use them to substantiate our claims. Each subsection is organized as follows: (a) short context description and/or finding, (b) excerpt of raw data, and (c) brief (common sense) explanation of the finding. The transcript notation we used includes the following symbols: (..) short pause, ((text)) comment by researcher, [..] excluded (non-audible) speech, and:: abruption of talk. The names of participants are fictitious.

Allowing for Social Interaction

The findings showed that the SL environment fostered a form of social interaction that is supportive of collaboration by catering to meaningful communication without expressing prejudices among its users.

Comparing Communication (Excerpt 1)

This excerpt is taken from a student's interview. She was asked what differences exist between communication in SL and communication in the real world.

I think it's easier to speak in SL because you don't see the other person looking at you, and [..] if I was in that room with other people, it would have taken me a little bit longer to get adjusted and acclimated to everyone's personalities. I think it's harder in real life because you can't just go to the chat wall and make a quick statement. You have to sit there and wait for people to stop talking. There are certain social norms you have to follow.

We can glean from the excerpt that the virtual learning environment in SL offered many opportunities for rich social interactions because the students felt more confident about taking part in learning activities due to freedom from the social norms required for face-to-face interactions. However, having an active role in SL learning activities also required oral skills combined with textual discourse (chat) abilities. Preservice teachers used both means of discourse. However, they seemed to prefer using chat to avoid the sound problems with the "speak" button and the noise associated with multiple people attempting to speak at the same time.

The learning environment on the college campus in SL was designed to promote social interaction. Small-group buildings were built to facilitate student interaction and group work. The buildings were 60 meters apart to eliminate interference in conversations during group activities. Students submitted personal pictures, and those pictures were used to decorate the walls within the group building to create a feeling of belonging.

Computer-Supported Collaboration (Excerpt 2)

Throughout the courses, students worked collaboratively in groups to complete activities during each session. Role-play activities were described on electronic notecards and stored in information-sharing containers (referred to as boxes), and students would purchase the materials for free (see Figure 2). Once students purchased the materials, they could access the materials from their inventory. These are idiosyncratic SL tools inherited from containers for packaging and purchasing goods in the SL marketplace (building units, furniture, clothing, etc.). Each student selected a role at the beginning of the semester and worked within that role throughout (time keeper, secretary, facilitator, leader, or organizer). In the anonymous student evaluations of the instruction at the end of each course, students were asked to rate, on a scale of one to five, whether collaborative problem solving and teamwork were encouraged via technologies. The scores ranged from 4.7 to 5.0, and the mean score across eight classes was 4.9. Students also commented about the collaborative learning within SL in the evaluations, stating, "This was an excellent learning experience and allowed us to actually collaborate and learn a lot more through an online class" and "The Second Life class was a great forum to promote collaboration with others." In the following excerpt, one of the groups had just finished planning the role-play scenario:

Janet: We've got everything (…) in line now, which makes me feel a whole lot better.
Heather: I had no doubt that we could do it; we're superwomen.
Stacy: Go team! Ha-ha.
Mandy: We were just overachieving with trying to write a behavior plan.
Heather: I know, I think we were just… I tend to do that a lot, over-think things. But I'm glad that you guys met with her and realized it's not as much as we were making it out to be.
Janet: Ha-ha, we are super!
Mandy: I'm glad that we thought it was harder than it really was instead of (…) expecting it to be really easy and it turning out to be really difficult.
Heather: Yeah.
Janet: Exactly.

Although some students encountered technical difficulties managing their own avatars, we found that the support of the virtual environment and the instructor were generally very good, enabling collaboration and increased motivation and engagement. The excerpt shows that even though some students had difficulties in the beginning and feared it would not work out (e.g., to engage in online role play), the opposite occurred for most of them, as the following line from Mandy illustrates: "I'm glad that we thought it was harder than it really was."

The Feeling of Belonging to a Group (Excerpt 3)

To see the value of working together as a team and to see each member of their group as a human being were two goals of the instructor. When working from a distance, using technology, individuals can easily forget that they are working with another person, and the distance may allow the individual a sense of anonymity not found in face-to-face interaction. While SL provides individuals with a visual representation of a human (avatar), it remains important that individuals form connections with one another on a human level to promote collaboration. The following excerpt, taken from the interview with the instructor, shows why SL was considered the more suitable distance educational platform in many respects, particularly in fostering social interactions among learners.

Second Life lends itself to social interaction as compared to Wimba ((a virtual classroom environment integrated with Blackboard)). So, for distance education, Second Life is my preferred educational platform for social interaction, because you actually get the physical presence of a person. In Wimba, unless you're using video conferencing you don't get that physical presence of a person. And so, the interaction is not as genuine. For example, at the end of this semester, when I was flying around to students, they'd finished working on one of the other groups role plays, and so they had a couple of minutes, and they were just talking, and I heard a student say to somebody in their group, Hey, what are you all takin' this summer? We should try to get in the same class. That would never happen in Wimba. Students just don't interact like that; they actually form relationships, and I think it's because of Second Life. I've even had students tell me, in previous semesters, that they felt they were in an undergraduate cohort again because they were actually making relationships, and they had friends, ((and that this class)) being held in Second Life, really helped them to feel like they were part of a group again, where they didn't feel disconnected from the online education. In Wimba, they didn't feel connected to other people.

The self-motivated communication shown in Excerpt 3 that led the students to form new relationships—not unlike the ways students socialize in residential college settings—is quite common in SL. Compared to other (asynchronous) platforms supporting online learning, SL seems particularly well suited for motivating distance education in terms of fostering social interactions. For example, it features a 3D graphical representation of the individual by means of avatars that are able to easily interact and communicate using audio or chat (Figure 3).

Expressing Emotions in Second Life

Nervousness Before a Role-Play (Excerpt 4)

The students had many opportunities to express their feelings while interacting in SL, and they revealed anxiety, excitement, joy, and frustration, which they mainly expressed during group work in the discussions areas. Before starting the excerpt below, one of the students (Andy) invited another (Rachel) to join him in the next role-play.

Rachel: (Chat) You make me nervous . . . I'm an avoidance kind of person
Andy: (Chat) Lol, don't be nervous!!!!!!!
Peter: (Chat) I am, too!
Rachel: (Audio) You know, I haven't been in the defensive role. I don't mind it. I mean, you know, I'm saying (..) I'll try. I'll try. ((Laughing.))

SL has a built-in gesture menu, though the students did not use this option as far as we could tell. This may have been due to a somewhat cumbersome invocation procedure. However, the students were intimately familiar with chatting and used chat in many situations to express feelings. In Excerpt 4, the

Figure 3. Participants and researchers are observing a role-play in the main lecture hall. Chat window to the left.

three chat lines were all exchanged within the same minute. Immediately preceding and following the chat exchange, Peter and Rachel attempted to formulate a question and answer it, respectively. Chat line communication was frequently intertwined with speech. The function of chat was to supplement the speech and to serve as a back channel, as shown in the excerpt. The students also used chat to respond to spoken questions from the instructor during lectures in the main hall. In that case, the students preferred to use chat to avoid audio problems; if several people pressed the "speak" button at the same time, sound problems would occur.

Wish There Were Better Emojis in SL (Excerpt 5)

The next excerpt depicts the instructor having just arrived in the students' group room, shown in Excerpt 4, to check the status of this group's work. As she landed in the room, she immediately started typing on her keyboard, an activity visible to the others and first noticed by Peter:

Peter: *(Audio) OK. Oops, she just came in too (..). Got that one on video.*
Instructor: *(Chat) No worries if you aren't finished!:)*
Instructor: *(Chat) I wish there were emojis in SL!*
Julia: *(Audio) Real quick, before everybody runs. The last question here was why she would have asked us to participate in this group activity, what her objective was, and why this is important to educators. And I'm pretty sure Andy and Rachel proved it in the last one; because we need effective communication with parents (..) as well as other educators.*
Peter: *(Chat) Exactly*

The instructor intended to tell the students that time was up, but she sensed the intensity of the situation (wrapping up joint work in a hurry), and she preferred to intervene unobtrusively, telling them without using words. To accomplish this, she started with a smiley face but realized this emoticon was too coarse grained for the situation ("I wish there were emojis in SL!"). Invoking the appropriate gesture from the gesture menu might take too much time, however; most SL users are not familiar with gesturing unless they use specific gestures frequently and program them into keyboard shortcuts.

Applying Gesture to Praise Students (Excerpt 6)

In this excerpt, the instructor explicitly invoked the "clap gesture" in SL, to praise a group of students who had just finished their role-play in front of the whole class (see Figure 3).

Instructor: *(Audio) Thank you, group, very much. Let me get my gestures ready here ((audio and avatar applause)). Yeey! Excellent job, group ((clapping hands)). And, um, I wanted to make sure, before we proceeded, would you all prefer that the last group go now, um, we may have to stay a couple of min:: - minutes after class in order to finish, or would you prefer to come next week? So yes is to go now; [..] if you would prefer next week (..), you can IM me (..) if you don't wanna say it in front of the group.*
Heather: *(Chat) Yes!*
Andy: *(Chat) Yes*
Julia: *(Chat) Yes*

Stacy: (Chat) Now
Peter: (Chat) Go ahead
Heather: (Chat)Now

The instructor is both clapping with the built-in gesture and physically clapping her hands, making the gesture both visible and audible to the students. This illustrates a deliberate effort at invoking gestures. It is different from the way gestures are invoked in most f2f situations, which is often automated and tacit for the speaker. However, many gestures are programmed into SL and invoked by keyboard commands, and when memorized, they can approximate second-hand nature (Figure 4). Excerpt 6 illustrates another typical situation of the lecture room; the instructor is the active speaker, with the students responding to questions by chat. This situation would be reversed in the small-group discussion areas, where the instructor would be the silent, listening partner, and the students would talk and chat, as shown in Excerpt 5.

The Instructor's Scaffolding

Scaffolding in SL in this case is quite elaborate. It demonstrates an active instructor who can manage the technology and students who put great effort into learning to use the technology.

Scaffold the Learning of SL (Excerpt 7)

It is recommended that instructors incorporate assignments into the course to scaffold SL learning. The subject-specific assignment given to the students was to apply the theoretical concepts taught in the class in a role-play in two stages, first to create the role play through collaborative group work with peers and then to act it (another group's) role play out. In complex learning environments like SL, incorporating

Figure 4. Role-play session in the main lecture hall. The person on the left raises his hand to ask question.

(technical) assignments ensures that students practice the skills necessary to participate in the class sessions. This is demonstrated in the following excerpt of an online interaction between two students and their instructor regarding a third student who is temporarily lost and needs help getting back to her group.

Laura: That is why I do not fly; I walk or run. ((Laughs)) (..) OK, I think she's coming. (..)
John: ((Instructor)), if one of our other people is flying around lost, tell them that (..) is there a way that we can get them to come here? ((Student)) seems to be a little lost.
Instructor: Oh yeah, I can—I can help. You said ((student)) is lost?
John: Yes, ((student)) A.
Instructor: OK, let me look on the mini-map. Oh, I found her; I'll bring her over. I'll be right back. ((Instructor flies away.))

Some skills that should be demonstrated include the ability to do the following: fly, teleport, speak, landmark a location, send a friend request, buy materials from a box (see the box on the table in Figure 5), retrieve materials from their inventory, create a notecard, and share a notecard via a box.

The instructor we interviewed reported that the most efficient way for the preservice teachers to demonstrate these skills is by submitting screenshots or videos.

Structure (Excerpt 8)

Instructors should plan the class's structure. How will the class begin? How will the students demonstrate understanding? What are the expectations surrounding student participation? How will students participate? What activities will students be asked to do? While this list of questions is not exhaustive, these questions can begin to assist online instructors in thinking about how to prepare for teaching in

Figure 5. A group session in one of the discussion areas is using boxes for information sharing when the instructor enters the room. The person on the right is typing on the keyboard to the chat window displayed in the lower left corner.

SL. The following excerpt is from an interview with the instructor conducted by observer 3 (one of the researchers).

Observer3: *If you (..) were asked to teach this course (..) in a conventional face-to-face way, would you organize it in the same way or differently?*
Instructor: *That's a really good question, I taught this course to undergrad, face to face, and [..] I tried to incorporate role-play, because I really like role-play (..) I found that people aren't as apprehensive online ((as they are in f2f situations)).*

The excerpt shows that the instructor had previously taught the course to undergraduate students in a conventional (f2f) setting and incorporated role-play based on her teaching preferences and previous research; and when she compares this to online teaching she found role-playing to work even better; many of the students were less apprehensive when role-playing online. Role-playing became a stepping-stone to apply the theoretical concepts taught in the lectures (see Figure 3). Furthermore, the role-plays were created and played out by the students in collaborative activities (see Figures 4 and 5).

Procedures (Excerpt 9)

Instructors also need to determine the procedures needed in class and then explicitly teach those procedures to students. Examples of such procedures include where students will meet to begin class; how to complete, submit, and review a warm-up; how to complete individual and group activities; what artifacts support the activities; and how the class session will end. The following excerpt is from the instructor interview.

When I first started teaching in Second Life, before I went to the Sloan training I used to type everything into the chat text, but it would disappear, and so I'd have to type it again. Or, I'd IM every student individually by typing instructions, and it was very ineffective and very non-time efficient, because it would take me forever for getting that information to multiple people.

The instructor explains the rationale for using information sharing containers, boxes, as an efficient way of sharing information, rather than send individual messages by chat. The use of boxes was the most convenient way for her to communicate to several students (see Figure 5). However, the boxes are not always easy to manipulate, and the instructor provided scaffolds (see Figure 2). We observed a discrepancy in the perceived benefit of using this tool between the instructor and some of the students. This discrepancy became evident when some groups encountered difficulties in making the boxes available for the rest of the class to buy in order to share information with another group during role-play activity. The complexity of boxes and other educational resources can be attributed to two object types in SL: functional (manipulative) and decorative. Other functional objects are chairs and tables, whereas plants, pictures, and photos are examples of decorative objects. The instructor used both types when designing the interior of the group rooms.

Planned Transitions (Excerpt 10)

In addition to planning the structure and procedures, faculty members need to plan how students will transition between activities. The following excerpt is from the interview with the instructor in the same dialogue context as shown in Excerpt 8, preceding it by two and one-half minutes.

Observer3: *Could you say a little bit about that process, or, how do you perceive (..) going from theory to practice in this domain?*

Instructor: *Yeah, definitely, that was my goal [..] throughout the whole (..) course of the semester, for the live class sessions [..]. I tried to only do five to ten minutes of lecture, and then some sort of individual activity. In the past I've also done pair activities, and then five to ten more minutes of lecture. Then I'd have them do the group work, and my idea with the group work was that whatever topic we had been talking about that day, or whatever content I had been teaching them, I wanted them to practice those skills. And some skills I had them practice more than others.*

The excerpt shows the number of minutes assigned to different activities and the typical sequence of activities, going from theory to practice. It details iterations of key concepts and skills practice and the arrangement of this practice. In a class of 30–35 students, it is difficult for the instructor to know who has submitted an assignment that will be reviewed later because doing so requires determining who is still working. This could be done with a printed list, checking which students have submitted; however, it is more efficient to ask students to physically move to another location when they have finished. For example, once students finish the lecture (see Figure 3) and are ready to discuss it, they walk over to the discussion area (see Figure 5). When students physically relocate, the faculty can see how many students are still seated and working. The other students can see it too, so they know there is a little time remaining until they begin again.

GENERAL DISCUSSION

In this section, we summarize and discuss our findings by addressing the research question raised in the beginning of the chapter: "What contexts can the instructor create to promote collaborative learning in an online teacher preparation program in Second Life?" We answer the question by pointing to relevant data extracts and comparing them with the findings reported in related research in three areas: (a) social presence, (b) body language and gesturing, and (c) instructor's scaffolding.

The results of the data analysis indicate that the learning we observed in SL was directly influenced by students' social interactions and the instructor's scaffolding. They also indicate that a third type of context, emotional, was present in the interactions but under supported in the environment.

Social Presence

An overarching theme throughout our data is social presence. Short, Williams, and Christie (1976) first defined social presence as the degree of awareness of the other person in a communication. Even while unaware of the concept, the instructor was conscious of those relationships and engaged in multiple actions to create them.

There are several reasons social presence is high in SL. First, SL users are featured by a 3D-graphical representation referred to as avatars that are easily able to interact and communicate using speech or text chat. Second, the number of users aware of each other is critical to experiencing a sense of communal presence (Bulu, 2012). In our case, this was fulfilled, as the course had more than 30 participants (in addition to three observers) who were visible to the whole class during the lectures (see Figures 3–4) and co-located in small groups facing each other during round table discussions (see Figure 5). Third, the sense of anonymity represented by avatars in the 3D environment (Excerpts 1 and 3) allowed learners to engage more effectively in practicing collaboration skills of a certain complexity. According to Bulu (2012), students' interactions in an online world relate more to their relationships with the other students and with the instructor than to immersion or the extent to which they feel the environment is real and accurately rendered. This is supported by our findings regarding the ease by which avatars could meet, communicate, and form relationships in the online environment (Excerpt 3), using both direct (e.g., speech, text chat) and indirect (e.g., boxes, notecards, slides) means of communication, and in ways that were different from their interactions in the asynchronous learning environment of other classes.

Body Language and Gesturing

Previous research indicates that gesturing is important for communication and learning (Goldin-Meadow & Wagner, 2005). Arguably, the best approximation to gesturing in online environments (aside from video conferencing, which aims to replicate f2f communication) is provided by 3D virtual worlds. The participants in our study (both instructor and students) frequently felt a need to express emotions, but the environment did not provide a mode of gesture invocation that was as seamless as gesturing in ordinary communication. Gesturing had to be invoked explicitly by menu selection, a somewhat cumbersome procedure unless memorized as keyboard shortcuts.

The students relied instead on text chatting, which was used in synchronicity with speech on almost all occasions we observed (Excerpts 4 and 5). The students also used text chat and sometimes speech when responding to the instructor's questions in the main auditorium (Excerpt 6). When they met in the discussion areas, they would use all communication channels at their disposal, even commenting on each other's domestic background sounds (e.g., dog barking, baby crying, etc.). The instructor would typically use speech to communicate with the students in the main auditorium, and she used text chat to give feedback (e.g., praise) and ask questions (Excerpt 6). The instructor also used gestures, position, and movement (nonverbal behaviors, Excerpt 6) and combined verbal and nonverbal behaviors (Gunawardena, 1995) to interact. Hence, the instructor preferred SL to video conferencing or the asynchronous learning environment used in other courses at the college (Excerpt 3).

The Instructor's Scaffolding

The instructor's scaffolding activities (Excerpts 7–10) required thought, planning, and follow-up and were learned through hands-on experience in the Sloan training and while using SL as an educational platform over several years. In addition, they were field tested in multiple courses (Excerpt 9). The lessons learned are that in SL, the instructor must be more deliberate in designing the contexts that facilitate learning because f2f contexts cannot be taken for granted in virtual worlds (Mørch et al., 2014). On the other hand, when the students applied the theoretical concepts taught in role-play activities, they practiced collaboration skills, involving perspective-taking and cooperative problem solving, while being

less apprehensive compared to a face-to-face course with role-plays (Excerpt 8). We also observed that an instructor's constructive feedback to the students in the lecture hall facilitated the group work and the transitioning between individual and collaborative learning activities. Other contributors to pedagogical scaffolding were well-designed virtual learning activities that allowed iterative skills practice in dedicated small-group rooms (Excerpt 10) and the instructor's continuous guidance and adaptive feedback while flying around the campus and visiting each of the working groups in a round-robin fashion (Excerpt 5).

Four types of scaffolding activities were essential for planning the course: (a) scaffold the students' learning of the new technology (Excerpt 7), (b) plan for the structure of the course (Excerpt 8), (c) implement the procedures in the virtual classroom (Excerpt 9), and (d) facilitate the transitions between activities (Excerpt 10) (Mørch et al., 2014). The instructor was trying to make the distance education experience more student-centered (Excerpts 8 and 10) and make use of technological artifacts (Excerpt 9), to extend and not merely replicate the traditional classroom, as indicated by Keskitalo (2011).

IMPLICATIONS FOR THE DESIGN OF ONLINE LEARNING CONTEXTS

Based on our findings, suggestions for new designs (technological features and pedagogical practices) include the following:

1. Use SL for experimentation (it is relatively low cost to design new contexts for collaborative learning and test out in small-scale experiments in semi-naturalistic settings).
2. Enact contexts other than those mentioned in the study (social, pedagogical, emotional) with implications for collaborative learning and the sociocultural perspective (cultural, institutional, etc.).
3. Render cultural and historical information in computer-based artifacts beyond mouse click actions and decorations of SL objects to also capture digital object modifications over time and cultural complexity beyond screen depth.
4. Increase support for scaffolding by computer-based feedback, using visualization and automated advice giving and leveraging adaptive feedback techniques and learning analytic methods and tools.
5. Increase support for gesturing in SL (e.g., allow users to define new gestures and invoke them by self-defined keyboard shortcuts).
6. Conduct work on Internet pedagogy by harnessing teaching principles for 3D virtual worlds.
7. Consider integrating SL with an asynchronous learning environment to supplement real-time interaction with time for independent problem solving and reflection (e.g., when working on assignments that allow multiple solution approaches, and individual preferences).
8. Follow up with research designs employing quantitative methods to identify causal effects of specific relationships of contexts to motivation, collaboration, and learning.
9. Follow up with new case studies, using virtual worlds other than SL (e.g., Minecraft), and identify best practices for creating contexts for collaborative learning in 3D virtual worlds.

CONCLUSION

The findings from this study indicate that carefully designed contexts for collaborative learning can increase the support of a 3D virtual world such as SL and that skilled instructors can accomplish the design work as part of course preparation and execution. This type of synchronous online learning environment provides a semi-naturalistic setting for practicing collaborative skills and role-playing, mediated by a new class of artifacts—end-user modifiable 3D objects (Caruso, Hartley, & Mørch, 2015; Mørch, Caruso, & Hartley, 2017).

Although SL cannot replace real classroom practice and does not intend to do so, the results we report suggest that SL had a major impact as an alternative to residential college education for this teacher preparation program, facilitating access to student teachers who live far away from the college campus.

SL also provides an arena for those who feel self-conscious in f2f situations (e.g., when role-playing or answering a question from the instructor in front of the class). SL engaged all the participants who could master the technology, which involved a learning curve for some of the students. The instructor provided technical assistance to students who needed it. The initial learning curve disappeared quickly upon successive use of the learning environment.

However, some limitations should be noted; the learning activities depended on the active participation of both instructor and students. This implies instructor and students will benefit from adopting a constructivist learning philosophy of active learning through the use of tools (Mørch, Caruso, & Hartley, 2017). However, planning and direct instruction are important for steering students in the right direction; without some scaffolding, they will be lost. The success of role-play as a learning method also depends on the students' serious treatment of the assignment and on the instructor's planning of the learning activities according to educational goals. In one of the interviews, a student said, "There are other classes I think Second Life wouldn't work very well, but with a specific style of course where we were learning how to collaborate with people, I thought Second Life was absolutely a wonderful tool!"

Despite the potential of 3D virtual worlds in education, research interest in this field is still in an embryonic stage. Thus, 3D virtual worlds need to be integrated throughout teacher education programs to provide preservice teachers with the necessary experience in online role-playing to apply professional skills in real school settings. In this area, there is plenty of opportunity for more research.

The findings of this study were limited to a single case study (one institution), and it was conducted with a convenience sampling method (the instructor responded to a request for participation sent by the researchers to the Second Life Educators mailing list (SLED). A third limitation was the insufficient number of interviews with the students. This can be attributed to the fact that students were asked to take part in an interview after the end of the course during a time frame that coincided with end-of-semester holidays and busy workdays (the participants were working as teachers in school settings).

REFERENCES

Allmendringer, K. (2010). Social presence in synchronous learning environments: The role of nonverbal signals displayed by avatars. *Educational Psychology Review*, *22*(1), 41–56. doi:10.1007/s10648-010-9117-8

Berge, Z. L. (1995). Facilitating computer conferencing: Recommendations from the field. *Educational Technology*, *35*(1), 22–30.

Berge, Z. L. (2008). Changing instructor's roles in virtual worlds. *The Quarterly Review of Distance Education*, *9*(4), 407–414.

Bulu, S. T. (2012). Place presence, social presence, co-presence and satisfaction. *Virtual Worlds*. *Computers & Education*, *58*(1), 154–161. doi:10.1016/j.compedu.2011.08.024

Caruso, V., Hartley, M. D., & Mørch, A. I. (2015). End-user development in Second Life: Meta-design, tailoring, and appropriation. In P. Diaz, V. Pipek, & C. Ardito (Eds.), *Proceedings 5th international symposium end-user development 2015* (pp. 92–108). Berlin: Springer. doi:10.1007/978-3-319-18425-8_7

Caruso, V., Mørch, A. I., Thomassen, I., Hartley, M., & Ludlow, B. (2014). Practicing collaboration skills through role-play activities in a 3D virtual world. In R. Huang, Kinshuk, & N.-S. Chen (Eds.), The new development of technology enhanced learning (pp. 165–184). Berlin: Springer.

Cheong, D. U., Yun, S., & Chollins, C. (2009). Is Second Life effective for pre-service teachers' teaching practice? In I. Gibson, R. Weber, K. McFerrin, R. Carlsen, & D. A. Willis (Eds.), *Proceedings of society for information technology & teacher education international conference 2009* (pp. 1418–1421). Chesapeake, VA: AACE.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453–494). Hillsdale, NJ: Lawrence Erlbaum.

Dabbagh, N. (2005). Pedagogical models for E-Learning: A theory-based design framework. *International Journal of Technology in Teaching and Learning*, *1*(1), 25–44.

Dede, C. (2009). Immersive interfaces for engagement and learning. *Science*, *233*(5910), 66–69. doi:10.1126/science.1167311 PMID:19119219

Dennen, V. P., & Burner, K. J. (2008). The cognitive apprenticeship model in educational practice. *Educational Communication and Technology*, *3*, 425–439.

Dieterle, E., & Clarke, J. (2007). Multi-user virtual environments for teaching and learning. In M. Pagani (Ed.), *Encyclopedia of multimedia technology and networking* (pp. 1033–1041). Hershey, PA: Idea Group.

Fischer, G., Lemke, A. C., Mastaglio, T., & Morch, A. I. (1991). The role of critiquing in cooperative problem solving. *ACM Transactions on Information Systems*, *9*(2), 123–151. doi:10.1145/123078.128727

Gao, F., Noh, J. J., & Koehler, M. J. (2009). Comparing role-playing activities in Second Life and face-to-face environments. *Journal of Interactive Learning Research*, *20*(4), 422–443.

Goldin-Meadow, S., & Wagner, S. M. (2005). How our hands help us learn. *Trends in Cognitive Sciences*, *9*(5), 234–241. doi:10.1016/j.tics.2005.03.006 PMID:15866150

Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer conferences. *International Journal of Educational Telecommunications*, *1*(2–3), 147–166.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81–112.

Hetland, P., & Mørch, A. I. (2016). Ethnography for investigating the Internet. *Seminar.net: Media. Technology and Lifelong Learning*, *12*(1), 1–14.

Hollan, J., & Stornetta, S. (1992). Beyond being there. In *Proceedings CHI'92* (pp. 119–125). New York, NY: ACM Press. doi:10.1145/142750.142769

Jarmon, J. (2008). Pedagogy and learning in the virtual world of Second Life. In P. Rogers, G. Berg, J. Boettcher, C. Howard, L. Justice, & K. Schenk (Eds.), *Encyclopedia of distance and online learning* (pp. 1–11). Hershey, PA: Idea Group.

Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundation and practice. *Journal of the Learning Sciences*, *4*(1), 39–103. doi:10.1207/s15327809jls0401_2

Keskitalo, T. (2011). Teacher's conceptions and approaches to teaching in virtual reality and simulation-based learning environments. *Teachers and Teaching*, *17*(1), 131–147. doi:10.1080/13540602.2011.538503

Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life*. Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511609268

Liu, X., Bonk, C. J., Magjuka, R. J., Lee, S. H., & Su, B. (2005). Exploring four dimensions of online instructor roles: A program level case study. *Journal of Asynchronous Learning Networks*, *9*(4), 29–48.

Ludvigsen, S., & Mørch, A. (2010). Computer-supported collaborative learning: Basic concepts, multiple perspectives, and emerging trends. In B. McGaw, P. Peterson, & E. Baker (Eds.), *The international encyclopedia of education* (Vol. 5, pp. 290–296). Oxford, UK: Elsevier. doi:10.1016/B978-0-08-044894-7.00493-0

Miller, F., & Wallis, J. (2011). Social Interaction and the role of empathy in information and knowledge management: A literature review. *Journal of Education for Library and Information Science*, *52*(2), 122–132.

Mørch, A. I., Caruso, V., & Hartley, M. D. (2017). End-user development and learning in Second Life: The evolving artifacts framework with application. In F. Paterno & V. Wulf (Eds.), *New perspectives in end-user development*. Berlin: Springer. doi:10.1007/978-3-319-60291-2_13

Mørch, A. I., Dolonen, A. I., & Nævdal, J. E. (2006). An evolutionary approach to prototyping pedagogical agents: From simulation to integrated system. *Journal of Network and Computer Applications*, *29*(2–3), 177–199.

Mørch, A. I., Engeness, I., Cheng, V. C., Cheung, W. K., & Wong, K. C. (2017). Essay Critic: Writing to learn with a knowledge-based design critiquing system. *Journal of Educational Technology & Society*, *20*(2), 216–226.

Mørch, A. I., Hartley, M. D., Ludlow, B. L., Caruso, V., & Thomassen, I. (2014). The teacher as designer: Preparations for teaching in a Second Life distance education course. In *Proceedings of 2014 IEEE International Conference on Advanced Learning Technologies (ICALT 2014)* (pp. 691–693). Los Alamitos, CA: IEEE Computer Society. doi:10.1109/ICALT.2014.201

Morse, S., Littleton, F., Macleod, M., & Ewins, R. (2009). The theatre of performance appraisal: Role-play in Second Life. In C. Wankel & J. Kingsley (Eds.), *Higher education in virtual worlds: Teaching and learning in Second Life* (pp. 181–201). Bingley, UK: Emerald Group.

Muir, T., Allen, J. M., Rayner, C. S., & Cleland, B. (2013). Preparing pre-service teachers for classroom practice in a virtual world: A pilot study using Second Life. *Journal of Interactive Media in Education*, *2013*(1), 3. doi:10.5334/2013-03

Pasfield-Neofitou, S., Huang, H., & Grant, S. (2015). Lost in Second Life: Virtual embodiment and language learning via multimodal communication. *Educational Technology Research and Development*, *63*(5), 709–726. doi:10.1007/s11423-015-9384-7

Price, M., Handley, K., Millar, J., & O'Donovan, B. (2010). Feedback: All that effort, but what is the effect? *Assessment & Evaluation in Higher Education*, *35*(3), 277–289. doi:10.1080/02602930903541007

Säljö, R. (2010). Digital tools and challenges to institutional traditions of learning: Technologies, social memory and the performative nature of learning. *Journal of Computer Assisted Learning*, *26*(1), 53–64. doi:10.1111/j.1365-2729.2009.00341.x

Short, J. A., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London, UK: Wiley.

Soller, A., Martinez, A., Jermann, P., & Muehlenbrock, M. (2005). From mirroring to guiding: A review of state of the art technology for supporting collaborative learning. *International Journal of Artificial Intelligence in Education*, *15*, 261–290.

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 409–425). Cambridge, UK: Cambridge University Press.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage.

Van den Boom, G., Paas, F., Van Merrienboer, J. J., & Van Gog, T. (2004). Reflection prompts and tutor feedback in a web-based learning environment: Effects on students' self-regulated learning competence. *Computers in Human Behavior*, *20*(4), 551–567. doi:10.1016/j.chb.2003.10.001

Vasileiou, V., & Paraskeva, F. (2010). Teaching role-playing instruction in Second Life: An exploratory study. *Journal of Information. Information Technology and Organizations*, *5*, 25–50.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wang, A. (2015). Facilitating participation: Teacher roles in a multiuser virtual learning environment. *Language Learning & Technology*, *19*(2), 156–176.

Wang, F., & Burton, J. K. (2013). Second Life in education: A review of publications from its launch to 2011. *British Journal of Educational Technology*, *44*(3), 357–371. doi:10.1111/j.1467-8535.2012.01334.x

Wertsch, J. V. (2007). Mediation. In H. Daniels, M. Cole, & J. V. Wertsch (Eds.), *The Cambridge companion to Vygotsky* (pp. 178–192). New York, NY: Cambridge University Press. doi:10.1017/CCOL0521831040.008

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *17*(2), 89–100. doi:10.1111/j.1469-7610.1976.tb00381.x PMID:932126

Yin, R. K. (2003). *Case study research: Design and methods*. London: Sage.

KEY TERMS AND DEFINITIONS

3D Virtual World: A web-based simulated world where three-dimensional graphical representations of individuals (i.e., avatars) can interact with each other by using text-based or voice-based tools. Avatars can move around in 3D space and explore buildings and other objects by simple commands, and users get a feel for the presence of others and distances to virtual objects.

Collaborative Learning: An educational approach that involves groups of learners working together to solve a problem, simulate a scientific inquiry, share knowledge, or create a product, such as a role-play script, presentation of a topic or concept map.

Design Context: Representations in virtual environments that model and extend environmental attributes of face-to-face interaction, such as movement, body language, emotion, social presence, objects, power, and instruction. Design contexts are persistent, dynamic, and updated incrementally by the computer or by users during sessions in virtual environments.

Preservice Teacher: A college or university student who is enrolled in a teacher education program with the goal of obtaining professional licensure prior to service as a teacher in elementary or secondary schools.

Role Play: A technique for teaching communication and problem-solving skills in groups when participants take on specific roles associated with different viewpoints (e.g., a profession, a culture, a workplace). The participants are involved in "as-if" or simulated actions, where the aim is to construct an approximation of aspects of a real-life situation that is impractical, expensive, or risky to carry out in the real world.

Second Life (SL): A 3D virtual world developed by Linden Labs and launched in 2003. The users download a client program, 3D viewer, which is free of charge. The SL world is composed of islands with buildings and owning an island requires payment. A 3D design environment based on simple geometric shapes (e.g., cubic shaped boxes) is integrated with the SL environment and allows residents to build virtual objects such as buildings and furniture.

Sociocultural Perspective: One of the branches in psychology (also called cultural psychology) used to understand how the society (social practices and culture) influences the way people interact in groups and, specifically, the social conditions that shape learning as it occurs in people as part of authentic (non-laboratory) learning activities mediated by culture-specific tools.

Special Education: Individualized programs and services delivered to students with disabilities or other special learning needs delivered by specially trained teachers in elementary or secondary schools.

Virtual Ethnography: An application of ethnographic methods for internet research, implying that social interactions carried out in an online world are subject to similar methods to those used when studying distant cultures. An example of a common data collection technique is to use screen capture software for video recording computer screen activity, as seen from a distant observer's screen in the real world who are co-located with informants in the virtual world.

APPENDIX 1

Interview Guide for Instructor

1. Description of the course
   a. How many times have you held this course in SL?
   b. Did you teach in F2F before in SL?
   c. What were the decisions for this course to be held in SL?
   d. Is the course held entirely in SL?
2. Scaffolding techniques
   a. What are the scaffolding techniques used? (technological and pedagogical)
   b. How did you create the scaffolds in the SL environment? And which ones work the best?
   c. In which way were the artifacts you made available in SL useful for collaborative and role playing activities?
   d. What was your role in supporting the collaborative activities in SL?
3. Social interaction and communication
   a. In which way does SL make social interaction easy or difficult?
   b. How can SL support communication within the groups?
   c. What advantages and disadvantages do you see, by comparing virtual world communication to its real world counterpart?
4. Collaborative interaction and learning
   a. Do you think that SL is a good environment for enabling students' collaborative interaction?
   b. Which features make the collaborative activities in SL better or worse than their real world equivalents?
   c. Could you please describe some activities that differ the most between SL and RL learning?
   d. Could you please describe some activities that differ the least between SL and RL learning?
   e. What attitude do students display toward using SL for collaborative activities?
   f. In what ways are students assessed in the course (individually and/or collaboratively)?
5. Artifacts
   a. How did the artifacts that you created (campus buildings, presentation slides and so on) facilitate role-playing activities and collaboration among the groups?
6. Role-play
   a. Why did you choose to teach theoretical concepts through role-play scenarios?
   b. How did you organize role-playing activities?
   c. Where did you get the ideas for the scenarios?
   d. Is Second Life especially well-suited for this?
   e. What advantages and disadvantages do you see, by comparing the role-playing activities to their real world equivalents?
   f. Do the sequence of the activities organized in Second Life by you, follow the same sequence of the events when organized for face-to-face seminars (if not, why?)
   g. (If not, to the previous question) What aspects of Second Life allow you to do things in new ways? (i.e. what are the unique features of SL that are useful, and why are they so?)

7. Flexibility
   a. (Self-organized learning): We observed that sometimes the students were working on their own in the work group buildings to apply the concepts and to create role playing games. You were not always present, but it counted as hours of your teaching, I suppose. Does this mean that Second Life can help make teaching and learning more flexible?
   b. (Flexibility of teaching): a) Can you teach the course while you are on travel or located in some other location than your university or home location? b) Are you at home or in your office when you teach your course in Second Life?
   c. (Flexibility of learning): Can the students who are physically co-located at the same place as you attend your lecture in a seminar room (where you are located), or is it required that all students always follow the course in SL from their own location?

APPENDIX 2

Interview Guide for Students

1. Introduction
   a. Presentation
   b. The interview will be recorded
2. Student information
   a. Avatar's name
   b. Age
   c. Gender
   d. Full time or part time student
   e. Group which you participated in and name of hall/building
3. Description of the course
   a. Course's name
   b. What is the course about?
   c. How is the course organized?
   d. Is the course held entirely in SL, if not what off-line sessions are there?
   e. What tools other than Second Life do you use in the course?
   f. What is the "percentage" you use Second Life among all the tools in the course?
   g. What are the three most important things you gain from participation in the course?
4. Description of activities in Second Life
   a. Describe your group's activities in SL
   b. Describe your individual activities in SL
   c. How easy was it to access the material provided by the teacher?
   d. Did you at any time feel that you did not have access to the information you needed?
   e. Did the use of SL for this course motivate you in any specific ways? (Please, elaborate briefly. If not, why?)

5. Teaching and learning activities
   a. Did the SL teaching methods give you the same amount of information, as you would get in classical lectures?
   b. Describe the activities that are most beneficial to your learning? What were the effective skills that were demonstrated in your group?
   c. Were there other skills that would have also been more appropriate to use? (If so, what were they?)
   d. Would you like to use Second Life for learning activities in the future?
6. Second Life environment
   a. Have you used SL for other courses than this one? If yes, which ones?
   b. How long did it take you to feel comfortable with the environment?
   c. Have you experienced any technical difficulties with Second Life?
   d. According to you, what are the main differences between learning in Second Life vs. learning in real life?
   e. Describe the activities that differ the most between Second Life and real life learning.
   f. Describe the activities that differ the least between Second Life and real life learning.
7. Social interaction and communication
   a. Which methods did you use to communicate with other avatars?
   b. Did you find any difficulties to interact and socialize within the group?
   c. Do you think SL makes social interaction easy or difficult?
   d. Which differences can you identify between communication in SL and communication in real world? (both strengths and weaknesses)
   e. Do you also use SL at your own time? If "Yes", what activities you are engaged with?
8. Collaborative activities
   a. How was your collaborative activity organized (e.g. by teacher, self-organized)?
   b. How were 'roles' assigned or did group members have equal status?
   c. Do you feel that you learned more as part of a group than you would have working alone? (elaborate)
   d. Compared to their real world equivalents, in which ways did SL support your collaborative activities?
   e. Compared to their real world equivalents, in which ways did SL hinder your collaborative activities?
   f. there anything you would have done differently if you were the teacher?
9. Role play
   a. What was your role as group member?
   b. How did the role-play allow you to apply the concepts taught in the course?
   c. What advantages and disadvantages do you see in virtual role-play compared to its real world counterpart?
   d. What were the objectives of the role-play?
   e. What outcomes did your group produce?

10. Artifacts
    a. What artifacts were involved in collaborative activities?
    b. Are the SL buildings similar to the real ones in the campus?
    c. What artifacts allowed you to practice the skills needed for the class?
    d. How were the boxes and the notecards created? (individually or collaboratively)
    e. How did these artifacts facilitate role-playing activities and collaboration among the groups?
    f. How were the artifacts created in SL (boxes, presentation slides, etc.) related to their real world counterpart (text book, articles, etc.)
11. Teacher's role
    a. What was the teacher's role in supporting your learning activities in SL?