TEACHING WITH VIRTUAL WORLDS:
FACTORS TO CONSIDER FOR INSTRUCTIONAL
USE OF SECOND LIFE*†

MICHAEL C. MAYRATH
Harvard University

TOMOKO TRAPHAGAN
Texas Education Agency

LESLIE JARMON
University of Texas at Austin

AVANI TRIVEDI
Texas Education Agency

PAUL RESTA
University of Texas at Austin

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†This article is dedicated to Dr. Leslie Jarmon. Leslie was a dedicated faculty member at the University of Texas at Austin, an inspiration to the Second Life educational community, and a prolific researcher. Working with her was always intellectually stimulating and fun. She was well known for her incomparable energy, creativity, unbridled optimism, and generous heart. Nothing was impossible to accomplish in Leslie’s eyes. She always encouraged those around her to shoot for their dreams no matter what. She is and always will be deeply missed by the people who knew her.

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ABSTRACT

Substantial evidence now supports pedagogical applications of virtual worlds; however, most research supporting virtual worlds for education has been conducted using researcher-developed Multi-User Virtual Environments (MUVE). Second Life (SL) is a MUVE that has been adopted by a large number of academic institutions; however, little research has systematically investigated the potential of using SL for higher education. A 2-year pilot study was conducted that included seven SL activities and a mixed-methods evaluation of the SL’s affordances, challenges, and limitations. Three SL integration factors emerged, each with sub-factors: pedagogical (relevance, complexity of required SL skills, use of SL affordances); contextual (student prior gaming experience, activity duration, frequency of events); and logistical (SL usability, training, technical support, computer issues). A framework for creating SL instructional activities is presented using the factors.

There is now considerable evidence documenting the potential of virtual worlds for learning and assessment (Barab & Dede, 2007; Clarke-Midura, Mayrath, & Dede, 2010; Kafai, 2006); however, most of this research has focused on custom developed virtual worlds, like River City and Quest Atlantis. Little research exists on the pedagogical potential and limitations of Second Life (SL) even though SL is by far the most widely adopted virtual world by academic institutions. SL has been used for a Harvard University law course, Stanford University virtual emergency rooms, and Britain’s National Health Service’s virtual hospital (Stein, 2007). Virtual islands created by the U.S. National Oceanic and Atmospheric Administration’s island, the Virginia Tech Memorial, the Van Gogh Virtual Museum, the U.S. Centers for Disease Control and Prevention, and Genome Island are examples of learning environments where students can interact with each other and the environment in new ways (Everts, 2007). In 2009, the University of Texas System purchased 49 parcels of land after the completion of the 2-year pilot study described in this article (Aujla, 2009).

The multi-user, high graphical fidelity, multimodal nature of SL creates many affordances for teaching and learning. SL is an example of a 3-D immersive environment, and immersive environments, like video games, have been found to facilitate flow and high, sustained engagement (Dede, 2009; Mayrath, 2009). Further, SL is free, and it provides a place where students can act out role-play simulations, collaborate with peers around the world, create 3-D models, and publish their work in multiple forms of media. These affordances and the low cost of using SL demand that research be conducted to examine the pedagogical potential and limitations of using SL. Second, the development of a framework for designing SL activities is needed to help instructors use SL in the classroom.
This study develops a framework for designing SL instructional activities. The framework is the result of aggregating data from seven SL activities during a 2-year pilot study. The framework consists of multiple factors that should be considered when designing SL instructional activities. The findings from this study are limited to the contexts in which the study took place; however, common themes and experiences across the different contexts allow us to compare what was effective and not effective.

**BACKGROUND**

**Pedagogical Applications of Virtual Worlds**

The technological concept for virtual worlds has existed for over two decades under many names, such as Multi-User Dungeon (MUD), Massively Multiplayer Online Role-Playing Game (MMORPG), and Multi-User Virtual Environment (MUVE). MUVEs have been studied extensively for their educational potential. At Harvard University, Dede and colleagues developed River City, a MUVE used to teach scientific inquiry skills to middle school students. River City was used by thousands of students across the country and was found to increase scientific inquiry skills, immersion, and intrinsic motivation (Dede, 1995, 2009; Dede, Nelson, Ketelhut, Clarke, & Bowman, 2004; Nelson & Ketelhut, 2007). Similarly, at Indiana University, Barab and colleagues created Quest Atlantis, which is a MUVE that uses commercial gaming strategies to teach scientific inquiry as well as language arts and social studies. Quest Atlantis has also been found to provide immersive participatory simulations (Barab & Dede, 2007; Barab, Sadler, Heiselt, Hickey, & Zuiker, 2007). These two MUVEs, developed specifically for education, are good examples of how virtual world technology can be utilized effectively as a pedagogical tool.

Educational MUVE games may lend themselves to the same gaming benefits found by Gee (2003), and Gredler (2004). SL is not a game as it does not have embedded game components, such as character traits, rewards, obstacles, narrative, competition, and collaboration (Squire, 2003). However, SL can be used as a platform to create a game that can be used by anyone with access. SL can be considered a MUVE; thus, the pedagogical potential of MUVEs can potentially be found for SL as well; however, more research is need to test the potential and limitations of SL for education.

SL was launched by Linden Lab in 2003 to provide users with a shared virtual experience. It was not developed specifically for education. Rather, it is a platform for users to create, meet, communicate, trade, and travel all within an online 3-D world inhabited by tens of thousands of avatars at any given time. A critical difference of SL compared to educational MUVEs described above is that users or instructors decide the instructional design. Therefore, SL space could
be developed to have pedagogical potential for immersion, participatory simulations, and inquiry-based learning, depending on the instructional design.

Recent research has reported that SL can promote interdisciplinary communication skills (Jarmon, Traphagan, & Mayrath, 2008; Jarmon, Traphagan, Mayrath, & Trivedi, 2009) when students from multiple disciplines used it as a communication environment in a process to complete a project, a sense of immersion during a role play activity (Mayrath, 2009), and increases in attitudes toward a computer science course (Ritzema & Harris, 2008). However, immersion and satisfaction were mediated by students’ ability to use the SL controls required for that specific activity (Mayrath, Sanchez, Traphagan, Heikes, & Trivedi, 2007). Student frustration occurred when the SL activity required skills, such as 3-D modeling, that were beyond the skills possessed by the student.

Jarmon (2009) found that SL’s three-dimensionality facilitated a sense of personal presence or immersion in the virtual world, which in turn promoted students’ engagement. From another perspective, SL has also been shown to be an effective tool for practicing health education skills through simulations (Boulos, Hetherington, & Wheeler, 2007; Yellowlees & Cook, 2006).

While the above suggest that the potential for the positive effects of integrating SL into the classroom is vast, an instructor should also consider difficulties that other instructors have experienced. Some of these issues include offensive behavior by avatars (Bugeja, 2007), student frustration (Mayrath et al., 2007), technology requirements (Conklin, 2007), as well as building restrictions and avatar/island occupancy limitations. Critical attention must be applied to the instructional design process (Sanchez, 2007).

There are no set rules for how SL and other virtual worlds should be utilized for education. However, Global Kids (2007), a leader in SL education for younger learners, presented the following Best Practices for Using SL for Real World Education:

1. let students play, explore, and have fun;
2. have a backup plan;
3. plan for things taking longer than expected;
4. use the multiple forms of communication in SL;
5. plan on students having different skill levels;
6. teacher becomes facilitator, student becomes peer mentor;
7. scale projects to fit resources;
8. use SL for distance collaborations;
9. give students opportunities to build relationships online; and
10. use Web 2.0 affordances.

In summary, the previous studies suggest that SL provides exciting opportunities for learning; yet, there are numerous challenges that must be considered when integrating SL into an educational setting. Research is needed to examine the affordances of using SL in various contexts, including the pedagogical,
contextual, and logistical factors associated with using SL for education. This article addresses these challenges and factors based on a 2-year SL pilot project at a major southwestern university.

**METHODS**

The overall goal of the SL pilot evaluation was to understand SL’s pedagogical effectiveness and practicality in higher education and specifically for the institution where the study was conducted. The following research questions were developed based on gaps in current knowledge of how to design SL activities for effective learning and motivation outcomes.

RQ1. What affordances in SL promote learning of content for graduate and undergraduate students?

RQ2. What challenges and limitations are inherent to using SL for learning in a large university setting?

RQ3. What pedagogical, contextual, and logistical factors affect outcomes of SL instructional activities?

**Second Life Pilot Projects**

These three research questions were investigated in a mixed-methods study conducted at a large southwestern university. A 2-year pilot evaluation of SL was carried out consisting of seven SL activities. Year 1 included two SL activities in a two-semester course. In the first semester of Year 2, two SL activities were carried out in two courses, and during the second semester three SL activities were carried out in three courses. Table 1 lists the seven SL activity titles, course descriptions, instructional objectives, activity descriptions, and training and technical support details. Figures 1 through 4 illustrate scenes from the SL activities.

Each project included one major SL instructional activity which was developed by the instructor and an instructional technology design expert. The instructors also each received land in SL, training for their students, and evaluation support. Each pilot project had an embedded formative and/or summative evaluation to address the research questions within the context of the SL activity being implemented.

**Participants**

Participants included a total of 6 instructors and 144 students. Three of the pilot courses were undergraduate level involving 115 students, and the other three courses were graduate level involving 29 students. The courses ranged in disciplines from English literature to communication to instructional technology,
<table>
<thead>
<tr>
<th>Activity name</th>
<th>Class description</th>
<th>Instructional objective</th>
<th>Activity description</th>
<th>Training and technical support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPRING 08</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Analysis of IT Research: Virtual Environments</td>
<td>Instructional Technology Research course with 12 graduate students</td>
<td>Develop an understanding of current research on and/or educational use of virtual worlds.</td>
<td>Over the course of 2 weeks, students explored and evaluated various ways SL is used in education and/or research studies on educational use of SL. Used SL, Web sites, and research articles. The project culminated in the final presentations of their findings.</td>
<td>Class received 5-6 hours of basic SL training (searching, teleporting, creating landmarks, etc.) over the course of 5 weeks. No SL land or building assigned.</td>
</tr>
<tr>
<td>Team-Based Distance Communication Using SL</td>
<td>Organizational Communication course with 59 undergraduates</td>
<td>Experience and evaluate using a virtual world technology for team-based communication across distances.</td>
<td>In one class period lasting 1 hour and 15 minutes, students were grouped into seven teams with 8-9 students per team. Teams were split in half and then went to separate computer labs. Teams in computer lab A described (text chat) the drawing with intersecting lines to teammates in computer lab B who attempted to replicate the drawing. Teaching Assistants judged the best replication.</td>
<td>Two 1-hour trainings covered basic SL skills, including communication, at an on-campus computer lab. Access to a two-acre section of land was restricted to the class's SL group. Seven meeting spaces were setup for teams. Class size exceeded land capacity and some avatars were denied access to the land and activity.</td>
</tr>
<tr>
<td>Behavior Observations in SL</td>
<td>Computer Mediated Communication course with 38 undergraduates</td>
<td>Observe avatar behaviors in SL. Then reflect on them within the context of class readings, such as eye-gaze during communication.</td>
<td>Outside of class, students spent at least 1 hour observing avatars' behaviors in SL. Many students did their observations at Orientation Island, the first place a new SL user (avatar) goes when entering SL. Students had 1 week to complete the activity by turning in a reflection paper.</td>
<td>Two optional 1-hour trainings in an on-campus computer lab to help students set up SL accounts and learn basic SL skills.</td>
</tr>
</tbody>
</table>
FALL 2007

SL Academic Controversy Debate

Computer Supported Collaborative Learning course (primarily online course) with 12 graduate students

Engage in an Academic Controversy debate.

Over the course of 2 weeks, each of the 3 groups of 4 students formed pro- and con-teams and debated self-selected topics in online text chats. Each team debated twice as they switched pro- and con- sides, once in SL and once in a text chat without visuals. After the debates, groups collaboratively reached consensus and wrote a paper to describe the best solution for the issue.

SL Project: Interdisciplinary Collaboration to Create Real-World Benefits

Inter-disciplinary Communication course with five graduate students from different disciplines

Demonstrate inter-disciplinary communication skills by building collaborations that address real-world issues.

Over the course of one semester, students as a team chose a project that offered them opportunities to directly experience inter-disciplinary communications and applied communication strategies. The student team used SL to create a virtual interactive mode of sustainable housing designs being piloted in real life, in collaboration with real life pilot initiative leaders and SL expert builders.

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Provided a manual covering basic SL topics. Conducted 4 hours of training including basic SL skills, a practice debate and a scavenger hunt.

Students received one session of training on avatar customization, searching, creating landmarks, and how to use their inventory.
<table>
<thead>
<tr>
<th>Activity name</th>
<th>Class description</th>
<th>Instructional objective</th>
<th>Activity description</th>
<th>Training and technical support</th>
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</thead>
<tbody>
<tr>
<td><strong>SPRING 07</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Discussing Leadership and Role Models</td>
<td>Composition &amp; World Literature course (the second</td>
<td>Learn about leadership through a role play activity using avatars customized to look like role models</td>
<td>Over the course of one class period (1-hour-and-15-minutes), students used SL's text chat to discuss various leadership topics, based on the research conducted prior to the discussion. Four chat sessions took place during the class period with students rotating among the meeting spaces so that each chat session was a completely new group of avatars. After the discussion, students wrote a paper on role models and leadership.</td>
<td>Students received one session of training on avatar customization, searching, creating landmarks, and how to use their inventory.</td>
</tr>
<tr>
<td>through a Role Play Activity in SL</td>
<td>semester from Fall 06 class below (undergraduate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FALL 06</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Creating Model Campus Buildings</td>
<td>Composition &amp; World Literature course (the first</td>
<td>Understand the integration of verbal and visual rhetoric</td>
<td>Over the course of 6 weeks, students built models of an ideal campus building. Activity concluded with a student essay on why their model was best.</td>
<td>Two orientation sessions were provided to students; building in SL was not covered. A manual was included, and SL trainer's office hours were provided.</td>
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<tr>
<td></td>
<td>semester in a 2-semester course) with 18 students.</td>
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</tbody>
</table>
Figure 1. Snapshot from SL debate activity of a small group chat.

Figure 2. Screenshot from inside a housing model built for an SL interdisciplinary communication project.
Figure 3. Group picture at sunset from the SL role play activity.

Figure 4. Snapshots of ideal buildings from the model campus building activity.
and instructors had to apply and be accepted to participate in the SL pilot projects. Table 1 lists the number of students in each course and the subject matter and context in which the SL activity was implemented.

**Measures and Materials**

**Student SL Survey**

A standard Student SL Survey was collected for all of the seven SL activities, see Appendix A for the 15 survey items. A 5-point Likert scale ranging from *Strongly Disagree* to *Strongly Agree* was used to measure student attitudes toward SL, SL usability, interest and engagement during the activity, pedagogical potential of SL, challenges and limitations of SL, and impact on affect learning. An open-response item allowed students to write in detail about their experiences using SL and their opinions about SL’s pedagogical potential. Due to the contextual differences between the SL implementations, statistical comparisons of the data were not made in this study; however, descriptive data for each activity’s Student SL Survey was compared to examine for trends across activities and contexts.

**Interviews and Observations**

Additional data were collected in three courses. In the *Composition and World Literature* course, two sets of interviews were conducted with the five students (a total of 10 interviews). Two focus group discussions were conducted in the *Interdisciplinary Communication* course (Jarmon et al., 2009). The interview questions and focus group topics addressed the same issues dealt with in the surveys, but aimed at obtaining data with greater depth. Interviews were transcribed and analyzed using open-coding procedures (Strauss & Corbin, 1998). For all the activities, researchers made informal observations of external representations of student frustration, enjoyment, immersion, and Flow (Csikszentmihalyi, 1997; Mayrath, 2009; Mayrath, Traphagan, Heikes, & Trivedi, 2009). Observations took place in class while students were using SL and while students were “in-world,” e.g., researchers’ avatars were able to observe the behaviors and communications of students’ avatars while in SL.

**Instructor and Researcher Reflections**

A debrief interview with each instructor provided feedback on their experiences using SL in their class, the affordances and challenges of using SL, and ideas for improvement. Instructor comments were analyzed with the Student SL Survey data to look for consistent patterns of responses. Additionally, researchers documented their accumulating experiences, observations, and insights with each SL implementation.
Apparatus

SL was used on the students’ own computers and in computer labs. When using SL in computer labs, steps had to be taken to install SL on each machine. This generally was taken care of by working with a lab technical administrator to install SL on the disk image of the lab. The administrator had to plan for installing SL updates.

Procedure

Acceptance into the SL pilot project required instructors to write a short proposal outlining their plan for using SL in their class. Criteria for acceptance to the program was based on potential impact on student learning, clarity of vision, and experience using technology in the classroom. After an instructor was accepted, he or she would meet with the instructional design consultant, and a plan for the SL activity would be developed. The activities varied from a semester-long group project to a single class meeting (see Table 1 for a detailed description of the seven SL activities).

A training session or two were scheduled for students. Training was intended to provide students with basic SL navigation, communication, and asset management skills. Training sessions included one-on-one tutoring, group workshops, and online tutorials. A support team including the trainer was present during in-class SL activities. After a SL activity was completed, students received the Student SL Survey. Interviews or focus groups were generally completed the week following the SL activity. Debriefing interviews with the instructors were also held following the SL activity.

RESULTS

Student SL Survey

Descriptive data from the Student SL Survey was compared for all seven SL activities. Statistical tests were not conducted due to the different contexts for each SL activity. However, comparisons between contexts were made based on the descriptive data and examined for consistency with the qualitative data. Table 2 below shows the average “Agree” or “Strongly Agree” responses to the 14 Likert-type survey items across the seven SL activities. There was high between group variance in students’ responses to the SL activity. Appendix B provides 14 charts that illustrate the variance in responses for each item by SL activity.

Conclusions made in the Discussion section are the result of examining the distinct differences across the seven SL activities in Student SL Survey responses. For example, there was a substantial difference in the response to the question “I found the Second Life activity to be engaging” for the Analysis of IT Research activity (50% of students responded “Agree” or “Strongly Agree”) compared to the Interdisciplinary Collaboration activity (100% of students responded...
“Agree” or “Strongly Agree”). Qualitative data was used to explore these types of substantial differences.

Student Prior Gaming Experience

In the three courses in the spring 2008 semester, statistically significant correlations were found between the degree to which students liked games and measures of their attitudes toward the instructional use of SL and the SL activities (see Tables 3 and 4). These results indicate that students who play games have more positive attitudes toward SL.

<table>
<thead>
<tr>
<th>Student SL Survey items</th>
<th>Total % “Agree” or “Strongly Agree”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I enjoyed the Second Life activity in this course.</td>
<td>57%</td>
</tr>
<tr>
<td>2. I found the Second Life activity to be engaging.</td>
<td>56%</td>
</tr>
<tr>
<td>3. I found the Second Life activity to be a good learning experience for this class.</td>
<td>54%</td>
</tr>
<tr>
<td>4. I liked the social interaction in the Second Life activity.</td>
<td>48%</td>
</tr>
<tr>
<td>5. I found the Second Life activity to be challenging.</td>
<td>31%</td>
</tr>
<tr>
<td>6. The activity using Second Life was relevant to course content.</td>
<td>71%</td>
</tr>
<tr>
<td>7. I had the skills to complete the activity in Second Life.</td>
<td>83%</td>
</tr>
<tr>
<td>8. Using Second Life helped me communicate with my classmates.</td>
<td>30%</td>
</tr>
<tr>
<td>9. Using Second Life helped me collaborate with my classmates.</td>
<td>30%</td>
</tr>
<tr>
<td>10. My engagement in the course increased because of Second Life.</td>
<td>26%</td>
</tr>
<tr>
<td>11. My learning in the course increased because of Second Life.</td>
<td>35%</td>
</tr>
<tr>
<td>12. It was a good idea to use Second Life in the course.</td>
<td>58%</td>
</tr>
<tr>
<td>13. I would enroll in a course that uses Second Life if there were another opportunity.</td>
<td>31%</td>
</tr>
<tr>
<td>14. Even with all the technological difficulties, Second Life is worth using for some courses.</td>
<td>48%</td>
</tr>
</tbody>
</table>

Table 2. Student SL Survey’s Combined Total Percentages of Students Across Seven of the SL Activities Who Responded with “Agree” or “Strongly Agree” to Likert Items
Table 3. Correlations between Liking Virtual Worlds/Games and Reactions to Second Life Activities: Data from Three Courses Combined ($N = 82-85$)

<table>
<thead>
<tr>
<th>Second Life Activities</th>
<th>I like being in a virtual world such as Second Life or There.</th>
<th>I like playing console games such as PlayStation games or Xbox games.</th>
<th>I like playing computer games (not including virtual worlds or console games) such as World of Warcraft (WoW) or Everquest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoyed the Second Life activity in this course.</td>
<td>.323**</td>
<td>.243*</td>
<td>.110</td>
</tr>
<tr>
<td>I found the Second Life activity to be engaging.</td>
<td>.390**</td>
<td>.304**</td>
<td>.232*</td>
</tr>
<tr>
<td>I found the Second Life activity to be a good learning experience for this class.</td>
<td>.428**</td>
<td>.239*</td>
<td>.171</td>
</tr>
<tr>
<td>I thought the Second Life activity was relevant to the course content.</td>
<td>.236*</td>
<td>.162</td>
<td>.134</td>
</tr>
<tr>
<td>I liked the social interaction in the Second Life activity.</td>
<td>.449**</td>
<td>.230*</td>
<td>.173</td>
</tr>
<tr>
<td>I found the Second Life activity to be challenging.</td>
<td>.216*</td>
<td>.181</td>
<td>.159</td>
</tr>
</tbody>
</table>

Note: Shaded cells indicate statistically significant correlations.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
Table 4. Correlations between Liking Virtual Worlds/Games and Reactions to Instructional Use of Second Life: Data from Three Courses Combined ($N = 82-85$)

<table>
<thead>
<tr>
<th>Instructional Use of Second Life</th>
<th>I like being in a virtual world such as Second Life or There.</th>
<th>I like playing console games such as PlayStation games or Xbox games.</th>
<th>I like playing computer games (not including virtual worlds or console games) such as World of Warcraft (WoW) or Everquest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>My engagement in this course increased because of Second Life.</td>
<td>.452**</td>
<td>.200</td>
<td>.229*</td>
</tr>
<tr>
<td>My learning in this course increased because of Second Life.</td>
<td>.518**</td>
<td>.250*</td>
<td>.389**</td>
</tr>
<tr>
<td>The use of SL helped me communicate with my fellow students.</td>
<td>.626**</td>
<td>.443**</td>
<td>.508**</td>
</tr>
<tr>
<td>The use of SL helped me collaborate with my fellow students.</td>
<td>.600**</td>
<td>.242</td>
<td>.412**</td>
</tr>
<tr>
<td>I enjoyed using Second Life in this course.</td>
<td>.544**</td>
<td>.352**</td>
<td>.283**</td>
</tr>
<tr>
<td>It is a good idea to use Second Life in this course.</td>
<td>.383**</td>
<td>.223*</td>
<td>.159</td>
</tr>
<tr>
<td>If there is another opportunity to take a course that uses Second Life, I will take it.</td>
<td>.408**</td>
<td>.235*</td>
<td>.186</td>
</tr>
<tr>
<td>Even with all the technological difficulties, Second Life is worth using for some courses.</td>
<td>.473**</td>
<td>.223*</td>
<td>.158</td>
</tr>
</tbody>
</table>

Note: Shaded cells indicate statistically significant correlations.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
Interviews and Observations

Results from open coding the interview data found numerous categories, which are discussed below. Student quotes are included to provide examples of interview question responses.

Potential Relationship between SL Activity Duration and Student Experiences

Some students expressed that their course’s SL activity would have been more effective if SL had been more fully integrated into the course. A student using SL for a one-time activity stated, “It would probably be more useful as a productivity tool if we were given a few more assignments within Second Life to get past the novelty stage, and find a comfort zone for doing some actual work together.” Even in the class where SL was used as an environment for a semester-long project, students expressed interest in using SL more, saying “SL needs to be properly integrated into the course, rather than stacked on top of the course, for it to be a valuable learning tool.”

Relevance—Connection between SL and Course Context

Student reactions to using SL in a class were often affected by their ability to perceive a connection between SL, the context of the situation, and the course goals. Students appreciated fully understanding the rationale for using SL over other options. Students who did not see the connection stated that the SL activity was pointless and asked why SL was used in place of alternative technologies. For example, one student wrote in the survey, “I feel like it was completely irrelevant and didn’t go along with the course goals.” In contrast, another student said, “This semester we’ve been learning about leadership and thinking about who our role models are and tying it all together with what our passion is in life. And this assignment was dealing with our [SL avatar] role model. So it was nice to role play into our role models and see what it would be like to be them.”

Complexity of Required SL Skills

The skills required for a SL activity were dependent upon the task, ranging from only entering SL for avatar observations to building a representation of an ideal campus building. In particular, skill demands for building in SL were perceived as high by students: students had difficulty in building and frequently requested more vigorous training. One student said, “Putting a building together was probably the most difficult thing I have ever done on the computer.” Students’ perceptions of the task’s difficulty and their readiness for the SL activity were directly related to the training provided, as we discuss further in the training
Other SL skills, such as moving and communicating were typically perceived as relatively easy.

**Use of SL Affordances**

Overall, students responded positively to SL’s capacity for simulations, experiential learning, and fairly high graphical fidelity. As for the capacity for simulations and experiential learning, a student in the *Interdisciplinary Communication Project* mentioned how SL was expanding the boundary of classroom-based education:

> I think SL expanded the notion of education or learning. Normally, you have your textbook and/or lecturers. And to be involved in the real world working with a real context on a project—that is visionary. In a lot of ways it really pushes the boundary of what it means to be learning. . . . You can actually be performing while you are learning. SL increases your imagination and creativity and god-given possibilities.

In addition, the students who participated in the *Behavior Observation Exercise* said, “Good Experience. I think this class should do more interactive activities like this” and “Great activity that provides hands-on observations.”

As for the fairly high graphical fidelity, students mentioned that SL facilitated the sense of personal presence and tangible experience, which increased their motivation and engagement. For example, a student in the debate activity wrote, “It’s really interesting to live in Second life as a self-made avatar at will. In my opinion, it’s an attractive place where all we see is beautiful and safe. Very cool!” Student safety was actually a primary concern for the researchers and instructors due to the adult content in SL.

**SL Usability**

Many students reported that SL has an “unintuitive user interface.” This affected every course and was reported, in some cases, to hinder learning. One student stated, “the controls were a little clunky, the user interface was a little cumbersome.” However, students often appreciated the opportunity to learn about SL, as one student wrote, “I’m really glad I was exposed to this.” Another student wrote, “For this course on educational research, it is important to be aware of the tool.” Students’ perceptions about SL’s usability affected their experiences. This was evident in the students who had trouble using SL expressing their frustrations in interviews while students who had less trouble learning the interface tended to be more positive in their comments.

**Training**

A majority of students expressed that training on how to use SL was necessary even for activities with the least demanding tasks, such as communication and
observation. One student stated, “There should definitely be training. I would say, offer training two to three times a week before the assignment.” Another stated, “Walk through everything step-by-step until the students get to the island that they should be on.” Yet, students’ views on how training should be done varied. For example, students stated, “I think students should be given a reason to use second life, and then left to learn it by themselves. One of the biggest ways that newcomers become part of virtual communities is by asking more experienced players for help using the program.” This particular response is salient because it is consistent with inquiry learning and problem-based learning (Bruner, 1961; Savery & Duffy, 1995; Sweller, 1988).

**Instructor and Researcher Reflections**

Post-SL activity debriefing meetings with instructors showed that they had to balance the risk of using a technology unfamiliar to students with the potential for highly engaging and effective learning experiences. Again, there were differences in the instructors’ experiences across the seven SL activities. One pilot instructor recommended that teachers must consider that “given a wide range of technology tools available, [it is important to consider] what’s the value of SL and when (under what learning conditions) SL will be a better tool than others.”

The research team implemented and led the seven SL activities in coordination with the course instructor. Researchers reported that getting students into groups was challenging because students new to SL had to accept an invitation to join the instructor’s group; however, they frequently closed the invitation message without reading and accepting admission into the group. Thus, students were often denied access to the instructor’s SL land. Similarly, students were denied access to their instructor’s SL land due to limits in the maximum number of avatars on one island that Linden Lab servers can support at one time. Researchers divided the larger classes into groups and had the groups log-in to SL at alternating times as a solution to the issue. Researchers also reported numerous crashes, bugs, and downtimes for SL which caused frustration in both the students and instructors.

Additionally, researchers observed that some students had trouble completing the SL activity due to the limitations of their own personal computers. These students reported glitches, lags, and crashes. The percentage of students who used their own computers for SL activities ranged from 63%-100% across the pilot courses. Additionally, most on-campus computer labs at the university had neither SL installed nor allowed SL to be installed. Therefore, arrangements had to be made for students to use specific computer labs with a current version of SL installed. If lab computers were used, it was important to make sure that the frequent SL updates were included in the lab computer maintenance routine.
Results Conclusion

The combination of perspectives from students, instructors, and researchers provided a robust data set for examining SL’s application in higher education across different kinds of learning activities. The data were reviewed for congruencies and variations. The results of this study are limited to the contexts in which the SL activities took place. The conclusions made in this study are focused on these specific case studies and are not intended to generalize across all contexts.

DISCUSSION

This study set out to answer three research questions and provide instructional designers with a framework for creating SL-based instructional activities. The data to address these research questions came from the synthesization of survey data, interviews, observations, instructors’ reflections, and researchers’ notes.

RQ1. What affordances in SL promote learning of content for graduate and undergraduate students?

Results showed that SL’s affordances for teaching and learning for higher education were supported in this study; however, numerous issues had to be addressed for activities to be successful. Student survey and interview responses from the Role Play activity showed evidence of Flow state characteristics, including immersion, timelessness, sustained engagement, effortless concentration, and enjoyment. Engagement and immersion are one of the primary pedagogical reasons for examining virtual world environments like SL (Dede, 2009). Data also showed that students enjoyed using SL for collaboration with new peers and organizations around the world; however, SL was not found to necessarily improve intra-class communication. This was due to other forms of technology being more efficient and easy to use, e.g., e-mail or IM.

RQ2. What challenges and limitations are inherent to using SL for learning in a large university setting?

The primary student-related challenge was learning how to use SL. Most students reported that SL’s interface was hard to use. Students also were limited in terms of technology and where they could use SL. At the time, many students could not use SL on their own personal laptops, and the research team struggled with getting computer lab administrators to continually update SL on the lab’s computers.
RQ3. What pedagogical, contextual, and logistical factors affect outcomes of SL instructional activities?

Three Pedagogical Factors

Pedagogical factors that affected the integration of SL into the classroom included: relevance, complexity of SL skills, and use of SL affordances. While relevance between an activity and an instructional objective is an established principle of instructional design, it is especially important when using SL because the student, if not familiar with SL, must invest time to learn a new technology that they perceive to be unrelated to their goals for taking the class. When students explicitly understood SL’s relevance, they valued the integration of SL in the course.

The second pedagogical factor is Complexity of SL Skills needed to complete the activity. In this study, students generally perceived SL’s overall usability as unintuitive, and hence often did not feel comfortable completing even easy tasks in SL. Furthermore, SL tasks that require high skills also require more time. For example, the Creating Buildings Activity required students to learn how to do 3-D graphic modeling and took place over 5 weeks.

The third pedagogical factor is Use of SL Affordances. Instructional designers should utilize SL’s affordances, including the 3-D immersive environment, global collaboration, role-play simulations, modeling and creation, and multimedia publishing. Results from the seven SL activities consistently showed that students generally reported positive feelings toward SL when these types of affordances were utilized in a scaffolded and supported manner.

Three Contextual Factors

Three contextual factors were identified: activity duration, frequency of events, prior student gaming experience. Activity duration refers to the length of a SL activity; whereas, frequency of events refers to the number of times activities were conducted throughout the course. These two sub-factors are constrained by available class time and therefore affected what types of SL activities could be utilized. Instructors planning a SL activity will have to consider how long and how often students will use SL.

In the seven case studies, two types of durations were found in the case studies: defined and undefined. Defined duration activities had set timeframes, such as the 1-hour Role-Play Activity, and generally took place in class. In contrast, undefined duration activities were open-ended in terms of time in SL, such with the 2-week-long Analysis of IT Research activity and the Interdisciplinary Communication Project. For undefined duration activities, tracking student time actually using SL was not feasible. Combinations of defined and undefined durations could be used to give structure to some activities while leaving other activities more open-ended and exploratory.
Figure 5 represents a continuum of duration and frequency for the seven SL activities. The continuum spans from short one-time activities to semester-long course projects. In just these seven SL activities there is a large amount of variation in terms of the duration of the task. Determining how long and how often students use SL can help instructors and researchers estimate levels of participation.

The third contextual factor is prior gaming experience which was found to have a significant correlation with affect toward SL. Students who are “gamers” are more generally comfortable in 3-D immersive environments compared to “non-gamers”; thus, an instructional designer should consider who the students are and what gaming experience they bring to the SL activity. A class of gamers might need to be challenged and given exploratory tasks, while novice gamers might need scaffolding to learning how to navigate, communicate, and manage assets.

Four Logistical Factors

Four logistical factors were identified: usability, training, technical support, and computer issues. SL’s interface was considered hard to use by many of the students. Thus, for an activity that required higher levels of SL skills, such as building, students expressed a stronger desire to receive more vigorous training. The amount of training provided depended upon the resources available, the students’ skill levels, and the skills required for the SL activity. In addition, the duration and frequency of the SL activity also affected training. For example, for one-time activities, students needed to be trained with the skills required for only general activities in SL. In contrast, for semester-long projects, students could be left to learn skills in SL through their own exploration. For example, we are aware of at least four examples (two instructors) at this university outside of our pilot program, where students are assigned to build in SL across the entire semester with minimum training or orientation, and instructors did not perceive that students were struggling due to the lack of training.

It appears that the long duration and high frequency of SL activities allow for high participation and exploratory learning, requiring less formal training. Thus, if the time is available, having students complete inquiry-based and/or problem-based learning activities as a form of training may provide students with more control and intrinsic motivation compared to traditional lecture-type trainings (Bruner, 1961; Lepper & Malone, 1987; Mayer, 2005; Savery & Duffy, 1995).

Technical support was needed throughout all seven activities, including instructional design consulting and setting up and managing SL spaces or groups for class activities. Computer issues were also a major factor that needed to be considered for each SL activity. The researchers found it important to describe the computer requirements explicitly to students before the activity began so they could plan accordingly.
One activity or presentation (1-2 hours) preceded by 2-3 1-hour trainings

5 weeks activity, 31-hour trainings

16 weeks with multiple activities, training embedded

One Time SL Activity

- Academic Controversy Debate Activity
- Analysis of IT Research Activity
- Behavior Observation Exercise
- Role-Play Activity
  *Occurred after Creating Buildings Activity
- Team-Based Communication Activity

Creating Buildings Activity

Interdisciplinary Communication Project

Fully SL Immersed Course

Figure 5. Continuum of Seven SL Activities' Duration and Frequency.
The findings from this study are synthesized into a framework of factors to consider when designing SL-based instructional activities for higher education (see Table 5). The framework lists pedagogical, contextual, and logistical factors related to SL-instructional activities, and it lists findings to help explain the factors. Also listed are practical questions that a SL instructional designer should consider when creating activities in SL.

CONCLUSION

This study aggregated results from seven SL activities and identified factors that affected the effectiveness of the SL activities. These factors and their sub-factors interact with each other; thus, based on our study we recommend that instructors and researchers take these factors into consideration as they plan the integration of SL into a curriculum. The factors are presented to help educators thinking about using virtual worlds as learning environments. While these factors are based on empirical data and longitudinal observation, they are still insights. We hope that readers will examine more closely the influence of these factors on learning in SL to further accumulate information that helps instructors to use SL in their classes effectively.

In conclusion, this study supports the use of SL for learning. Factors were identified that should be considered when designing a SL instructional activity. The instructional designer should plan for pedagogical, contextual, and logistical factors. Planning for these factors will increase the efficiency of facilitating the SL instructional activity.
Table 5. Framework for Creating SL Instructional Activities

<table>
<thead>
<tr>
<th>Factors</th>
<th>Findings</th>
<th>Practical/Questions addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pedagogical factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>SL activities need to be directly related to the course context and objectives.</td>
<td>How does SL facilitate achievement of instructional objectives? How does the activity relate to instructional goals?</td>
</tr>
<tr>
<td>Complexity of Required SL Skills</td>
<td>Consideration must be given to what SL skills are required to complete the activity.</td>
<td>Are SL skills required to complete the activity within reach of students’ capacities?</td>
</tr>
<tr>
<td>Use of SL Affordances</td>
<td>SL affordances for graphics, social connections, exploration, creation/building, and simulations need to be utilized.</td>
<td>How does the SL activity design take advantage of SL’s capacity for simulations, high fidelity graphics, customized avatars, and/or experiential learning?</td>
</tr>
<tr>
<td><strong>Contextual factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student prior gaming experience</td>
<td>Students who like games are more likely to view their SL learning experiences positively.</td>
<td>Are students “gamers”? If so, how can SL be used to engage them in the learning tasks?</td>
</tr>
<tr>
<td>Duration</td>
<td>Class time constrained students’ SL use.</td>
<td>How much time will be spent using SL for one activity?</td>
</tr>
<tr>
<td>Frequency</td>
<td>Student experiences differed in one-time activities vs. semester-long activities.</td>
<td>How many times SL activities will take place across the semester?</td>
</tr>
</tbody>
</table>
Logistical factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL usability</td>
<td>Students found SL to have a learning curve.</td>
<td>Do students experience difficulties in learning to use SL?</td>
</tr>
<tr>
<td>Training</td>
<td>Dependent upon the duration and frequency of the SL activity, training may be needed to scaffold students.</td>
<td>What kind of training should be provided? How much should the training cover? What is the students' level of SL experience compared to the requirements of the activity?</td>
</tr>
<tr>
<td>Technical support</td>
<td>Instructors new to SL needed help setting up land, managing groups, and carrying out activities.</td>
<td>Does the land need to be private? Are groups needed? How many students? Where do students go if they have trouble using SL? Are students warned about adult content in SL?</td>
</tr>
<tr>
<td>Computer issues</td>
<td>Student's ability to access SL needs to be considered so all students can participate.</td>
<td>Can they run SL on their own computers? Do labs on campus have SL installed? Automatic SL updates in labs?</td>
</tr>
</tbody>
</table>
APPENDIX A
Second Life Student Survey

5-point Likert scale used for following statements.
Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

Survey statements:

1. I enjoyed the Second Life activity in this course.
2. I found the Second Life activity to be engaging.
3. I found the Second Life activity to be a good learning experience for this class.
4. I liked the social interaction in the Second Life activity.
5. I found the Second Life activity to be challenging.
6. The activity using Second Life was relevant to course content.
7. I had the skills to complete the activity in Second Life.
8. Using Second Life helped me communicate with my classmates.
10. My engagement in the course increased because of Second Life.
11. My learning in the course increased because of Second Life.
12. It was a good idea to use Second Life in the course.
13. I would enroll in a course that uses Second Life if there were another opportunity.
14. Even with all the technological difficulties, Second Life is worth using for some courses.
15. Please provide any additional information about how you feel about Second Life. (Open-ended question)
1. I enjoyed the Second Life activity in this course.
Figure 2. I found the Second Life activity to be engaging.
Figure 3. I found the Second Life activity to be a good learning experience for this class.
Figure 4. I liked the social interaction in the Second Life activity.
Figure 5. I found the Second Life activity to be challenging.
Figure 6. The activity using Second Life was relevant to course content.
Figure 7. I had the skills to complete the activity in Second Life.

Figure 8. Using Second Life helped me communicate with my classmates.
Figure 9. Using Second Life helped me collaborate with my classmates.
Figure 10. My engagement in the course increased because of Second Life.
Figure 11. My learning in the course increased because of Second Life.
Figure 12. It was a good idea to use Second Life in the course.
Figure 13. I would enroll in a course that uses Second Life if there were another opportunity.
Figure 14. Even with all the technological difficulties, Second Life is worth using for some courses.
REFERENCES


Direct reprint requests to:

Dr. Michael C. Mayrath
1112 Juniper St.
Austin, TX 78702

e-mail: michaelmayrath@yahoo.com