Extending the Classroom through Second Life

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ABSTRACT

Second Life is a three-dimensional (3D) electronic environment where members can socialize, hold virtual meetings, or conduct economic transactions. Utilizing virtual environments like Second Life is believed to provide educators with a new medium for teaching and information dissemination that bypasses the normal boundaries associated with traditional online and face-to-face interactions. This unique platform not only provides educators with traditional online teaching conventions but also allows for simulated social interactions, which are essential to student-teacher relations in the classroom. This paper presents a series of field trials and focuses on one recent case study of the integration of Second Life into an introductory computer course. The benefits, lessons learned and effective practices of integrating the technology are provided. The case study findings are supplemented with results from student surveys. The study found that the integration of Second Life activities improved students' learning experience. Furthermore, students participated in the Second Life activities in the case study showed higher learning motivation and better performance. Limitations of this study and future research directions are also provided.

Keywords: Multi-User Virtual Environments, Second Life, Virtual Education, Learning Experience

1. INTRODUCTION

Over the past few years, Multi-User Virtual Environments (MUVEs), which provide graphical spaces for social interaction, have attracted the interest of a number of researchers, especially for those interested in learning. Second Life (Linden Lab, 2008) is one example of a MUVE, which has gained a lot of exposure recently. According to an estimation published by Gartner Group (2007), 80 percent of active Internet users will have a virtual presence in the form of an "avatar" in at least one virtual world by the end of 2011.

Following the same trend, the number of academics using some form of a MUVE as a platform for learning has grown at a rapid pace due to the success of Second Life (Livingstone and Kemp, 2006, 2007). For example, the University of California (UC), Irvine started an experimental distance learning initiative for the purpose of supporting courses so that they can use it as a platform for computer design projects; under supervision of Service Learning Projects with San José State University's Master of Library and Information Science (SJSU MLIS) program, a hybrid course in Second Life is offered at UC Davis, and Harvard University's Berkman Center built a virtual version of Austin Hall in Second Life and holds meetings there (Lester, 2006).

As educators move their teaching platforms and adapt pedagogy towards the technology and culture of the information age, we can observe a shift in educational strategies. Today's students are more familiar and comfortable using technology as a learning tool. Online and hybrid courses have been around for many years; now however we are seeing a growing interest and increased usage of education within 3D virtual settings.

Hundreds of universities and educational institutions have reportedly owned/rented land to hold classes or sessions in Second Life (Linden Research, 2009), and coupled with the myriad of related projects and initiatives related to Second Life and education (e.g., The Schome Community, 2007; Roussou, Oliver and Slater, 2006), we believe a need exists to further study the effectiveness of such a medium as a learning environment. From the author's preliminary investigation, the following research questions need to be addressed:

RQ1: What are the advantages and disadvantages/ problems of involving Second Life in classrooms?

RQ2: How to adopt virtual world technology to teaching and learning in universities effectively?

RQ3: How to design effective activities for learning in an environment like Second Life?

In an initial effort to explore the potential of Second Life in education and to answer the above research questions, a series of field trials were carried out involving Second Life activities in a classroom setting. This paper reports the series of field studies we conducted. It is organized as follows: in the next section, a brief introduction of Second Life is

presented. Attempts of using Second Life for educational purposes in literature, the research methodology utilized, and field trials using the Second Life environment are discussed in sections three to five and our main study in section six. The findings of these field studies are summarized and future research directions are discussed at the end.

2. WHAT IS SECOND LIFE?

Second Life (SL) is an Internet based three-dimensional virtual world, created by San Francisco based company Linden Labs. Originally released in 2003, Second Life has seen a large influx of users over the last few years, now totaling over 16 million registered accounts (Linden Research, 2008). Other similar virtual environments do exist, such as Twinity (Metaversum GmbH, 2009), Active Worlds (ActiveWorlds, 2009) and There (Mekena Technologies, 2009). While these other spaces remain competitors, Second Life still has a strong user base and strong attraction for new users, with some attributing its popularity to the large amount of varying in-world activities (Wagner, 2008).

Users interact within Second Life, with objects and other users, through their virtual representation known as an avatar. It is through this avatar that one can customize their own appearance (e.g. give him/herself a new age, gender or even change into a non-human form such as animal), transform their environment by creating virtual objects, communicate, collaborate and cooperate (Fetscherin and Lattemann, 2008), and view content and travel around in the Second Life environment (The Schome Community, 2007). The "residents" of Second Life create content and can communicate via text chat or through voice communication. Interactive objects are built by using a scripting language (Linden Script) that is theoretically designed to be simple enough for those with no previous programming experience. This encourages widespread group participation and creativity, the stated goal of Second Life. Therefore, it makes it a potentially innovative and exciting new tool for the improvement of education.

Limitations of using virtual worlds, such as technical limitations including latency, are a factor. Due to the high bandwidth required by Second Life, latency or lag with download times are experienced especially for those who have slower Internet connections (Bainbridge, 2007). Even though users have to deal with limitations of Second Life, many argue that the benefits that arise from using virtual worlds, such as immersive content, 3D social interaction and realistic visualization, make it well worth the effort (Braman,Vincenti, Arboleda & Jinman, 2009). Despite the growing interest in this environment and its potential usefulness for various projects, very limited studies have been reported on how to use it effectively in the classroom. The following section presents a brief review on the research in using virtual world for educational purposes.

3. VIRTUAL WORLDS AND EDUCATION

Despite the large numbers and variations of Second Life projects being conducted by educators, businesses, research groups and individuals, there still remains disagreement on the pedagogical benefits of this medium.

The New Media Consortium (NMC, 2007) conducted a survey in spring 2007 to capture insights about the work of 209 individual educators regarding their use of Second Life in education and research. According to this survey, 62% of the respondents reported to have been using SL for more than six months while only 54% reported to be involved with an education-related activity in SL. Among the respondents who claimed to be involved with such activities, only 5% reported to be taking classes on SL. 45% of respondents reported rich interactions provided by SL has been their most positive experience in SL followed by education events and learning in SL, while "Griefing/abuse (harass or aggravate others)" is being reported as the second worst experience in SL. Respondents to the survey also showed great interest regarding the potential of SL for education – half of them said that they would integrate SL into existing courses or develop new courses to incorporate SL activities. With such a growing interest in using SL for education, what kind of benefits or problems can we expect from adopting such technology in education?

Anderson and his colleagues (2008) conducted their research in the marketing and pedagogical potential of the Second Life environment. They reported that Second Life can be used by higher educational institutions for marketing purpose, for collaborations with other institutions, or as a pedagogical tool. They also noted that due to the slow graphics and high demand of computer hardware, Second Life should be viewed mainly as a learning tool that complements rather than substitutes other teaching forms. According to their observation, most frequent courses taken in SL are design courses, although no limitation was found in terms of the courses that can be conducted in SL. However, they did not explain how SL can be adopted for educational purposes effectively.

When reflecting on the pedagogical issues related to Second Life, Bradshaw (2006) summarized characteristics of Second Life as: engaging, around the clock meeting place, creativity, endless possibilities for experimentations (e.g. experimentations in physical, social and cultural issues), and simulating an infinite array of social and physical situations for research and learning. Issues related to using Second Life for educational purposes were also discussed. While teachers need to get themselves ready for the new environment, there seems to be limitless areas and topics that can be discussed in Second Life. In reflection, Bradshaw (2006) argues that a teacher's role becomes more important when involving a class in Second Life, and that teachers need to be fully present, engaged and alert at every stage. Bradshaw (2006) did present the kind of preparation an instructor needs in order to be successful when utilizing SL for educational purposes, such as matching learning outcomes to scenarios when designing activities, preparing the instructors themselves with SL, and preparing for technical problems. However, no empirical evidence was reported to support the arguments.

Virtual worlds have also been utilized as an educational game environment that offers a role-based, multi-user, "learn-by-doing" experience with the possibility of multi-user cooperation and collaboration (Slator et al., 2006). Slater, et al. (2006) conducted research on the virtual world game, Dollar Bay, which is designed to help players acquire

concepts and skills that should transfer to a context outside of the game. They argue that the educational game should be both engaging and informative. Roussou, Oliver and Slater (2006) conducted research in the attempt to compare learning between two experimental virtual reality (VR) conditions and a non-VR condition that differ in the levels of activity and interactivity. Although there was no conclusive evidence that participants' ability to learn was affected by the interaction, they did notice that students' reflective thought were supported by a passive VR condition when a robot acted as an additional level of mediation. They suggest more research is needed to study the impact of virtual environments on learning.

Lamoureux (2007) argued in his presentation that the alternative learning environment such as a virtual world, Second Life in this case, provides an "alternative and potentially neutral space" to students that are not comfortable with formal classroom lectures. Therefore, involving this type of alternative learning environment will give flexibility to students in terms of their ways of learning. Other researchers (e.g., De Castell and Jenson, 2007; Hamalainen, 2008) also suggest that experiences through avatar interactions in an immersive virtual world, can have a direct relationship to challenges met outside of the virtual world itself.

Although all of the above research projects tend to illustrate the potential benefits and/or problems of Second Life or other virtual worlds in educational settings, very few presented how this kind of environment can be best utilized for learning, and how to design learning activities involving virtual worlds, such as Second Life, effectively.

4. RESEARCH METHODOLOGY AND PROCEDURE

The focus of this study is to explore the potential benefits as well as problems associated with the use of Second Life in the classroom, how to adopt virtual world technology such as Second Life, and how to use such technology effectively for educational purposes. This section presents the research methodology and overall procedure we utilized for this study.

Generally, a case study is a research methodology that is conducted by giving special attention to completeness in observation, reconstruction, and analysis of the cases under study (Zonabend, 1992). It is conducted in a way that incorporates the views of "actors" in the case under study. Yin (1993, 1994) recommends the use of a case study methodology for *exploratory, explanatory and descriptive* studies. Stake (1995) also recommended that the selection of the cases offers the opportunity to maximize what can be learned, knowing that time is limited. Considering the explorative nature of this particular study, we believe the adoption of case study methodology will give the researchers a better idea of how Second Life can be used effectively to enhance learning and to improve students' learning experience.

In order to generate insights into our three primary research questions, we conducted a series of case studies. The investigation of multiple cases enables us deeper understanding of the research questions.

Before the official start of the main study, three pilot field trials were conducted between 2006 and 2008 to investigate the feasibility of each individual activity (e.g. research project, hands-on labs) under study. Due to limited number of participants in the trial, the evaluation of the activities was done mostly by interviews, class discussion, instructor's observations, and student performance analysis. With more student participation during the second field trial, a short survey containing mostly open-ended questions was conducted at the end to collect students' responses more formally. The result from the pilot studies helped us determine the protocols utilized for future field trials. The details of the set up and the results of the field trials (pilot and main) are discussed in the following sections. Table 1 on next page shows a summary of all the courses involved in these trials.

The following procedures were carried out for the main study:

- Identify a course for the field trial
- Design one or more course activities to be carried out in Second Life
- Train students in the use of Second Life (avatar customization and control)
- Observe students' activities in Second Life
- Interact with students in Second Life
- Conduct a brief interview with randomly selected students who participated in Second Life activities
- Evaluate student performance through the evaluation of students' project reports
- Examine students' diary (self-reflection) on their experience and thoughts on Second Life activities
- Conduct a short survey to collect students' feedback

One of the authors was the instructor for all the courses involved in this study. This offers firsthand experience and observation from an instructor's point of view. During each field trial, the observation on students' activities was documented. By the end of each trial, all the documents (observation notes, interview records, students' project reports and self-reflections) were analyzed in depth to identify common issues and benefits related to the use of Second Life activities in the classroom.

Performance (learning outcomes) from students who participated in the Second Life activities and those who did not participate (from previous semesters) were compared to check the effectives of the Second Life activities. After the analysis of the results from each trial, necessary adjustments were made when designing activities for a new trial.

The following sections describe the details of a series of field trials using Second Life activities in a classroom setting we conducted between 2006 and spring 2009. In order to show how the activities evolved over time, the pilot studies are presented first, followed by the main study.

5. PILOT TRIALS

A series of Second Life activities designed to enhance students' learning experience and to explore the possibilities of Second Life for educational purposes was conducted between 2006 and 2008. Multiple sections of three courses offered by the Computer and Information Sciences department in a mid-Atlantic metropolitan university,

	Course	Level	No. of Sections	Exercise	No. of Participants	Time Frame	Duration
Pilot Trials	Introduction to Information Technology for Business (COSC111)	Undergraduate introductory course	4	Research and presentations on the impacts of Second Life on businesses and computing	16	Fall 2006-Spring 2007	4 Weeks
	Computers and Creativity (COSC109)	Undergraduate introductory course	1	Hands-on: Lab activities	14	Summer 2007	2-Hrs in World + general discussions during the semester
	Programming Languages: Design and Implementation (COSC455)	Undergraduate upper level course	2	Research (comparison of LSL and other scripting languages, and their effects on 3D programming), presentations, building/script testing	2	Fall 2007-Spring 2008	4 Weeks
Main Study	Computers and Creativity (COSC109)	Undergraduate introductory course	8	Research, class discussions, videos	240	Fall 2007-Spring 2008	Semester long
			6	Research, class discussions, videos, lab activities and optional In-World Projects	180	Fall 2008-Spring 2009	4 to 16 Hours for optional in-world projects

Table 1. Summary of Courses Involved in the Field Trial

"Introduction to Information Technology for Businesses" (COSC111), "Computers and Creativity" (COSC109), and "Programming Languages: Design and Implementation" (COSC 455), were utilized in these studies. A summary of the courses involved in the field trials is shown in Table 1 (ordered by the time period of the delivery). These field trials are discussed in detail in the following sections.

Three factors contributed to the selection of case study sites (courses in this study): the need for diversity of the student body, availability of the lab space, and teaching schedules of the authors. The introductory level course in our university provides a diverse student body in terms of their academic background, while an upper level computer science course presents students with level of computer experience that more complicated activities require.

5.1 Courses Background
A lower level computer course titled "Computers and Creativity" (COSC 109) is a general education science elective that satisfies required credits for most students at the university. This course hinges on using the creative side of technology while studying the underlying technological foundations and evaluating the societal impact of computers. Students from various majors and varying backgrounds of computer experiences elect to take this unique course. This course includes both a lecture and lab component where students can gain hands on experience in different software packages related to topics discussed in class. General topics for this course include learning about multimedia, Web design, computer graphics, gaming and animation. While these are main topics for the course, the fundamentals for computer hardware, software and networking are also incorporated into the class curriculum to give students a well-rounded background on computer basics. Another introductory course is "Introduction to Information Technology for Business" (COSC 111). In this course the focus is primarily on business and its interaction with information technology. Students typically focus on business and office automation software, MS Office, while learning the fundamentals of computer terminology. Other topics often discussed in the course range from security issues to project management. At the end of each semester students are required to work in groups of three to four, and research on a relevant topic for the course. Most often students choose topics that relate to business strategies and technology, though they are allowed a broad range of potential topics of their choice. As a final requirement of their large group research paper, they must present to the class their results.

In an upper division class titled "Programming Languages: Design and Implementation" (COSC 455), computer science majors are required to study the particulars of various programming languages. This course emphasizes design requirements of languages as well as highlighting the features and differences of many programming languages. These languages can include Prolog, Lisp, Java, C++, FORTRAN and even COBOL. As a final project in this course, each student is required to write and present a research paper related to a particular language, an

implementation of a particular language or research on a new developing language.

5.2 Activities for Pilot Trials and Observations

This section discusses the activities we conducted during three pilot trials as well as the feedback collected through instructor's observation, students' self-reflection report, and through discussion with the participants. In order to study the feasibility of each activity and make the scale of the study manageable, we introduced only one activity at a time.

5.2.1 Research Project on the impact of Second Life on Business and Computing (COSC 111): As the initial attempt to investigate the potential of Second Life in the classroom, a pilot field trial involving a research project was introduced in an introductory course (COSC 111) in the fall of 2006. This initial trial spanned four sections of approximately 120 students. One group of four students from each section conducted a scholarly research project on the impact of virtual worlds on business and computing by collecting data and background information. Research groups were given the option to pick any topic of their choice or to select from a list of related topics provided by the instructor. The topic selected by the students as part of their research was to focus on the virtual world of Second Life specifically. In this course, students were primarily interested in the development of online spaces and drawn to the economic and business applications of online virtual communities. When presenting their findings to the class, they were also encouraged to briefly explain what Second Life is to the other students. Student perceptions of Second Life in this class were assessed though instructor's direct observation, class discussions and students' self-report.

During the course of the project, the instructor met with each group individually periodically to discuss their expectations for the project as well as their experiences. At the onset of the project, students in the research group reported that they were intrigued by the research topic even though they have skepticism regarding the value of Second Life. After some initial guidance from the instructor of possible sources of information online and in scholarly research databases, students found the research more exciting. They were generally surprised that many businesses and other academics viewed such environments as legitimate forms of online interaction and areas for research and business transactions. Many expressed their interest in Second Life after the end of the coursework. Students involved in these projects were able to achieve all project requirements and most groups went beyond the scope of their project often going well beyond page requirements for the final research paper. Those researching on Second Life out performed most other teams of students not only through the volume of written material produced, but more importantly through its quality in terms of the amount of background research conducted on the topic by the group. Students working on a Second Life related topic received 90% or above, which was on average higher than the majority of other project grades. Group motivation on their selected topic was noticeable by student feedback and conversation which may be a contributing factor in their success. Besides information on Second Life, one group

included information on the history of virtual reality and its usage in military and training simulation as a way to legitimize the use of Internet based 3D realities in an educational setting. This increase in student achievement seemed correlated to the students' genuine interest in the topic and its novelty.

The successfulness of our very first trial encouraged us to explore more on the potential of various types of SL activities in other classes.

5.2.2 Hands on Lab Activities (COSC 109): In a summer 2007 session, as a pilot study in the investigation of Second Life's potential for educational purposes, exercises involving Second Life such as building, avatar appearance editing, field trips and a "look" into various online activities in 3D environments were introduced in "Computers and Creativity" course (COSC 109). By the very nature of Second Life environment, it is the user that creates content that makes up this world. It seemed that there is a natural fit for this particular course. This initial pilot run was instrumental for looking at how students initially interacted and learned in this environment individually and as a class. It was also very helpful in the development and structure of subsequent discussions and in class topics for future sections. This trial also allowed the instructor to help better explain key aspects of Second Life and use it for experimental teaching.

Subsequent sections have been primarily introduced to Second Life through class discussions and research homework assignments. At the time of this study, while some student chose to work in Second Life for their final term project, we were waiting for future lab upgrades for further large scale lab tests. Feedback was gathered primarily from these students to investigate what types of activities were effective (Braman, Jinman & Trajkovski, 2007a). Students responded with great interest after being introduced to Second life once they understood the environment and what was possible through the platform. Although many students initially had a difficult time acclimating to the navigation controls of their avatars it was not a detrimental factor in our lab experience overall.

The instructor felt that students who had access to Second Life either in the lab or at home for hands-on activities conveyed a stronger interest in virtual environments compared to students whose entire understanding was based on videos, discussions and research on Second Life. Even though most students seemed legitimately intrigued and participated in class discussion on the topic, those that experienced immersion within Second Life had a better understanding of the environment. The concept of a virtual environment and its potential use seemed well understood by those that actually experienced the environment compared to those only exposed to Second life through lectures or readings.

5.2.3 Research Project on Linden Script Language (COSC 455): During the Fall 2007 and Spring 2008 semesters, several students in the Programming Language design and implementation class (COSC455) were encouraged to investigate and analyze Second Life's internal scripting language, Linden Scripting Language (LSL), as

part of their final research project. Since the focus of this class was on language analysis, this seemed to be a fitting topic. Students were asked to evaluate and compare LSL to other scripting languages, practice hands-on in Second Life by building scripted objects and studying the effects of 3D programming. Since Second Life was not discussed directly in this course as part of general instruction, students working on this project were asked to explain the environment in their class presentations for the benefit of the other students.

The students who evaluated Second Life from a programming perspective for their project, similarly reported high interest on the concept after time was spent learning about Second Life and time spent immersed in the environment. The instructor met with students outside of class time in Second Life to assist on initial building and toured students on areas of interest for this particular assignment, such as areas that dispensed free open source scripts in LSL. Through observation and discussion with the students, the instructor noticed that students in this particular class had a difficult time initially grasping the concept of Second Life compared to the COSC111 course since it was not discussed in any of the lecture prior to the start of their research project. More time was needed for understanding the capabilities and potential of the environment. Students also needed more time to adjust to the new computing environment. Submitted projects met the standard requirements (such as page length, scope, research depth, quality and presentation), but it was noted in the final submitted research papers, all students digressed into the aspects of the Second Life culture and economy instead of a primary focus of LSL. In their project report, students expressed a fascination of these aspects of Second Life in addition to merely the programming aspects of the platform that were defined in the research project requirements.

5.3 Pilot Trial Evaluation - Student Survey (COSC 109)
In addition to interviews with randomly selected students during different stages of the activities, a short survey questionnaire was distributed to students in COSC109 at the end of the summer 2007 to collect students' feedback on their experience in class associated with Second Life activities. The questionnaire contains ten open-ended questions covering students' past knowledge on Second Life, pros and cons of the Second Life environment, and their opinion in terms of educational potential of Second Life. The responses collected from this survey served as a guideline for the design of future class designs. Students were asked to hand in their answer on a voluntary basis. Seven out of fourteen students (50% response rate) responded to the survey. Content analysis was conducted on the responses. Responses were summarized in Table 2 below.

According to responses from the survey, even though 85.7% of the students who responded to the survey questionnaire indicated that they have never heard or used Second Life before it was introduced in the class, student's overall reactions to Second Life were positive and encouraging. One student wrote "*I love being in a virtual world, where I can see the creations and self expressions of other users*". Another student wrote that he found it interesting because "*it was like a whole new world*" to him. Students also noted that Second Life "*offers opportunities*

for students to explore". Some students suggested including more Second Life activities in the course for future students when they were asked to provide suggestions regarding course design.

Question	Yes	No
Before taking COSC109, have you ever used or heard about Second Life (SL)?	1 (14.3%)	6 (85.7%)
Do you think one day SL could be used as an extension to a regular classroom?	6 (85.7%)	1 (14.3%)

Table 2. Summary of Responses

Responses for the open-ended questions are summarized in Table 3.

Questions	Responses
Difficulties in using SL	• Navigation • Control of the avatar
Like the most about SL	• Ability to visit different places • Ability to communicate with others • Ability to see creations and expressions of others
Dislike the most about SL	• Learning curve • Lack of action • Difficult to control without a mouse
Potential of SL for educational purposes	• Allows students to explore • Allows distributed collaboration among students and instructors
SL for publicizing projects	• Allows accomplishments to be shared globally

Table 3. Summary of Open-ended Questions

When asked to discuss their thoughts on using Second Life for online education or to supplement face-to-face classroom instruction, a student commented that it was certainly a possibility "*Because all it takes is the ability to raise your hand and listen and to watch*". Visual representation or recreation of a classroom setting, voice chat, and text messaging in Second Life, makes this possible.

When asked about the difficulties they experienced in Second Life, most students noted that how to control their own avatars and move around can be difficult especially when they try to do it without a mouse.

Overall, the student responses were positive regarding the Second Life activities involved. The majority (85.7%) of students who responded recommended involving more Second Life activities in future courses. Some of the negative comments came from students who had little experience with the computer. They commented that it was hard to move around unless one puts time to practice. All of the students agree that the displaying of artwork or student research projects in Second Life is useful for publicizing projects, which "*allows accomplishments to be shared globally*".

6. MAIN STUDY: INTEGRATING VARIOUS ACTIVITIES INTO ONE COURSE (COSC109)

The instructor's observations as well as the feedback collected from the students during the field trials were beneficial for understanding the potential of Second Life activities in an educational setting. After the field trials were conducted, a number of modifications were made according to the lessons learned. The COSC 109 course was once again selected for integrating these various activities for the main study due to the diversity of the student body and course related topics. Strategies have been developed to further determine best practices for utilizing Second Life for educational purposes. For example, improved hands-on activities (i.e., improved in-world locations to visit, locations that students expressed a stronger interest, improved building/scripting tutorials, enhanced demos and introductory materials), better understanding of time requirements for class activities and preparation, knowing which activities are more useful and what related Second Life topics are more relevant to student interests to enhance motivation (i.e. topics on virtual crime, social impacts, online addiction, content, and copyright). Our initial testing with hands-on activities, research and class discussions were helpful for the design of future activities. This section discusses our latest effort in utilizing Second Life in classrooms.

6.1 Main Study Set up

Since most students have never used or even heard of Second Life before, it was very important to introduce students to this particular environment. Before students even have in-class access, we discuss aspects such as the culture, the societal norms, economy, the rules, interaction and the general impact of virtual worlds on the real world. In order to get students ready for other activities, two to three class periods (approximately 150-225 minutes in total) were utilized to discuss virtual worlds and its underlying technology. In subsequent class periods, sometimes an associated topic regarding Second Life might come up where the class may have a short discussion. Instead of immersing students into Second Life directly, taking time to have in depth discussions on the above topics helps them grasp concepts from the start. It is the authors' experience that introducing students to the environment before discussing Second Life often frustrates and discourages students from being interested in using the software in the future.

Typically students are introduced to virtual worlds such as Second Life through a class discussion where a well-rounded view is illustrated. Next the instructor utilizes various video clips and Machinima (films in 3D worlds) often from YouTube site to give students a visual component to the discussion. During the following weeks of typical course content, virtual worlds are again discussed and several small homework assignments are initiated based on current Second Life issues. Some of the topics include previous articles on how entrepreneurs in real life have made substantial income using Second Life, articles looking at the cost cutting effect of businesses using SL for meetings, educational view points as well as issues related to online crime and copyright. Students also see how Machinima is changing how people create and distribute user created content, especially through Second Life (Fillimon, 2009).

6.2 Moving into Second Life

After discussions on virtual worlds and their underlying technology, Students were introduced to activities in Second Life. Students were asked to initially create their accounts and initialize their avatars. This activity was generally quick and the class did not encounter any problems. Once logged into Second Life, the class did spend some time in Orientation Island, an introductory space in Second life where new users automatically start their virtual lives in order to initially adjust to basic movements and camera controls. It is important to note that this initial class was all physically situated in the lab together and stayed within the same general proximity in Second Life as well. This makes sure that any questions or problems are taken care of as soon as they arise. It also helps reduce students' anxiety level when facing new environments.

Students were then asked to visit an area in Second life previously created by the instructor as an experimental educational space named the "Extension Project" (Braman, Jinman & Trajkovski, 2007b). There were several areas to explore including an area where students' artworks were hosted in a virtual display gallery. Students could view their artwork in 3D (See Figure 2). The class also explored our virtual classroom, looked at a slideshow and viewed a video stream on a virtual television screen (See Figure 3). The majority students at one point became overly distracted with the avatar appearance editors such that the class spent some time adjusting their in-world appearances.

Next the class visited a free online "Sandbox" region where students could practice modeling 3D objects, experiment with textures and basic scripting. We then took the class on a series of tours to several popular destinations as part of a Second life field trip. These areas included visiting the interactive computer on Dell Island, NMC's library and museum, a virtual recreation of Dublin, Ireland and the Ohio University campus. We also visited one popular music destination so students could experience firsthand how interactive and social residents are in this particular environment.

Students were reminded that at all times that we were interacting with other people and to respect all locations and people appropriately as if we were there physically.

7. MAIN STUDY EVALUATION RESULTS: DATA ANALYSIS

After reviewing the results from the pilot study, some modifications were made to the survey questionnaire to collect more in depth feedback.

By the end of spring 2009, after the integration of multiple activities into COSC 109, an updated version of the questionnaire was distributed to those who participated in the Second Life activities. This questionnaire includes both open-ended as well as Likert-scale questions to seek specific feedback. The open-ended questions covered the pros and cons of involving Second Life in classroom activities and the students' feelings about the social and interaction possibilities of Second Life. The Likert-scale questions

focused on students' perception on the usefulness of the Second Life, its ease of use, the intention of using Second Life in the future, and the enjoyment of using Second Life in class.
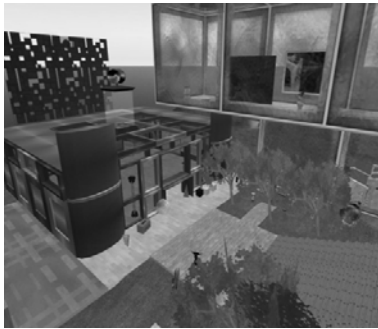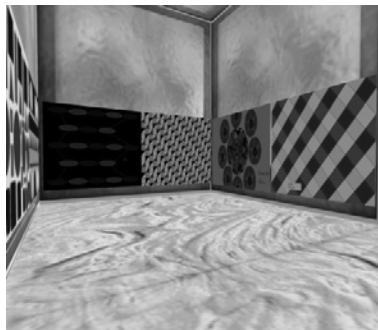

Figure 1. Extension Project

Figure 2. Display Area

Figure 3. Meeting Area

The students were asked to return the questionnaire in class on a voluntary basis. The answers to the Likert-scale questions were investigated through frequency distributions. Content analysis on the responses to open-ended questions was conducted using NVivo (QSR International, 2009), a content analysis software application. In addition, student self-reports and interviews with randomly selected students were also analyzed for additional findings that are not revealed by the questionnaire.

48 out of 90 students returned their questionnaires (53.3% response rate). Among all the students who responded, 23 (47.9%) were female, 25 (52.1%) were male. Only three (6.3%) had experience with Second Life prior to class activities. Student age ranges from 18 to 29 with an

average of 20. Students were from nineteen different majors, such as accounting, sports management, biology, chemistry, business administration, history, healthcare management, nursing, physics, and computer science, just to name a few. This represented diverse background from the students.

7.1 Results of the Open-Ended Questions
Again content analysis on the answers to the open-ended questions was conducted using NVivo. The results are presented in two categories: the pros and cons of using Second Life in classroom and the social and interaction potential of Second Life.

7.1.1 Pros and Cons of Using Second Life in Classroom:
As expected, students' feedback shows that most of them are in favor of Second Life activities in the classroom. They appreciated that Second Life allows "*the realization of unlimited imagination*"; the capability of flying and teleporting is "*a fun thing to play with*"; the interesting aspect of seeing real business and "*almost any kind of real life events*" represented in Second Life; being able to go to different places which in turn can be very useful for taking classes online; the capability of representing another person; being able to "see" someone in addition to talking to other people; and "*the way the surroundings and people look so real*". One student summarized "*whatever you can do in real life, you can do in Second Life*".

Students also noted some problems associated with Second Life. Most concerns were focused on the need for training in how to navigate and how to control the avatar into the direction they want. They also noted that the above problem can be solved by more practice on the usage of the tools provided in Second Life. This illustrates the importance of the design of training session on how to use Second Life before any serious project is assigned in a class.

Another problem students reported is the requirements for the system to run Second Life smoothly. Students noted that there were times that "buffering was required" when a large number of students were using Second Life at the same time. Instructors may need to examine their lab computers and network configuration to make sure that they meet the requirements for running Second Life before conducting formal class activities. Moreover, instructors may want to divide students into smaller groups to make the exercise more manageable.

Some students also noted that traveling in Second Life was difficult because they did not know where to go; there were "too many things" to focus on at times; and it can be deceiving since one can represent anything in Second Life. Therefore, to ease the anxiety instructors need to present clear direction as to where to visit and what to look for.

7.1.2 Social and interaction potential of Second Life: In terms of the potential of using Second Life for interaction, students reported that it could be a nice "release" from the reality where people can be acting as whoever they want; the potential of meeting people from around the world which helps "*broaden one's social life*", and help in improving issues with social anxiety. However, they also noted that "*it would take some time to get use to*" the interactions in Second Life, and there could be negative experience due to the possibility of predators. Therefore, a discussion on the

Question	SA(5)	A(4)	N(3)	D(2)	SD(1)
Intend to use SL in the future	1 (2.1%)	22 (43.7%)	7 (14.6%)	11 (22.9%)	8 (16.7%)
SL could be useful for educational purpose	7 (14.6%)	41 (70.8%)	4 (8.3%)	2 (4.2%)	1 (2.1%)
SL is easy to use.	7 (14.6%)	21 (43.7%)	16 (33.3%)	4 (8.3%)	0 (0.0%)
Have the computer resources necessary for the SL	19 (39.6%)	22 (45.8%)	3 (6.3%)	2 (4.2%)	2 (4.2%)
Have the knowledge to use the SL	13 (27.1%)	22 (45.8%)	6 (12.5%)	5 (10.4%)	2 (4.2%)
Rather use other tool than SL	9 (18.8%)	14 (29.2%)	22 (45.8%)	1 (2.1%)	2 (4.2%)
Nervous when working with SL	3 (6.3%)	4 (8.4%)	9 (18.8%)	10 (20.8%)	22 (45.8%)
Feel threatened when using SL	0 (0.0%)	2 (4.2%)	2 (4.2%)	20 (41.6%)	22 (45.8%)
Feel more comfortable meeting people in SL	4 (8.3%)	10 (20.9%)	3 (6.3%)	9 (18.8%)	22 (45.8%)
Enjoyed using SL in class	13 (27.1%)	33 (68.7%)	0 (0.0%)	1 (2.1%)	1 (2.1%)
SL is a safe environment for education	8 (16.7%)	19 (39.6%)	14 (29.2%)	6 (12.5%)	1 (2.1%)

Table 4. Summary of Likert-scale Questions

kind of expected conduct in Second Life is necessary to let student aware the difference between the communication in Second Life and real world.

7.2 Results of the Likert-Scale Questions
Twelve questions examining students' perception on the usefulness of the Second Life, perceived ease of use, the intention of using Second Life in the future, and the enjoyment of using Second Life in class were included in the questionnaire. The majority of the students reported a positive response toward the use of Second Life in the classroom.

Descriptive analysis on the Likert-scale questions was conducted. The majority of the students (95.8%) reported that they enjoyed using Second Life in classroom. 85.4% of the students reported that they believe Second Life is useful for educational purposes. While 85.4% of the students reported that they have the resources necessary to run Second Life, and knowledge necessary to use the Second Life, only 58.3% of the students reported that they feel Second Life is easy to use. This may be one of the reasons why only 45.8% of the students reported their intention to use Second Life on a regular basis in the future.

Although statistical analysis was not possible to make a more generalized conclusion due to the limited number of responses collected, one can still see students' positive attitude toward Second Life activities in a classroom setting. While the majority of the students enjoyed Second Life related activities, many of the students still prefer to use other social networking tools when it comes time to selecting tools for communication. Therefore, identifying when it is the most appropriate to involve Second Life in one class is critical. Instructors need to put more effort on identifying the appropriate class activities when involving Second Life.

Responses to the Likert-scale questions are summarized in Table 4.

In summary, the analysis of the survey questions shows that the involvement of Second Life activities in the classroom does result in a positive learning experience in educational setting.

8. DISCUSSION

In this section we discuss our findings from these field trials as we try to answer the research questions raised earlier. These answers have been summarized in Table 5.

To begin the assessment of our case study, we examined advantages and problems, best practices for adoption, effective activities, experienced problems and lessons learned with Second Life classroom adoption.

8.1 Advantages and Problems
Our field trials demonstrated potentials for Second Life activities in an educational setting. Based on our observations and student feedback, it appears that Second Life activities do have a positive impact on students' learning experience. Students are often attracted and excited to learn how they can discuss issues with other students, build 3D models, and manipulate objects in Second Life. Previous research on learning discusses a number of mechanisms that promote effective learning in the classroom, such as providing feedback, promoting active learning, and increasing motivation (Beatty, 2004).

Providing feedback at a timely manner is reported to help draw students' attention to the learning process which in turn leads to improved performance in the classroom (Kluger and DeNisi, 1996). Research literature also reported the key role that students' motivation can play in improving performance in the classroom (Weiner, 1990). Students who are motivated to learn do actually learn more than students who are not motivated (Frase, 1971). When doing projects in Second Life, students received instant feedback from the

Research Questions	Answers and Recommendations	
RQ1: What are the advantages and disadvantages/problems of involving Second Life in classrooms?	**Advantages**	**Disadvantages**
	• Improves students' learning experience through the design of appropriate class activities • Provides students the sense of reality through simulation • Provides nonverbal cues in online discussion • Provides the capability of interaction between students and various people from around the world to discuss class topics • Provides an advantage for some assignments (3D modeling, online social interaction, role playing, etc.) through visual and immersive aspects • Provides the instructor the key capability of teaching in an online environment without time/space constrains	• Complexity and steep learning curve of the environment • Difficulty in the orientation in the surroundings when guidance is not designated and provided appropriately as part of the instruction • Limitations with computer hardware, bandwidth and lab resources • Potential for griefing
RQ2: How to adopt virtual world technology to teaching and learning in universities effectively?	• Conduct small initial testing and trials with students so that instructors can learn what activities are the best for their students and assess their interest level and motivation. • Pay special attention to the sites (especially public places) for class visits so that negative impacts from activities, such as a griefing attack, can be reduced to minimum • Do a stress test of the lab facilities to make sure of the proper functioning of systems during class exercises while letting students be aware of the technological constraints that students won't be overly frustrated when facing technical difficulties	
RQ3: How to design assignments or activities that are effective for learning in an environment like Second Life?	• Provide training to students before carrying out any serious tasks to make sure students know how to navigate in the system and how to control their avatars • Use a combination of class discussions, videos, hands-on lab sessions in Second Life and research-based projects to improve student engagement and learning • Give students the freedom to form groups and to select project topics in an area related to the course to increase student motivation • Design activities for small groups to make sure that both the instructor and students won't be overwhelmed by the amount of work involved • Determine the role of Second Life in the course before designing or implementing any activities	

Table 5. Restatement of Research Questions and Preliminary Answers

system on their actions to guide them through the process. Meanwhile, the instructor also maintained contact with students both during lab session as well as outside of class meeting times. In addition to office hours in the physical office, the instructor also set up several time periods for office hours in Second Life to provide guidance to the students. This mechanism helped retain students' attention in the course. Moreover, student feedback showed that the activities in Second Life added enjoyment in learning. Students that participated in Second Life activities did show higher motivation in learning as a result.

Active learning refers to techniques that require students to actively process and apply information to learn as opposed to passive listening (Meyers and Jones, 1993). The immersive nature of Second Life not only gives students a sense of real world experience but also enables them to actively pursue the understanding of the materials rather than simply listening to the lectures or watching videos.

Important verbal and nonverbal visual cues observed by students in a traditional classroom setting (Richmond and McCroskey, 2004) are still present through the immersive visual and audio components of this environment. When activities are well designed to let Second Life fit into

classroom discussion, it helps engage and motivate students to learn.

However, the innovative side of Second Life can sometimes become a distraction in a class. As an example, in several classes students were generally amazed by the fact that their avatar could fly anywhere they wanted. Some students kept flying or kept afloat in the air while others were trying to focus on certain discussions. Seeing others constantly flying by during a class discussion can be annoying. Trying to control a class of students in an environment where there is free reign of creativity and content can be problematic. It is important that instructors emphasize certain rules of appropriate behavior while engaged in Second Life course activities.

Another problem that a class may experience is a "Griefing" attack (discussed in Section 8.4). This can be upsetting to some students, and discourage them from returning to Second Life. Some students may not only become discouraged, but perceive the environment as a game and not take course work seriously.

8.2 Adopting Virtual Worlds for Teaching and Learning
Based on our experience, one cannot let students delve into the virtual world on their own on the assumption that

students will be able to master the new environment quickly for effective class activities. Careful consideration on the training materials and exercises need to be taken before the start of any activities in world.

Instructors should also consider the technical feasibility of their particular computer lab environment. Due to the high system requirements of the platform, some institutions may have difficulty implementing such class activities. It is highly recommended that systems meet or exceed the minimum systems requirements for the Second Life client. It should also be noted that for large scale class activities that require a permanent setup in Second Life, one may own or rent sufficient space to keep buildings or Second life models persistent in Second Life. Those thinking about small class activities could use a smaller space or utilize public areas designated for educational purposes. Some Universities and research groups share or rent out virtual space for such activities.

8.3 Effective Activities for Learning

Our previous field trials showcased several effective activities for learning computer related subjects. These activities include field trips, class discussions, building and manipulating objects, and in-world presentations. A course can introduce a single Second Life activity, or it can incorporate a combination of multiple activities during the semester. The final field study showcases one possible way to integrate multiple Second Life activities in one course. However, there is no "one size fits all" solution. Depending on the class size and nature of the course topic, different class activities may be involved. For example, when a small class is involved, one can lead the class on a field trip. Discussions can be carried out during the trip. However, if it is a big class, taking the whole class into Second Life is not recommended. Instead, one should try to divide students into smaller groups before conducting activities.

Another consideration for developing effective activities relates to the utilization of Second Life itself. Will the class be meeting only online for a particular class meeting through Second Life? Will the class be logged into Second Life while in a physical classroom? Initially, students may be comfortable with the latter approach while learning basic skills in Second Life and can ask for assistance from classmates or the instructor. The role of Second Life as part of classroom instruction is a key determining factor for how it's used and how activities are executed. Is the platform being used as a sole distance learning tool or used for supplementing or enhancing an in-class activity?

8.4 Problems Experienced

During our trial run of Second Life we did experience several problems despite our best efforts for preparation:

- High technological requirement of Second Life Environment: One major hurdle was the limited technological resource available for our initial testing due to the high system requirements for running Second Life successfully. The lab computers had limited graphical capabilities and we had to set the resolutions at a minimum. Students generally were not overly impressed with the appearance of Second Life because of this and their high graphical expectations

stemming from their previous experience with video games. One student was sorely disappointed in the quality of the graphics and its lack of action, and conveyed that in a very enthusiastic manner.

- Griefing Attack: While the class was building in the open Sandbox region, we did experience a griefing attack. A resident in the same virtual area released a particle bomb that released several hundred copies of various images and particles in a way that disrupted the server that was generating the simulation of that region. The students were made aware of the possibility of these events happening (though rare). The attack slowed down the simulation to an unusable form where avatars began not respond to commands. The instructor was able to transport most of the students back to "safety" but several students were stuck. A few students had their computers freeze and had to completely restart their computers. A few students lost some interest out of frustration for some time, while the majority of other students were very intrigued by the fact that an unknown person in an unknown distant location could have such an effect on their local machine by an avatar's behavior.

8.5 Lessons Learned

As expressed in students' feedback, it takes time for one to master the various controls in the virtual world. The interviews with the students who grasped the controls and movements of the avatars much faster than other students showed that their familiarity with gaming helped them gain such an advantage. Although basic controls of movement can be attained by most users relatively quickly, they usually need several hours of hands-on experience to grasp all the controls and functions of the program. Therefore, it is essential to design a training session before any specific in-world activities are introduced in a classroom.

One factor that played an important role as to what sections of classes were given hands-on activities versus discussions and videos of Second Life was the size of the actual class. Due to limitation in instructor and lab resources, smaller classes were selected for group activities in-world. Some class sections had approximately sixty students, where some were composed of thirty or less. Even for an instructor with experience with Second Life, taking a large class in-world at the same time can be a daunting task due to the many problems that can occur both in real life (technical, logistical, recourses) and in the virtual world (griefing, students getting lost, etc.).

9. FUTURE WORK AND CONCLUSIONS

Our preliminary investigations and field trials of using Second Life in the classroom have encouraged us to further pursue this project. However, due to the limited response received in previous surveys, it is hard to generalize our findings. More research is needed for a formal evaluation of best practices to gain insights into the factors that contribute to the improvement of learning experiences and outcomes. The identification of such factors will help improve the design of class activities in the future.

Further testing is required to refine classroom activities and to engage students in this medium. Based on the lessons learned through our series of field trials of various classroom and lab activities, we hope to continue to refine and design new activities to further enhance learning, and improve students' learning experiences. During the 2009/2010 academic year more comprehensive studies throughout different classes will be conducted, and student engagement and perception will be assessed through surveys and discussions. Class activities can be improved upon after each succession of courses using Second Life.

It is the authors' intention to begin the development for a larger and more permanent educational space for student interaction. Many institutions are starting to invest in Second Life Islands for the establishment of larger online classroom space, virtual campuses and libraries and for other experimental setups. We are looking to investigate what strategies of using virtual worlds for education are the most effective for delivering course content.

In this paper we examined Second Life as one of the more popular MUVEs as an educational space. We also reported our preliminary observation and general feedback from students who we engaged with Second Life based activities. The pros and cons of each type of practice were discussed through our descriptions of course activities with students in various formats. We also discussed many of our class exercises and what we hope to accomplish in the near future through Second Life.

We see Second Life as a useful tool to extend the capabilities of the tradition classroom teaching environment. Involving students in Second Life related class projects has led us to believe there is much potential for this environment which needs further investigation. Although our experiences have been positive and encouraging based on our observations and feedback we received, we wish to continue making changes to improve our SL exercises. By experimenting further and gathering more data and feedback we will look at effective ways to adopt these technologies into higher education teaching methods.

As online virtual environments, such as Second Life, are used more frequently in an educational setting, we will see a growing number of projects and activities. With the various features provided by many MUVEs, inclusion of such environments in the classroom will not only bring benefits to learning but also problematic experiences as well. Through the discussion of the series of field trials we conducted, this paper sheds light on the benefits as well as shortcomings of a specific virtual world used for education, and how to incorporate virtual worlds to enhance learning.

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