
Use of Second Life in K-12 and Higher Education: A Review of Research

Chris Inman
Vivian H. Wright
Julia A. Hartman
The University of Alabama

Abstract

This study reviewed empirical research conducted in Second Life by educators since Second Life's launch in 2003. The study's purpose was to identify how Second Life is being used in both K-12 and higher education. The methodology, findings, and recommendations of 27 research studies were analyzed. Researchers identified potential problems when using Second Life in education, including issues with the Second Life software and hardware requirements, a steep learning curve, and the possibility of students becoming exposed to distractions or inappropriate content. Researchers discussed potential uses of Second Life including role-play, game and simulation creation, implementation within distance education programs, and the ability to encourage student-centered learning activities. Analysis also revealed several recommendations for educators intending to use Second Life.

Introduction

As the capability and sophistication of technology improves, educational institutions seek new opportunities to take the classroom online (Erickson & Siau, 2003). During the past decade, three-dimensional (3-D) virtual world environments have increased in popularity, and educational institutions have taken note. A virtual world environment can be defined by the following characteristics: it exists whether a user is logged in or not, it is populated by many users, it provides the illusion of 3-D space, avatars represent users in-world, and an interactive chat function is available (Dickey, 2005; Robbins-Bell, 2008).

Virtual Worlds in Education

The use and implementation of virtual worlds in education has been in place since the 1970s (Livingstone, Kemp, & Edgar, 2008); investigations into the adoption of three-dimensional (3D) worlds in education have increased over the past two decades (De Lucia, Francese, Passero, & Tortora, 2009). Educators have been drawn to 3D virtual worlds for a number of reasons. As 3D immersive worlds provide opportunities for synchronous communication and collaboration (Kemp & Livingstone, 2006), a prevailing reason to investigate 3D worlds is their use as a tool for distance learning.

Educators are also looking to virtual worlds for their potential to foster experiential and constructivist learning. Constructivist learning holds that knowledge is constructed by learners rather than transmitted and that discussion encourages negotiation and collaboration among learners (Jonassen, 1999; Vygotsky, 1978). Research by Dede (1995) indicated that 3D virtual environments could potentially provide safe environments whereby students could learn by doing. Dickey (2003) found that although there are constraints, 3D virtual worlds do support constructivist learning because users interact with each other and the environment. In applying Rogers' (1969) experiential learning theory, Mason and Moutahir (2006) successfully used a virtual environment (Second Life) to create a project-based multidisciplinary program. Hew and Cheung (2008) also found that educators use virtual worlds as experiential spaces.

Educators are also looking to virtual worlds for research opportunities. Hew and Cheung (2008) found that educators are conducting research in virtual worlds in one of three ways: to study "participants' affective domain, participants' learning outcomes, and participants' social interaction(p. 9)." In studying the affective domain, researchers are interested in examining learner attitudes and feelings regarding the use of virtual environments as educational learning environments. For example, a study by Cooper (2007) reviewed student opinion regarding the effectiveness of a video game created in Second Life called "Nutrition Game," and found that most students viewed the game positively. Likewise, Martinez, Martinez, and Warkentin (2007) conducted a lecture inside Second Life and then surveyed their students regarding the effectiveness of the lecture venue; most students indicated that they enjoyed it because using Second Life was innovative.

Another area of interest is learning outcomes, or whether 3D virtual worlds can either help students learn or improve learning. Cooper (2007) found that a majority of students surveyed said they found the game "engaging and informative (p. 49)." A study by Holmes (2007) investigated whether the use of scripted, animated 3D software agents inside a 3D virtual environment would improve student learning. Although there were some issues (i.e., software agent not meeting student expectations and limitations in the functionality of the agent), students indicated that the agents did help them learn. Researchers also are interested in whether 3D virtual spaces facilitate social interaction between students, as well as whether students use the communication features associated with particular 3D virtual environments. In a study by Peterson (2006), the researcher examined non-native speakers (students who do not speak English as their first language) as they communicated and interacted inside the 3D environment Active Worlds. Peterson found that students did use the communication tools and features available to them and that these tools encouraged learner interaction.

Educators and learners from all age groups currently frequent several virtual worlds, including There (for teens and adults), Club Penguin (for kids), Webkinz (for kids), Active Worlds (for teens and adults) and Second Life (for adults over 18 years of age). Although there are over 80 active, available educational worlds on Active Worlds (Active Worlds, 2009, ¶ 3), Second Life has drawn the most media attention as well as more attention from educators. This study will focus on the use of Second Life in education, both in K-12 and higher education.

Second Life and Education

Launched by Linden Lab in 2003, Second Life is an online, three-dimensional virtual environment in which users take on the form of an avatar, a representation of the user, and then interact with other users in the synthetic environment. Users are encouraged to truly live a second life by purchasing clothing, constructing buildings and other items such as cars and

landscape, and by meeting and visiting new people. Second Life is not a game; there are no objectives to achieve or levels to complete. Instead, it is a virtual world accessible through the Internet which presents a 3D, virtual platform in which individuals and groups can meet to create and collaborate. Linden Lab also maintains a grid called Teen Second Life, for teens aged 13 to 17 years of age, which is completely separate from the main Second Life grid. According to Linden Lab, there are at least 300 universities around the world that teach courses or conduct research inside the virtual world of Second Life (Michels, 2008, ¶4). Educational organizations such as the New Media Consortium (NMC) and the International Society for Technology in Education (ISTE) have even constructed islands inside Second Life. Since the use of virtual worlds has increased, Second Life has become a popular destination for educators and non-educators alike. Educators are choosing Second Life because they believe that Second Life allows for manipulation of space and time limited only by imagination (Vogel, Guo, Zhou, Tian, & Zhang, 2008), it presents a high degree of realism with minimal risk, provides a great venue for informal learning situations (Pence, 2007-2008), and because Second Life has received noticeable attention in the media (FitzGibbon, Oldham, & Johnston, 2008). Further, Second Life is not a game, but rather “lends itself well to the exploration of subjectivities in virtual communities” (deWinter & Vie, 2008, p.315). Given that virtual worlds will continue to be part of the educational discussion, should educators continue to use Second Life, a content analysis of actual research studies conducted and documented in Second Life by educators can potentially assist others as they formulate and design teaching and learning opportunities inside the virtual environment. Findings could provide researchers with previous types of studies already attempted, and could assist educators in deciding how to use Second Life as an educational tool. Therefore, this study’s purpose was to locate and review empirical research that has been conducted by educators, both in K-12 and higher education, in Second Life from its launch to the current time.

Study Design

Purpose of Study

The use of 3-D virtual worlds in education has increased in recent years. In particular, the virtual world of Second Life, which launched in 2003, has increasingly been used by educators to teach students, conduct class, and to explore the unique opportunities virtual worlds may present for teaching and learning. Anecdotal evidence abounds concerning what educators are doing in Second Life (Livingstone & Kemp, 2006). Additionally, studies describing how universities in the United States are creating a presence in Second Life (Jennings & Collins, 2008) and how higher education in the United Kingdom is progressing in Second Life (Kirriemuir, 2007) are available, but a review of empirical research studies concerning educator usage of Second Life is difficult to locate. Such a review can assist educators to identify current teaching and learning strategies being implemented in Second Life as well as to help researchers identify areas for further research.

The study’s framework is influenced by a review of 3-D virtual worlds in education (both K-12 and higher education) by Hew and Cheung (2008) and by a content analysis conducted by Kay (2006). The literature review was guided by the following questions:

1. What types of research methods (qualitative and quantitative) have been applied using Second Life in K-12 and higher education settings?
2. How is Second Life used by students and teachers?
3. Of the research conducted thus far in Second Life, what are the related findings?

Selection of Resources

Relevant literature to be included in this review was identified using the following criteria. First, the literature must present a completed empirical research study with the methodology, results, and discussion clearly identifiable. Second, because the focus of the investigation is the use of Second Life in K-12 education and higher education, the study presented must involve the use of Second Life in K-12 education or higher education. Finally, the study must not be sponsored by Linden Lab, the creators of Second Life, and it must not appear in any presentation, workshop, or publication supported by Linden Lab.

A multi-step process was used to identify the relevant research studies to be included in this current study. First, conference papers from three major technology and education organizations were searched for references of "Second Life" from 2004 to 2009 (Second Life launched in 2003). Conferences examined were the Society for Information Technology and Teacher Education Conference (SITE) presented by the Association for the Advancement of Computing in Education (AACE), the AECT International Convention presented by the Association for Educational Communications and Technology (AECT), and the National Educational Computing Conference (NECC) presented by the International Society for Technology in Education (ISTE). These organizations were selected because they are respected organizations in the field of education technology. AECT is one of the oldest professional organizations in the field, ISTE established the National Educational Technology standards (NETS), and AACE houses the EdITLib Education and Information Technology Library.

Second, prominent empirical research journals published by AACE, AECT, and ISTE were searched for the term "Second Life". Journals searched included *Educational Technology Research and Development*, the *Journal of Technology and Teacher Education*, the *Journal of Research on Technology in Education*, and the *Journal of Computing in Teacher Education*. Moreover, the EdITLib Education and Information Technology Library housed by AACE was also searched. Third, the following research databases were searched for the term "Second Life": Academic, Academic OneFile, Academic Search Premier, EBSCOhost, Education Full Text, ERIC, and PsycARTICLES. Finally, in order to identify research studies outside of the previous sources, a broad search of the term "Second Life" was conducted using Google Scholar. In total, these searches yielded 27 research articles that met the current study's stated criteria.

Data Analysis

The basic unit of analysis was each individual empirical research study. Each study reviewed was evaluated in terms of methodology, the topic of focus, and the reported findings. The examination of methodology included the following elements: type of research (qualitative, quantitative, or mixed methods), the sample size, the education level of focus (i.e., K-12, higher education), and data collection and analysis. The examination of the topic of focus describes the context of the study and the specific activities in which students were engaged. The examination of findings discusses the implicated findings in the studies. A more thorough description detailing how data were analyzed is provided in each of the following three sections.

Results and Discussion

Overview

The search of relevant literature was conducted over a seven-week period in spring of 2009. A total of 27 studies fitting the criteria of this study were identified (see Table 1). Two studies were retrieved from Academic OneFile (Brown, Hobbs, & Gordon, 2008; Gillen, 2009).

One article was retrieved from AECT conference proceedings (Chow, Andrews, & Trueman, 2007). Two articles were retrieved from the 2007 SITE conference proceedings (Franklin, Mayles, Liu, & Chelburg, 2007; Sanchez, 2007a). Five articles were retrieved from the 2008 SITE conference proceedings (FitzGibbon, Oldham, & Johnston, 2008; Gao, Noh, & Koehler, 2008); Margerum-Leys, 2008; McKay, Shie, & Headley, 2008; Park, Jung, & Collins, 2008). Two articles were retrieved from EdITLib (Mayrath, Sanchez, Traphagan, Heikes, & Trivedi, 2007; Sanchez, 2007b). Seven articles were retrieved from Education Full Text (De Lucia, Francese, Passero, & Tortora, 2009; Delwiche, 2006; Good, Howland, & Thackray, 2008; Jarmon, Traphagan, & Mayrath, 2008; Luo & Kemp, 2008; McVey, 2008; Rappa, Yip, & Baey, 2009). Eight articles were retrieved from Google Scholar (Fetscherin & Latteman, 2008; Hayes, 2006; Lambert & Kidd, 2008; Messinger, Ge, Stroulia, Lyons, Smirnov & Bone, 2008; Rycroft, 2007; Vogel, Guo, Zhou, Tian, & Zhang, 2008; Yee, Bailenson, Urbanek, Chang, & Merget, 2007; Yellowlees & Cook, 2006).

Table 1

<i>Source of Study</i>	
Source	Study
Academic OneFile	Brown, Hobbs, & Gordon (2008); Gillen (2009)
AECT conference proceedings	Chow, Andrews, & Trueman (2007)
SITE (2007) conference proceedings	Franklin, Mayles, Liu, & Chelburg (2007); Sanchez (2007a);
SITE (2008) conference proceedings	FitzGibbon, Oldham, & Johnston (2008); Gao, Noh, & Koehler (2008); Margerum-Leys (2008); McKay, Shie, & Headley (2008); Park, Jung, & Collins (2008)
EdITLib	Mayrath, Sanchez, Traphagan, Heikes, & Trivedi (2007); Sanchez (2007b)
Education Full Text	De Lucia, Francese, Passero, & Tortora (2009); Delwiche (2006); Good, Howland, & Thackray (2008); Jarmon, Traphagan, & Mayrath (2008); Luo & Kemp (2008); McVey (2008); Rappa, Yip, & Baey (2009)
Google Scholar	Fetscherin & Latteman (2008); Hayes (2006); Lambert & Kidd (2008); Messinger, Ge, Stroulia, Lyons, Smirnov & Bone (2008); Rycroft (2007); Vogel, Guo, Zhou, Tian, & Zhang (2008); Yee, Bailenson, Urbanek, Chang, & Merget (2007); Yellowlees & Cook (2006)

Methodology: Each Study's Design

In this section, a discussion of the methodology used in the reviewed studies is provided to answer the question, *What types of research methods (qualitative, quantitative, or mixed method) have been applied using Second Life in K-12 and higher education settings?* In empirical research studies, the methodology section includes information regarding research design, the sample size, and a description of data collection instruments (Lauer, 2006). Therefore, the researchers focused on these areas for analysis. First, each identified study was read and re-read. Second, each study's sample size, type of research conducted, education level of focus, and data collection instruments were identified as categories and recorded in a table, with one column for each category. Third, information recorded in each of the four columns was individually read thoroughly to summarize data and to determine any trends.

Type of Research.

In this section, the types of research methods implemented in the identified studies are summarized. Research method is divided into types of qualitative, quantitative, or mixed method. According to Merriam (1998), qualitative research focuses on nature and essence, as the researcher becomes the primary instrument for collecting data. Qualitative research produces findings which are rich in description, but results may not be generalizable. In contrast, quantitative research focuses on quantity, with information generally represented as numbers or measurements (Lauer, 2006). Quantitative research produces precise numerical findings which are typically, more generalized based on study design. As can be seen in Table 2, studies are almost evenly split between qualitative, quantitative, and mixed methods (i.e., both qualitative and quantitative measures are included in research). There were nine qualitative studies, nine quantitative studies, and nine mixed method studies, therefore, not suggesting any one dominant type of research being conducted in Second Life.

Table 2

Research Method Distribution

Qualitative	Quantitative	Mixed Method
Brown, Hobbs, & Gordon (2008)	Fetscherin & Lattemann (2008)	Chow, Andrews, & Trueman (2007)
Delwiche (2006)	FitzGibbon, Oldham, & Johnston (2008)	De Lucia, Francese, Passero, & Tortora (2009)
Franklin, Mayles, Liu, & Chelburg (2007)	Lambert & Kidd (2008)	Gao, F., Noh, J. & Koehler, M. (2008)
Gillen (2009)	Luo & Kemp (2008)	Jarmon, Traphagan, & Mayrath (2008)
Good, Howland, & Thackray (2008)	Messinger, G, Stroulia, Lyons, Smirnov & Bone (2008)	Mayrath, Sanchez, Traphagan, Heikes, & Trivedi (2007)
Hayes (2006)	Park, Jun, & Collins (2008)	McKay, van Shie, & Headley (2008)
Margerum-Leys (2008)	Vogel, Guo, Zhou, Tian, & Zhang (2008)	McVey (2008)
Rappa, Yip, & Baey (2009)	Yee, Bailenson, Urbanek, Chang, & Merget (2007)	Rycroft (2007)
Sanchez (2007a)	Yellowlees & Cook (2006)	Sanchez (2007b)

Sample Size

Sample size varied from zero to 835 subjects. In calculating the median sample size, two ethnographies were removed from analysis, and two further studies were removed because a specific sample size was not provided. Therefore, 23 studies were included in the mean sample calculation of 107.78 subjects. The sample standard deviation was approximately 204.57. There is a noticeable break in sample size distribution (see Table 3). Six studies had sample sizes of 97 subjects or higher, with the largest sample size being 835 subjects. The remaining 17 studies had sample sizes of 43 subjects or fewer, with the lowest number of subjects being four. Approximately 74% of the identified studies had a sample size between four and 43 subjects.

Table 3

Sample Size

Article Author	Sample Size
Margerum-Leys (2008); Jarmon et al. (2008); Franklin et al. (2007); McVey (2008)	4 to 10
Brown et al. (2008); Lambert et al. (2008)	12
Delwiche (2006)	15
Chow et al. (2007); Mayrath et al. (2007); Sanchez (2007a); Sanchez (2007b)*	18
Luo et al. (2008); De Lucia et al. (2009); Gao et al. (2008)	22 to 36
Good et al. (2008); Rycroft (2007); McKay et al. (2008)	41 to 50
Messinger et al. (2008)	97
Park et al. (2008)	120
FitzGibbon et al. (2008)	243
Fetscherin et al. (2008)	249
Yellowlees et al. (2006)	579
Yee et al. (2007)	835

*Sanchez 2007a and Sanchez 2007b share the same sample.

Education Level of Focus.

Of the studies analyzed, only one focused on elementary education (Park, et al., 2008). Additionally, only one focused on middle school education (Franklin et al., 2007) while two focused on high school age education (Gillen, 2009; Rappa et al., 2009). The remaining 23 studies focused on higher education. In higher education, 4 studies focused on Second Life use with graduate students (Chow et al., 2007; Jarmon et al., 2008; Lambert et al., 2008; McVey, 2008) and 12 focused on undergraduate students (Brown et al., 2008; De Lucia et al., 2009; Delwiche, 2006; FitzGibbon et al., 2008; Gao et al., 2008; Good et al., 2008; Margerum-Leys, 2008; Mayrath et al., 2007; McKay et al., 2008; Sanchez, 2007a; Sanchez, 2007b; Vogel et al.,

2008). The remaining 7 studies focused more upon examining concepts rather than a particular type of student (in K-12 or higher education). These studies included the following: how library information science educators could use Second Life (Luo et al., 2008), the impact of online media such as Second Life on young adult development of political awareness (Rycroft, 2007), comparing behavior in Second Life to behavior in the real world (Yee et al., 2007), exploring mental health simulations in Second Life (Yellowlees et al., 2006), the relationship between avatar and self (Messinger et al., 2008), possible Second Life use in adult education (Hayes, 2006), and factors influencing how one accepts the use of Second Life (Fetscherin et al., 2008).

One unavoidable pattern can be identified from data concerning the education level of focus: Second Life is currently predominantly associated with higher education. A total of 23 out of the identified 27 studies were conducted in the context of a higher education classroom, or conducted with higher education students, or were experiments conducted by higher education faculty.

Data Collection and Analysis.

As mentioned previously, there were nine qualitative studies, nine quantitative studies, and nine mixed method studies identified. Three studies used an ethnographic approach to collect and analyze data: Rycroft (2007), Gillen (2009), and Hayes (2006). Three studies used a case study approach to collect and analyze data: McKay (2008), Margerum-Leys (2008), and Franklin et al. (2007). One study, Sanchez (2007a), implemented an interactive qualitative approach. Six studies used interviews to collect and analyze data, three studies used focus groups, and nine used participant observations to collect and analyze data. Eleven studies collected and analyzed transcriptions from a number of places, including discussion board transcripts, chat histories in Second Life, asynchronous forum transcripts, a wiki, blog postings, listserv postings, email comments, and standard end of course assessment forms. Seventeen studies used a survey or questionnaire to collect data, with seven of those studies being subjected to statistical analysis. Regardless of the research method, the use of a survey or questionnaire was the predominant type of instrument used to collect data, with 17 studies using such instruments. Other than a survey or questionnaire, the most common form of data collection was the transcription of data (11) from message boards, emails, listservs, chat transcripts, wikis, and blogs.

Topic of Focus

In this section, a discussion of the topic of focus in the reviewed studies is provided to answer the question, *How is Second Life used by students and teachers?* In empirical research studies, the methodology section usually includes information regarding the context of the study. Therefore, the researcher focused on the methodology section, paying close attention to what educators were doing (i.e., teaching a class, facilitating a class, conducting an experiment, etc.) in Second Life and to what students were doing (i.e., listening to a lecture, working on a group project, etc.) in Second Life. After reading and re-reading each study, two themes emerged: student activity and educator activity. Therefore, a column for educator activity and a column for student activity were created and identified as categories. Second, the methodology of each study was organized and recorded in the two columns according to educator activity and student activity. Third, information recorded in each column was read and noted to identify key words or phrases such as “taught a course” or “simulation.” Fifth, key words and phrases were grouped together and identified as patterns.

Educator Activity.

In 13 of the studies reviewed, educators taught a course or facilitated a course with Second Life. In five studies, educators conducted experimental research. In three studies educators participated as an ethnographer, and in two studies educators gathered information from surveys. In one study, educators were building simulations, and in another, educators examined the use and design of space in Second Life. The most significant finding within these data is that 13 out of 27 studies, or 48%, used Second Life either to teach a course, to facilitate a course, or as part of a course.

Student Activity.

Three of the studies showed that students were engaged in role-playing activities (Gao et al., 2008; Mayrath et al., 2007; Rappa et al., 2009), and one of the studies focused on role-play and gender issues (Park et al., 2008). In two studies students attended lectures or virtual seminars (Chow et al., 2007; De Lucia et al., 2009). In FitzGibbon et al. (2008), students answered a survey indicating how much they knew about Second Life. Students in a study by Margerum-Leys (2008) explored the use of design and space in Second Life, and students in McVey (2008) went on a virtual tour. Middle school students played games in Franklin et al. (2007) while college students in Delwiche (2006) created games. Students studied Second Life (Lambert et al., 2008) and participated in various group projects in Second Life (Brown et al., 2008; Gillen, 2009; Good et al., 2008; Jarmon et al., 2008; Vogel et al., 2008).

A significant pattern can be identified when reviewing these data: in only two of the studies (Chow et al., 2007; De Lucia et al., 2009) were students engaged in activities in Second Life that can be characterized as the traditional lecture-based, teacher-centered form of education. In all of the other studies, with the exception of FitzGibbon et al. (2008) where students responded to a survey, students were engaged in student-centered forms of education such as engaging in role-play, exploring the surroundings of Second Life, and using Second Life to collaborate or communicate on group projects.

Findings of the Studies

In this section, a discussion of the findings is provided to answer the last guiding question, *Of the research conducted thus far in Second Life, what are the related findings?* In empirical research studies, research findings are usually listed in the findings section and the recommendations section. Therefore, the researcher focused on these two areas for analysis in order to answer the question. First, each identified study was read. Second, each study's findings and recommendations were summarized and recorded in a table, with one column for findings and one column for recommendations and conclusions. Third, information recorded in the two columns of findings and recommendations were read thoroughly to determine any patterns in the form of key words or phrases such as "distraction" and "training and support." Fourth, key words and phrases were color coded and identified as themes. Fifth, the identified themes were then organized into categories. The identified categories were potential problems, potential uses, and recommendations.

Potential Problems.

As can be seen in Table 4, researchers discussed potential problems with using Second Life. One significant problem, or theme, concerns the acceptance and adoption of Second Life as an educational tool, as some students did not see the value of its use (Jarmon et al., 2008; Lambert et al., 2008; Vogel et al., 2008), while others did not take it seriously (FitzGibbon et al.,

2008). Fetscherin et al. (2008), however, suggested that student acceptance of Second Life was dependent upon the perceived value of communication, the communication channels available in-world (i.e. inside Second Life), and cooperation. A second theme, technical problems associated with Second Life's heavy requirements for computing capacity coupled with the normal problems associated with computer maintenance, also caused significant frustration and consternation (Chow et al., 2007; Delwiche, 2006; Franklin et al., 2007; McVey, 2008; Sanchez, 2007b). Second Life requires a cable or DSL Internet connection, at least 800 MHZ processor (1.5 GHz recommended), and at least 512 MB of memory (1 GB recommended). If a computer does not have these requirements, it will have difficulty operating the Second Life software program. Potential technical problems include slow download time of the virtual environment, software freezing up, and software crashes, all of which will impact a student's experience with Second Life. In addition to technical problems, FitzGibbon et al. (2008) and Luo et al. (2008) identified Second Life's steep learning curve as another potential problem; the interface can be difficult to master and it takes time to learn how to build objects inside Second Life. Researchers also noted the potential for distraction due to Second Life's wide open structure as a problem, as there are no goals or tasks to accomplish in Second Life similar to those associated with video games and massively multi-player online games, and users are free to go and do as they please (FitzGibbon et al., 2008; Luo et al., 2008; McKay et al., 2008). Hayes (2006) pointed out the perception that Second Life was too open to abuse and misinformation, as well as mentioning such problems as pornography in-world (i.e., inside Second Life), the tension between private ownership of content and public access, and the appearance of "gated neighborhoods" which reflect material and social divisions among participants (p. 158).

Table 4

Potential Problems with Second Life

Authors	Potential Problem
FitzGibbon et al. (2008); Jarmon et al. (2008); Lambert et al. (2008); Vogel et al. (2008).	• Student acceptance of Second Life as an educational tool or environment
Chow et al. (2007); Delwiche (2006); Franklin et al. (2007); McVey (2008); Sanchez (2007b)	• Technical problems and lack of staff support
FitzGibbon et al. (2008); Luo et al. (2008)	• Steep learning curve
FitzGibbon et al. (2008); Luo et al. (2008); McKay et al. (2008)	• Potential for distraction and exposure to incorrect or inappropriate content

Potential Use.

Researchers identified several potential uses of Second Life (see Table 5). One potential use, or theme identified, is that Second Life has the capacity to facilitate role-play activities that are equally effective as role-play activities in the real world (Gao et al., 2008; Mayrath et al., 2008). The notion of role-play is supported by findings by Yee et al., (2007) that interactions in Second Life are governed by the same social norms in the real world, even though Messinger et al. (2008) found that behavior in a virtual world was more outgoing and risk-taking when

compared to behavior in the real world. Indeed, McVey (2008) recommended that any activity planned in Second Life should follow familiar social conventions. Related to the notion of role-play is the use of Second Life to explore gender roles as students take on different roles in different situational contexts (Park et al., 2008). A second potential use of Second Life is that Second Life can be implemented as a tool for distance education, since it allows for synchronous virtual experiences and information seeking as well as meeting opportunities (Brown et al., 2008; Chow et al., 2007; Luo et al., 2008). The ability to create simulations inside Second Life which reflect real world situations and processes is a third theme, as Yellowlees et al. (2006) created simulations in the form of mental hallucinations, while Franklin et al. (2007) successfully built and tested middle school science experiments. Engaging in group work and group projects is another potential use of Second Life recognized by educators, as students successfully worked together and in some instances preferred to be together rather than alone (Brown et al., 2008; Delwiche, 2006; Mayrath et al., 2007). Another theme identified is Second Life's potential to encourage and foster alternative forms of education which are student-centered rather than teacher-centered, and that follow constructivist principles such as problem-based learning (Good et al., 2008; Luo et al., 2008; McKay et al., 2008). Second Life also provided opportunities to build and create virtual communities (Gillen, 2009; Rycroft, 2007). Finally, several educators noted Second Life's ability to allow students to communicate, collaborate, and interact socially (De Lucia et al., 2009; Delwiche, 2006; Gillen, 2009; Margerum-Leys, 2008; Rappa et al., 2009).

Table 5

Potential Uses of Second Life

Authors	Potential Use
Gao et al. (2008); Mayrath et al. (2008); Park et al. (2008)	<ul style="list-style-type: none"> Facilitating role-play activities, including exploration of gender roles
Brown et al. (2008); Chow et al. (2007); Luo et al. (2008)	<ul style="list-style-type: none"> Distance education
Yellowlees et al. (2006); Franklin et al. (2007)	<ul style="list-style-type: none"> Simulations and games
Brown et al. (2008); Delwiche (2006); Mayrath et al. (2007)	<ul style="list-style-type: none"> Group work and group projects
Good et al. (2008); Luo et al. (2008); Jarmon et al. (2008); McKay et al. (2008)	<ul style="list-style-type: none"> Student-centered teaching and learning strategies based on constructivist principles such as problem-based learning
Gillen (2009); Rycroft (2007)	<ul style="list-style-type: none"> Build/create virtual community
De Lucia et al. (2009); Delwiche, (2006); Gillen (2009); Margerum-Leys (2008); Rappa et al. (2009)	<ul style="list-style-type: none"> To foster and encourage student communication, collaboration, and social interaction

Recommendations.

Several of the studies provided insight into how to adopt Second Life for educational purposes (see Table 6). A prominent theme was that educators should establish a clear connection between course objectives and course activities in Second Life (Delwiche, 2006; Mayrath et al., 2007) and that a correspondence between the technology and what students view

as being useful to them must be present to hold their attention (Brown et al., 2008). Without this connection, students may not see the value or relevance in using a tool such as Second Life (Brown et al., 2008; Jarmon et al., 2008; Lambert et al., 2008). A second theme was that educators should place an emphasis on technical training and support, as Second Life requires robust, up-to-date computers to handle and run the software, and support staff who are familiar with Second Life were not available (Chow, et al., 2007; Mayrath et al, 2007; Jarmon et al. 2008; Sanchez, 2007b). A third theme was that educators should provide scaffolding activities inside Second Life which help students to build skills, to practice, and to acclimate to the virtual environment (Delwiche, 2006; Mayrath, et al., 2007; McVey, 2008; Rappa et al., 2009; Sanchez, 2007b). Margerum-Leys (2008) and De Lucia et al. (2009) mentioned a fourth theme that spaces, such as collaborative zones and lecture rooms, should be constructed to achieve or encourage intended instructional goals and objectives.

Table 6

Recommendations by the Researchers

Researchers	Recommendations
Brown et al. (2008); Delwiche (2006); Mayrath et al. (2007); Sanchez (2007b)	<ul style="list-style-type: none"> • Establish a clear connection between course objectives and activities in Second Life
Chow, et al. (2007); Mayrath et al. (2007); Jarmon et al. (2008); Sanchez (2007b); Delwiche (2006); Mayrath, et al. (2007); McVey (2008); Rappa et al.(2009); Sanchez (2007b)	<ul style="list-style-type: none"> • Incorporate technical training and support into any planned Second Life activity • Create scaffolded learning activities for students so they can practice inside Second Life and acclimate to the virtual environment
Margerum-Leys (2008); De Lucia et al. (2009)	<ul style="list-style-type: none"> • Design and construct different spaces to encourage different types of student interaction

Summary

Data gathered from this review can offer several pieces of information regarding the use of Second Life in education to further inform future research. First, neither form of research, qualitative, quantitative, or mixed method, is currently more prevalent. Second, the sample sizes of the studies conducted thus far are relatively small, with approximately 74% of the identified studies having a sample size between four and 43 participants. Third, Second Life is currently predominantly the domain of higher education, with 23 out of the identified 27 studies conducted by higher education faculty or in the context of a higher education classroom or with higher education students. Fourth, regardless of research method, the use of a survey or questionnaire was the predominant type of instrument used to collect data, with 17 studies using such methods. Fifth, educators in 13 out of 27 studies, or 48%, used Second Life either to teach a course, to facilitate a course, or as part of a course. Lastly, in 14 of the 17 studies where students were involved, students were engaged in student-centered types of learning such as role-play, simulations, project-based learning, group learning, and explorative learning.

Several potential problems with using Second Life were identified by researchers. Problems include issues such as student acceptance of Second Life as an educational tool, technical problems, a steep learning curve, the potential for distraction and disruption caused by avatars unrelated to the class, and potential exposure to misinformation and pornography. Despite these problems, educators also recognized potential uses for Second Life as an instructional tool or forum. Potential uses included implementing Second Life to engage in role-play activities, to explore gender roles, to augment distance education, to create and participate in simulations and games, to employ group-based and project-based learning, and to use student-centered forms of teaching and learning. With potential uses in mind, researchers also made recommendations regarding how to implement Second Life. Recommendations include connecting course content and objectives to learning activities in Second Life, incorporating technical training and support, providing scaffolded learning opportunities for students to acclimate to the virtual environment, and designing and creating distinct types of spaces to encourage different types of social interaction.

Second Life and Constructivism

Several studies mentioned the use of Second Life as a constructivist tool or environment (Good et al., 2008; Luo et al., 2008; McKay et al., 2008). Constructivism is neither a theory of learning nor a model for designing instruction (Jonassen, 2006). Instead, it is an “epistemological and psychological thesis about how we learn (Splitter, 2008, 139).” Windschitl (1999) notes that constructivism is based on the reasoning that learners actively interpret, create, and reorganize knowledge; such knowledge creation is reflected in John Dewey’s notion of “learning by doing.” In constructivism, students actively participate in the knowledge creation process rather than merely receiving knowledge from the transmitter (i.e. the teacher). Learning experiences therefore include “problem-based learning, inquiry activities, dialogues with peers and teachers that encourage making sense of the subject matter, exposure to multiple sources of information, and opportunities for students to demonstrate their understanding in diverse ways (Windschitl, 1999, 157).” Based upon the content analysis, Second Life facilitates all of these activities, thus indicating that it may be a constructivist tool.

Recommendations for Using Second Life

This study identified a number of actions that educators should take if they are to venture forth either into Second Life or virtual worlds in general. A description of the recommendations is provided below.

Identify Course Goals and Objectives

As with using any technology tool or activity, it is important to identify the objectives of the course and the educational goals students are to achieve. This step should not be overlooked as students may not consider Second Life to be a serious educational environment or tool (FitzGibbon et al., 2008; Jarmon et al., 2008; Lambert et al., 2008; Vogel et al., 2008). The instructor should devote significant time to ensure that students understand the connection between course goals, requirements, and the activities to be completed in the virtual environment.

Choosing a Virtual Environment

Choosing a virtual environment to incorporate into teaching and research is also an important consideration. Virtual worlds such as Second Life have age restrictions (age 18 and older); the Teen Second Life grid is restricted to teens aged 13 to 17, although teachers and researchers can gain entry by completing a screening process. Once a teacher is admitted to Teen Second Life, the educator must stay on islands restricted to adults; teens may visit and leave the adult islands, but adults cannot leave. Educators or researchers using Second Life should spend time and effort to select the virtual environment most appropriate to address their needs. Cost and pricing should also be considered.

Hardware and Software Requirements

Second Life maintains significant software and hardware requirements. As stated earlier, Second Life requires a cable or DSL Internet connection, at least 800 MHZ processor (1.5 GHz recommended), and at least 512 MB of memory (1 GB recommended). Without meeting these minimum requirements, any computer attempting to run the Second Life program will encounter difficulty in the form of slow software download times, software freezes, and software shut-downs (Chow et al., 2007; Delwiche, 2006; Franklin et al., 2007; McVey, 2008; Sanchez, 2007b). Such occurrences will likely tarnish any activity the student attempts to complete. Educators should ensure that students have access to computers that can process the software, either personally owned computers or a computer lab on site.

Connecting Content to Course Activities

Similar to the need of identifying course goals and objectives is the need of explaining the connection between course content and Second Life activities. Students must be able to understand why completing the course activity in Second Life will contribute to the course and to their overall understanding of the course material. Instructors should take special care to make the connection clear or the students may not consider the activity worthwhile (FitzGibbon et al. 2008; Jarmon et al., 2008; Lambert et al., 2008; Vogel et al., 2008).

Use of Space

The Second Life environment is vast, with wide-open spaces. Therefore, it may be helpful to create specific types of spaces to encourage different types of student interaction (Margerum-Leys, 2008; De Lucia et al. 2009). For example, to encourage student collaboration in building projects, creating a sandbox (an area where any avatar can build for free) where students could practice together would be helpful. Teachers and researchers should also consider restricting space, both in terms of who has access and in what the avatar (student) can view on the monitor screen at any given point. Such restrictions could assist in addressing the problems of student distraction and exposure to unrelated content mentioned in a few studies (FitzGibbon et al., 2008; Luo et al., 2008; McKay et al., 2008).

Scaffolded Learning Activities

Given that Second Life has a steep learning curve due to the complexity of the interface (FitzGibbon et al., 2008; Luo et al., 2008), it is sensible to design learning activities that help students to slowly learn how to use Second Life (Delwiche, 2006; Mayrath, et al., 2007; McVey, 2008; Rappa et al., 2009; Sanchez, 2007b). Such activities could begin with an introduction to Second Life, followed by avatar creation, and then move to a search activity in which students

learn how to search and teleport inside Second Life, all while locating items for their avatar. More complex activities could follow.

Student-Centered Learning Activities

While Second Life can certainly support the traditional teacher-centered form of education, it also supports and encourages more student-centered, constructivist forms of education described by Windschitl (1999) such as problem-based learning, inquiry, dialogue between peers and teachers, access to multiple sources of information, and opportunities for students to demonstrate their understanding in diverse ways. Second Life is particularly suited for open-ended problem-based learning because it does not suffer from lack of resources or constraint of scale found in the real world (Good, 2008, p.171). Second Life does not lack for information, as island after island is available to be searched. The Second Life tools also present the possibility for students to demonstrate understanding in a number of different ways (i.e., role-play, game creation, simulation creation, works of art, three-dimensional models, etc.).

Limitations and Conclusions

There are two limitations to the study. First, the study was restricted to research studies involving only Second Life. Other virtual worlds were purposely not included. Therefore, it may be difficult to generalize any findings with other virtual worlds. Second, despite the best efforts of the researchers to locate all empirical research studies with Second Life not sponsored by Linden Lab, it is possible that some studies were missed and were therefore not included. Any exclusion was not done so with intent.

Despite these limitations, this review has several implications for the use of Second Life as an educational tool. First, it is clear that if educators are to continue to use Second Life as an educational tool and environment, then more empirical research should be conducted to determine best practices for using this particular virtual world. An important question should also be considered, for both researchers and educators: given that only 4 studies focused on the use of Second Life in K-12 education, should researchers and educators look to virtual environments other than Second Life in which to teach K-12 students? Furthermore, should researchers and educators continue to consider virtual world environments as viable learning tools? Currently, Second Life has two distinct and entirely separate grids: the main adult grid for people ages 18 and up and the Teen Second Life grid for teens ages 13 to 17. Students over the age of 17 are not legally allowed to enter the Teen Second Life grid, and educators are considerably restricted in how they can enter and interact with teens in the Teen Second Life grid. If virtual environments are to continue to be used as learning and research tools, it may be time for researchers and educators to collaborate to develop a more safe and secure environment for all students in K-12. Initiatives such as the Immersive Education Initiative by Media Grid (<http://mediagrid.org>) are currently working to establish standards and best practices for virtual worlds. Perhaps efforts such as these can assist in developing a virtual arena that is more appropriate for K-12 students and educators (Kelton, 2008).

For research purposes, studies such as these are intended to provide snapshots of research and activity currently taking place at a given point in time. Therefore, it is recommended that further research continue where this study ended, as Second Life may undergo change over time, either assisting or hindering educator efforts in Second Life. Future research may also examine

specific reasons why little research with K-12 education is taking place in Second Life when compared with higher education. Certainly, further research could explore the various ways in which higher education educators and researchers are using the Second Life platform to teach, research, and experiment. It is important that research continue, since it is likely that virtual worlds, in the form of Second Life or another platform, will continue to play a role in education and research.

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