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Virtual Worlds
- in Elementary School & College Classrooms -

ABSTRACT

This paper presents case studies of an elementary school class and a graduate college course designed to provide students with the opportunity to explore the use of virtual worlds—primarily Minecraft and Second Life—for teaching and learning. Based on the findings, implications for the design of virtual world classes are provided.

ABSTRACT

Este trabajo presenta estudios de caso a partir de una clase de escuela primaria y un curso universitario diseñados para ofrecer a los estudiantes la oportunidad de explorar el uso de mundo virtuales, principalmente *Minecraft y Second Life*, con propósitos de enseñanza y aprendizaje. Con base en los hallazgos, se proporcionan las consecuencias del diseño de clases en mundos virtuales.

Keywords: Virtual World, Second Life, Minecraft, Course Design, Constructionism.

INTRODUCTION

Virtual worlds provide unprecedented opportunities for students to learn by literally constructing their knowledge in 3D representations such as objects, places, buildings, and interactive media. Twining (2009) contends that pedagogy in virtual worlds helps students be collaborative rather than individualistic.

This paper presents case studies of an elementary school class and a graduate college course designed to provide students with the opportunity to explore the use of virtual worlds—primarily Minecraft and Second Life (SL)—for teaching and learning. Its primary purpose is to describe and evaluate strategies for teaching virtual world courses.

LITERATURE REVIEW

Although a considerable amount of research has been carried out on the sociology of virtual communities and virtual worlds, the body of knowledge on virtual worlds used in education is still relatively incipient (Campbell & Jones, 2008), with only a few studies that have attempted to highlight the potential of SL for teaching. Jarmon, Traphagan, Mayrath and Trivedi (2009) studied the effectiveness of the SL environment for a project–based experiential learning approach, particularly because students were able to learn by doing, and use what they learned in real life. Their students collaborated with real and virtual groups to create a Second Life version of two low–in-come model homes using sustainable design features designed by a real world non–profit agency.

According to Edirisingha, Nie, Pluciennik, and Young (2009), the SL environment creates a sense of immediacy and social presence, reducing the sense of distance through the use of high–bandwidth technology. This in–world socialization could be extended to network building in real life among the participants and a positive learning experience overall. Twining (2009) contends that pedagogy in virtual worlds helps students be collaborative versus individualistic, it helps them learn by doing and

by becoming, and that avatars can be used as a reflective tool.

Virtual worlds provide unique opportunities for students to learn by literally constructing their knowledge in 3D representations such as objects, places, buildings, and interactive media. The emergence of social networking technologies and virtual worlds has given rise to the importance of learning theories, such as connectivism and constructionism. Constructionism, a theory pioneered by Seymour Papert, asserts that children learn best when they are in the active role of the designer and constructor. Papert (1991) defines constructionism as, "... a mnemonic for two aspects of the theory of science education...

From constructivist theories of psychology we take a view of learning as a reconstruction rather than as a transmission of knowledge. Then we extend the idea of manipulative materials to the idea that learning is most effective when part of an activity the learner experiences as constructing a meaningful product." In virtual worlds, learners can build anything they can imagine. Educators in virtual worlds must not only consider pedagogy, but also the use of effective design and building opportunities to support instruction.

This paper presents two case studies that integrated constructionism into virtual world classes in an elementary school class and a graduate college course:

CASE STUDY 1
Minecraft at Momilani
Elementary School

A fifth grade technology class at Momilani Elementary School on the island of Oahu in Hawaii focused on a project in which students were tasked to design a themed roller coaster in Minecraft. They worked together in groups of 3–5 (see Figure 1) and utilized Google Docs and Minecraft to learn about variables, hypothesis, and data collection. This allowed them to practice aspects of the scientific process in order to learn about physics in a safe virtual environment.

Figure I.Student collaboration during the experiment design process

Students applied the Engineering Design Process throughout this learning unit when carrying out experiments in Minecraft to test hypotheses on the in-game physics. One example of this process in action occurred when they ran their first experiment. The results of the data collected varied so greatly that this sparked an active discussion on the cause of this discrepancy. Students were encouraged to use the proper terminology to explain their thoughts on the subject to one another. They came to a consensus that the method by which they were launching minecarts was inconsistent and no longer a control variable; it had, instead, become an independent variable which was influencing the outcome. They worked in small teams to develop potential solutions and then presented these solutions to the class; after which, as a class, the students determined which solution they would use in future experiments. Figure 2 displays the solution to eliminate the human error in launching the minecarts. By placing the minecart on a powered rail, and launching it with a button, the launch was far more consistent.

Figure 2. Minecart launching mechanism for the experiments

The experiments covered variables such as height, distance, power, slope, and turns. In all, there were three experiments, in which students were testing independent and dependent variables, while identifying important control variables. Throughout the experimentation process, students collaborated and continued to suggest improvements to the experiment designs that in turn improved the collection of accurate data. In Figure 3, students used colored blocks to help measure the distances the minecarts traveled.
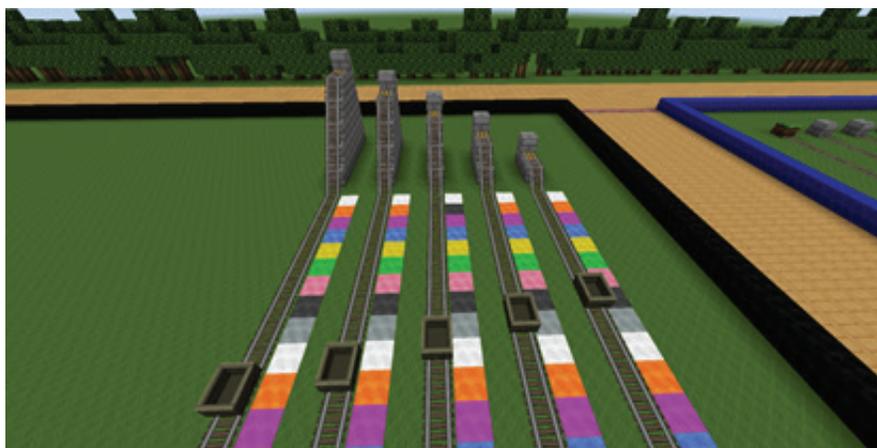

Figure 3. Testing the affect height has on the distance traveled by a minecart

For the final product, students created a roller coaster and, by doing so, applied and demonstrated their understanding of physics within Minecraft. Students understood that the roller coaster did not need any power on the downslope, as the in-game gravity would help move the minecarts. On the incline slopes, they practiced maximizing the powered rails at intervals, reducing the overall number of powered rails needed. Students were given the freedom to be creative and expressive with the theme of their roller coasters. Figure 4 shows the features designed by one of the groups. The students called this the "funnel" due to the shape and motion the minecart takes when it travels through. The design of this feature went through many revisions before it worked the way the group wanted. This type of learning through process would not have been possible were it not for the use of Minecraft in the project.

Figure 4. Creative use of in-game physics to incorporate a "funnel" feature

At the end of the project, students used a modified walk-about system in which they visited each other's roller coasters (see Figure 5) and used Google Forms to evaluate their satisfaction as customers.
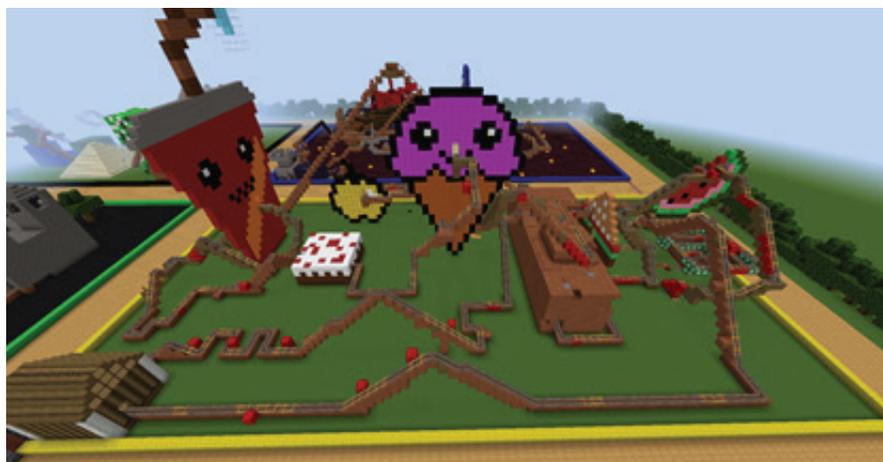

Figure 5. Pixelart food themed roller coaster design

CASE STUDY 2
Second Life & Minecraft at College of Education, University of Hawaii

A graduate educational technology elective course, LTEC 652D *Authoring E-Learning Environments – Virtual Reality* was designed to provide students with the opportunity to explore the use of virtual worlds, primarily Second Life (SL) and Minecraft, for teaching and learning. The course provided hands-on experiential learning and was designed to enable graduate students to design, develop, and evaluate instruction in SL and Minecraft.

Students identified and analyzed emerging research, as well as tools, pedagogy, virtual world teaching environments, content resources, and assessments for virtual world teaching. In this fully online course, students attended mandatory weekly synchronous in-world class sessions in SL (see Figure 6) and Minecraft. In addition to leveraging VW such as SL and Minecraft as distance learning delivery tools, the students researched the various ways that SL and Minecraft could be leveraged for instructional purposes, such as exploring other educational SL constructions, evaluating the design of educational simulations in SL, and evaluating lessons that integrated Minecraft.

Figure 6. Students attend weekly synchronous in-world class sessions in SL

The course covered basic fundamentals of building in SL (see Figure 7) with a focus on building simple educational objects; e.g., materials dispenser, media screen, slideshow, URL loader, book, etc., as well as on how to promote interactivity in SL. The ultimate goal is for the students to design, facilitate, and evaluate instruction in SL.

Efforts were made to incorporate hands-on, experiential learning activities to facilitate learning on this course. To keep students engaged during the synchronous in-world class sessions, students went on virtual field trips to evaluate the design of educational simulations in SL. Throughout the semester, students were engaged in hands-on project-building and they learned to create gift bags, t-shirts, landscape elements, materials dispensers, URL providers, slideshows, books, among other objects.

Figure 7. Students learn basic fundamentals of building in SL

The course also has a strong research component with students being required to research and compile a list of virtual world educational resources (both in-world and online) and to develop an annotated bibliography of research on virtual world teaching and learning.

In addition to the synchronous in-world sessions in SL and Minecraft, there were also asynchronous components in this fully online course. UH's course management system, Laulima (Sakai), provided a document repository; Google Classroom provided students with asynchronous collaborative opportunities using the Google Apps for Education Suite; and, furthermore, students were required to blog their virtual world learning experience using blogging tools of their choice. The final course assignment was the creation of a virtual world class module by student teams.

Working in self-selected three-person teams, students collaboratively designed, developed, and evaluated instruction in SL. Figure 8 shows an example of a student group's final project.

Figure 8. Student groups created virtual world instructional module

For the first time, in Fall 2015, students on this course learned to use Minecraft (see Figure 9). Having experienced Minecraft and learned about how teachers are using Minecraft in classrooms, students will individually put the skills they have learned to create a lesson plan which leverages the strengths and unique features of Minecraft to teach a topic which they will demonstrate in a Minecraft Show & Tell session.

Figure 9. COE MinecraftEdu Tutorial World

RESULTS

The instructors of these virtual world classes provide reflections about the implementation and effectiveness of the classes. Overall, instructors of both virtual world classes found students responding positively to their virtual world classes. Both instructors observed increased student engagement and motivation levels.

The Momilani Elementary School technology teacher was able to successfully integrate game-based learning using Minecraft that created a classroom culture of collaboration and teamwork amongst the students, as well as improved verbal and written communication skills

In general, the LTEC 652D instructor found that SL and Minecraft provided immersive 3D learning environments for online graduate students. The synchronous in-world class sessions were interactive, engaging, and invaluable to students' learning experience. In particular, the hands-on, experiential in-world learning activities facilitated students' learning on this course.

However, there were also a number of challenges insofar as implementing such technologies in the classes. For example, both instructors found that they had to spend much longer planning and preparing to teach these virtual world classes. In the case of Momilani Elementary School, the instructor only got to see students once a week, making it difficult for him to accomplish all aspects of the Minecraft class project. In general, elementary students knew Minecraft well and did not experience any learning curve.

In contrast, LTEC 652D students attended synchronous in-world sessions in SL and Minecraft every week and the instructor observed a very steep learning curve for graduate students learning the basic fundamentals of using and building in SL. Similarly, Sanchez (2009) found that a high learning curve exists for new users of SL. The majority of students in a world literature course that were involved in some SL activities during the semester, registered negative emotions with their experience, ranging from boredom to frustration and anger. Sanchez grouped these negative experiences into four categories: technical, interface, user expectations, and time. The time-consuming nature of SL also alienated some students.

Additionally, the LTEC 652D students experienced some technical problems during

the course. Similarly, Skiba (2009) found three main challenges of using SL: mastering the SL environment (learning how to build, how to purchase, how to find scripts, and gaining additional skills); securing an appropriate level of hardware and access; and lastly, enabling the students to master the skills necessary to use SL. According to Skiba, students' reaction to using SL was described as mixed initially, with students registering a more positive experience over time.

IMPLICATIONS & CONCLUSION

An elementary school Minecraft class and a graduate education elective course taught in SL and Minecraft served as case studies for this paper. The findings of this study have several implications for the design of virtual world courses. When developing virtual world classes, instructors should:

1. Learn and experience firsthand the virtual worlds from the perspective of the students.

2. Have an in-depth appreciation and understanding of the virtual world game mechanics as well as the possibilities and constraints of the virtual world for teaching and learning; focus on creating learning contexts or "simulations" that cannot be carrie out easily or cost effectively in the real world.

3. Allow students to take the lead in virtual world classes; recruit students to be a part of the teaching and learning process to increase student buy-in.

4. Start small with something that students are familiar or comfortable with. Teachers need to have a realistic learning target and should ideally begin by creating a virtual world lesson based on an existing lesson preferably one that is already well developed.
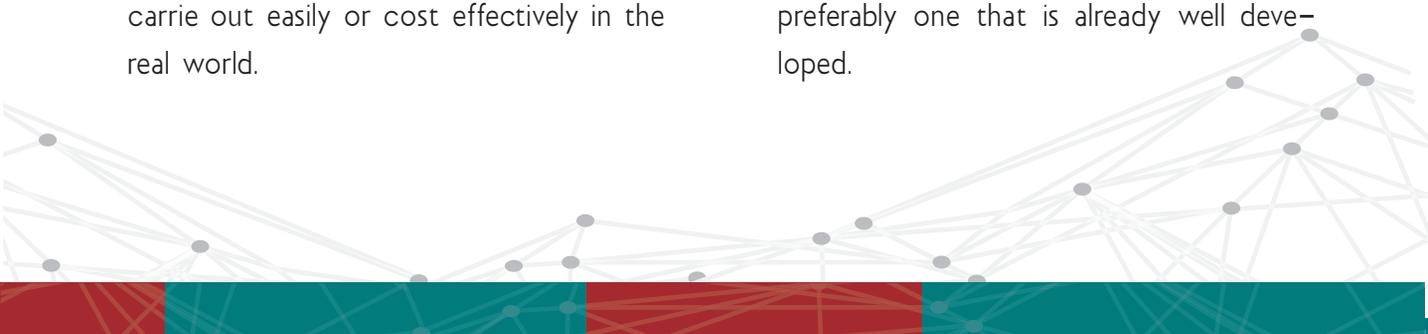
In conclusion, the instructors of both virtual world classes contend that such classes can be successfully implement in both face-to-face and fully online learning environments. The elementary school students met weekly in the school's computer laboratory while the graduate students met synchronously online in SL and Minecraft. Depending on the student population, a learning curve for using the virtual world may or may not exist. In general, K–12 students are predisposed to games and virtual worlds, and are very comfortable using these for learning. On the other hand, adult graduate students tend to experience a steep learning curve with the technology.

Overall, both instructors found that it took a substantial amount of time and effort to learn and master the virtual worlds for teaching and learning and both had to spend much more time planning and preparing to teach these virtual world classes. However, instructors of both virtual world classes found that the added effort required was well worth their time, as students responded positively and were generally more engaged and motivated.

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