Intentions to Use Virtual Worlds for Education

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ABSTRACT

Virtual worlds are becoming increasingly sophisticated, showing potential as an effective platform for a variety of collaborative activities, including learning. This study examines students' intentions to use the virtual world Second Life (SL) for education, and explores factors associated with their intentions. Based on the Technology Acceptance Model (TAM) and extended factors, a research model is proposed. The model is tested through a survey administered to business school students who participated in Second Life in upper level MIS courses. Results suggest that perceived ease of use affects user's intention to adopt SL through perceived usefulness. Computer self-efficacy and computer playfulness are also significant antecedents to perceived ease of use of virtual worlds. Implications for educators are presented.

Keywords: Virtual world, Second Life, Education, Technology Acceptance Model (TAM)

1. INTRODUCTION

The social networking capabilities of Web 2.0 have facilitated the use of the Internet and the Web much more as a collaborative platform than it was just a few years ago. In addition to information dissemination, advertising, and sales transactions, the Web is rapidly becoming popular as a place to conduct meetings, teach or take a class, interact virtually with others, or just socialize online.

Three-dimensional (3-D) social networking environments, or Internet-based virtual worlds, have been emerging rapidly since 2003. A virtual world is a computer-based simulated environment created with two- and three-dimensional graphical representations of a physical space. People interact with one another via avatars, which are graphical, 2- or 3-D representations of a user. The virtual world environment is an immersive, virtual reality space. The most well known Internet-based virtual world today is Linden Labs' Second Life (2009), a 3-D virtual world where users can socialize using voice and text chat. Virtual worlds are attracting attention in industry as well as academia for their potential to enhance online education and societal communities (Baxter, 2008; Cross, O'Driscoll, and Trondsen, 2007; Gartner, 2007; Lohr 2008; Ringo, 2007; Sarvary, 2008).

This study examines college students' intentions to accept and use virtual worlds as a learning platform. The focus on current college students is very relevant as evidence suggests that virtual worlds are becoming more prevalent in business, potentially affecting this population when it graduates and enters the workforce.

1.1 Background

Many companies, most notably IBM, are already investing strategically in the three-dimensional (3-D) Internet technologies that enable virtual worlds for business and for education (Lohr 2008; Ringo, 2007; Sarvary, 2008). Gartner, Inc., a leading information technology research and advisory company, presented its forecast for the future value of virtual worlds at its 2007 conference, stating that by the end of 2011, 80 percent of active Internet users and Fortune 500 enterprises will be participating in some form of virtual world (Gartner, 2007). They project that the community-related and collaborative aspects of virtual worlds will be of most value to corporate Internet users, while transaction-based, commercial activities will be of less importance. While they propose that the collaborative and community aspects of virtual worlds will be significant, they also caution companies to invest carefully, as the technology is young, and will continue to develop and mature.

1.2 Existing Research

There is a growing body of academic literature that explores the use of virtual worlds and avatars in business (e.g., Kock, 2008; Arakji and Lang, 2008). V-commerce, or Virtual Commerce, describes the integrative use of the 3-D Internet

and virtual worlds to market products and services. Arakji and Lang (2008) developed a framework for organizations to measure the potential business costs and benefits associated with having a virtual presence in a virtual world. Barnes (2007) has recently developed a research agenda to examine the effectiveness of advertising towards intent to purchase. With more than 100 virtual worlds currently in existence online, new 3-D Internet environment models are emerging as opportunities to explore new integrative marketing channels. Barnes' research is among the first to empirically test the potential for avatars and virtual objects to influence trust and the intention to make purchases online in a 3-D virtual world.

Similar to how v-commerce models extend from e-commerce, v-learning can be viewed as an extension of e-learning (Baxter, 2008; Cross, O'Driscoll, and Trondsen, 2007). Cross, O'Driscoll, and Trondsen (2007) propose ways in which the capabilities of virtual worlds may be used to enhance existing learning models. Besides the well known value of the Internet for electronic collaboration and anytime/anywhere learner and teacher participation, virtual worlds provide the new element of an augmented reality. With a self-created avatar, a participant can take on any role or persona in the virtual world and exist in that character, or any number of different characters. Furthermore, the virtual place itself can be a simulation of a real environment or one based strictly on the limits of the creator's imagination. This has the potential to create new simulation opportunities for learning in both corporate and academic settings. Baxter (2008) reported that it is expected that Second Life and other virtual worlds will be complementary to existing teaching methods for some time. Given the media-rich and immersive nature of Second Life which has a vibrant economy, the application has been adopted in delivering a variety of courses such as E-commerce (Wagner, 2008), entrepreneur-ship (Mennecke, Hassall, and Triplett 2008), and software engineering (Ye, Liu, and Polack-Wahl 2007). Overall, results in the above mentioned courses have been positive in terms of the potentials of 3D virtual world as a learning environment, although a number of issues also emerge such as administrative support from the schools, technical skills of both the instructor and students, and social engagement of students. These questions present the opportunity for additional research on the prospects for virtual world use in education.

1.3 Current Investigation

In this paper, we examine the potential of virtual worlds as a learning environment. Second Life was chosen as the virtual platform because it is one of the most widely known virtual worlds. Second Life has grown from 2 million residents in January 2006 to more than 13 million residents as of May 28, 2009, with over 1.142,000 Million users logging in during the last 60 days (Secondlife.com, 2009) Evidence based on early course delivery that have integrated virtual worlds with the teaching and learning process (Mennecke, Hassal, and Triplett 2008; Wager, 2008; Ye, Liu, and Plack-Wahl 2007) indicates that there are many positive attributes associated with virtual worlds for collaboration and learning. In addition, the notion that the 18-34 year old group is the ideal target for this type of technology-enabled experience is commonly accepted. To date there is little, if any, empirical evidence to suggest that this population group perceives the expected value of virtual worlds the way industry analysts and researchers suggest. Using a survey based on the TAM model, our exploratory study empirically examines undergraduate business students' acceptance and intention to use virtual worlds for educational.

2. CONCEPTUAL BACKGROUND

This study is based on the Technology Acceptance Model (TAM) (Davis, 1989) and extended factors found in follow-up studies. TAM has been recognized as one of the most powerful models in examining the acceptance of new information technology (IT). In addition to its strength in empirically testing factors associated with the intention and use of technologies, the effective use of TAM can provide practical results, such as a greater understanding of antecedents associated with intentions to use, as well as recommendations for interventions that may increase these intentions (Venkatesh, Davis, and Morris, 2007). Adapted from the Theory of Reasoned Action (TRA) model, TAM posits that two beliefs – perceived ease of use (PEOU) and perceived usefulness (PU) - determine one's behavioral intention to use a technology (BI). Additionally, TAM indicates that PU is influenced by PEOU. Subsequent studies have applied TAM to a wide range of IT (Davis and Venkatesh, 1996; Gefen and Straub, 1997; Fang et al., 2006), including E-commerce (Gefen, 2003; Gefen and Straub, 2003). These studies show that TAM holds across IT types. Studies applying TAM to virtual worlds are just beginning to appear, such as one by Fetscherin and Lattemann (2008), whose study focused on the business value of SL.

While the parsimony of TAM makes it easy to apply to a variety of situations, the leanness of the model is also considered as its key limitation. A number of studies have been conducted to examine additional antecedents of IT use, such as positive image (Moore and Benbasat, 1996), cultural dimensions (Straub, Keil, and Brenner, 1997; Mao and Palvia, 2006), and habit (Gefen, 2003), to provide a better understanding of other factors that contribute to the adoption or abandonment of new IT.

In this study, three variables were explored as antecedents to PEOU. Examining the antecedents to PEOU is important not only because PEOU may affect BI both directly and indirectly, but also because it relates to users' perceptions in the early stage of using a system. Based on decision making theories, Venkatesh (2000) proposed that individuals shape their perceived ease of use of a new system based on their general beliefs regarding computers and computer use. In particular, three antecedents were proposed as important: computer playfulness (CP), which is defined as the degree of cognitive spontaneity in microcomputer interactions; computer self-efficacy (CSE), which represents one's belief about her/his ability to perform a specific task/job using a computer; and computer anxiety (CA), which is an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers. These factors respectively capture the intrinsic motivation (playfulness), knowledge and control (self-efficacy), and emotional (anxiety) aspects of technology use, and have been shown to affect individual's perceptions of how easy it is to use IT (Venkatesh, 2000).

3. RESEARCH MODEL AND HYPOTHESIS

Based on TAM and extended TAM theories, the research model examines six variables: PEOU (Perceived Ease of Use), PU (Perceived Usefulness), CP (Computer Playfulness), CSE (Computer Self-Efficacy), CA (Computer Anxiety), and BI (Behavioral Intention) to use Second Life (SL) for education purposes. The relationships among the variables and the hypotheses are depicted in Figure 1.

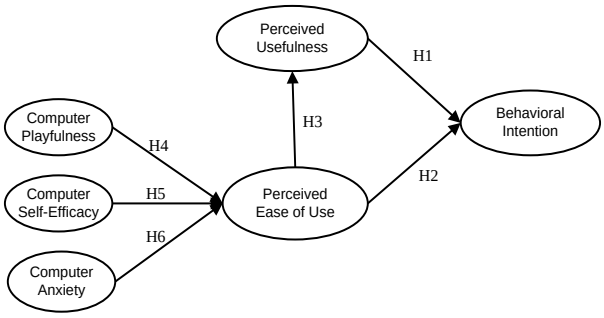


Figure 1. Research Model

According to TAM, both PU and PEOU are significant antecedents to BI. In addition, PEOU affects PU significantly. These relationships are specified in H1-H3:

H1. Perceived Usefulness (PU) will positively affect Behavioral Intention (BI) to use Second Life for education.
H2. Perceived Ease of Use (PEOU) will positively affect Behavioral Intention (BI) to use Second Life for education.
H3. Perceived Ease of Use (PEOU) will positively affect Perceived Usefulness (PU) of Second Life.

Based on previous studies of extended TAM, CP, CSE and CA are all significant antecedents to PEOU. These relationships are specified in H4-H6:

H4. Computer Playfulness (CP) will positively affect Perceived Ease of Use (PEOU) of Second Life.
H5. Computer Self-Efficacy (CSE) will positively affect Perceived Ease of Use (PEOU) of Second Life.
H6. Computer Anxiety (CA) will negatively affect Perceived Ease of Use (PEOU) of Second Life.

4. DATA COLLECTION

The study was conducted in the Fall 2007 semester with undergraduate and continuing studies students in the business school at a university in Northeastern United States. The students were from two junior-level E-commerce classes and two senior-level Management Information Systems classes, and ranged in age from approximately 20-35 years old. Prior to the survey, students were given a brief introduction to SL, and an assignment involving hands-on interaction with SL. The activities include downloading and installing the Second Life client software, creating an account, and completing Linden Lab's orientation island. After these basic activities, students were asked to work in teams to complete tasks such as learning about specific software by exploring information at corporate information center, and collaboratively solving computer configuration problems. Students were instructed to take snapshots of team members working together in Second Life, and write up a report reflecting on their experiences. Students were given three weeks from the introduction to SL to submitting the assignment. Figure 2-1 and 2-2 are two screenshots of student teams working on collaborative learning and problem solving tasks in SL.

After completing the assignment, students were given the URL to participate in the online survey. The questionnaire instructed students to think about SL being used by instructors in the future for a variety of activities, and provided examples such as virtual office hours, video and audio playback of lectures, and open areas for students to study together and work on team assignment. The survey was open online for one week. Extra credit was given as an incentive for survey participation.

The online survey collects responses to items measuring the PEOU, PU, and BI, which were adapted from Davis (1989). The CP, CSC, and CA items were adapted from Venkatesh (2000). All items were measured on a seven-point scale ranging from strongly disagree (1) to strongly agree (7). The questionnaire also collected user information such as demographics, current use of social networking sites, and previous knowledge of Second Life. The main survey items were listed in Table 3.

Figure 2-1 Student Teams Working on Learning Tasks on IBM Island

Figure 2-2 Student Teams Working on Computer Configuration Tasks on Dell Island

5. DATA ANALYSIS AND RESULTS

The data were analyzed using SmartPLS (Ringle, Wende, and Will, 2005). The tool allows simultaneous analysis of the measurement model (factors), and the structural model (path analysis). The sections below provide the results of respondents' demographics, factor analysis, and hypotheses testing.

5.1 Demographic Statistics

Among a total of 90 students, 77 valid responses were collected, resulting in the response rate of 85.6%. Among the respondents, 68.8% were male (n=53) and 31.2% were female (n=24). The majority of the respondents were between 20-24 years old (n=66, 85.7%). The respondents reported very experienced in using a PC (Mean=6.06, SD=1.02), and very experienced in using the Internet (Mean=6.60, SD=1.09).

When asked about whether they have an account and use a social networking site regularly, the top two sites reported are Facebook and Myspace. Table 1 lists respondents' current use of social networking sites.

Respondents were also asked about their use of Second Life before the study. The great majority had never heard about SL before (68.8%). Some had heard about SL but do

Web 2.0 Sites	Frequency	Percent
Facebook	57	74.0%
MySpace	33	42.9%
LinkedIn	13	16.9%
Other sites	10	13.0%

Table 1 - Use of Web 2.0 Sites

Second Life Use Before Class	Frequency	Percent
I had a SL account and logon regularly	3	3.9%
I had a SL account but rarely logon	7	9.1%
I had heard about SL but do not have an account	14	18.2%
I had never heard about SL before	53	68.8%
Total	**77**	**100.0%**

Table 2 - Use of Second Life Before the Study

Construct	Item ID	Item in the Questionnaire
Perceived Ease of Use (PEOU)	PEOU1	Learning to use SL was easy for me.
	PEOU2	I found it was easy to get SL to do what I want it to do.
	PEOU3	My interaction with SL was clear and understandable.
	PEOU4	I found SL to be flexible to interact with.
	PEOU5	It was easy for me to become skillful at using SL.
	PEOU6	I found SL easy to use.
Perceived Usefulness (PU)	PU1	Using SL in my study would enable me to accomplish tasks in the course more quickly.
	PU2	Using SL would improve my performance in my study of the course.
	PU3	Using SL in my study would increase my productivity.
	PU4	Using SL would enhance my effectiveness in my study of the course.
	PU5	Using SL would make it easier to learn the course.
	PU6	I would find SL useful in my study of the course.
Computer Playfulness * (CP)	CP1	The following questions ask you how you would characterize yourself when you use computers: Unimaginative
	CP2	Unoriginal
	CP3	Uninventive
Computer Self-Efficacy (CSE)	CSE1	I could complete the job using a software package: If there was no one around to tell me what to do as I go
	CSE2	If I had never used a package like it before
	CSE3	If I had only the software manuals for reference
	CSE4	If I had seen someone else using it before trying it myself
Computer Anxiety (CA)	CA1	Computers do not scare me at all
	CA2	I feel at ease in a computer class
	CA3	I feel comfortable working with a computer
Behavioral Intention to use SL (BI)	BI1	Assuming the course activities would be available in SL, I predict that I will use it on a regular basis
	BI2	I intend to use it.

*Note the negative items for Computer Playfulness were converted to positive in data analysis

Table 3 - Items for Latent Constructs

not have an account (18.2%). Only a small number of students had a SL account or used them regularly. See Table 2 for the use of Second Life before the study.

5.2 The Measurement Model

The results confirmed the measurement model and the items adapted from previous research. Table 3 shows the items for each construct.

The reliability of the constructs is reported in Table 4. As shown, the composite reliabilities of the different measures all exceed the recommended 0.70 level, and the AVE for each measure exceeds 0.70.

Table 5 reports the convergent validity using the factor loadings and cross loadings of the items to all the constructs. All items loaded on their respective constructs from a lower bound of .75 to a higher bound of .96, and they loaded more highly on their respective constructs than others. In addition, all of the items' loadings onto their respective constructs are significant at the .001 level, as indicated by the T-statistics of the outer model loadings ranging from 3.50 to 77.20. The result confirms the convergent validity of the indicators as representing distinct latent constructs.

Table 6 reports the discriminant validity of the measurement model. The elements in the matrix diagonals represent the square roots of the AVEs. They are all greater than the off-diagonal elements in the corresponding rows and columns, supporting the discriminant validity of the scales.

5.3 Structural Model and Hypotheses Testing

Figure 3 shows the results of the structural model. The test yields results of path coefficients (beta), which indicates the positive and negative relationships between the constructs, the strength of the relationships, and their statistical significance. The test also yields squared multiple correlations (R^2) values, which indicate the amount of variance of the dependent construct that can be explained by the independent constructs.

	AVE	Composite Reliability
Anxiety	0.70	0.87
BI	0.83	0.91
PEOU	0.70	0.93
PU	0.88	0.98
Playfulness	0.91	0.97
Self-Efficacy	0.80	0.94

Table 4 - PLS Results of the Measurement Model

Overall the model accounts for 65% of variance in behavioral intention, 33% in PU, and 18% in PEOU. PEOU is a strong antecedent to PU (beta= .58, p<.001). PU has a strong effect on BI (beta = .76, p<.001). Contrary to the original TAM model, PEOU has no significant direct effect

	BI	Anxiety	Playfulness	Self-Efficacy	PEOU	PU
BI1	**0.90**	0.21	0.23	0.14	0.44	0.67
BI2	**0.93**	0.14	0.13	0.26	0.49	0.79
CA1	0.12	**0.80**	0.23	0.50	0.11	0.03
CA2	0.28	**0.87**	0.24	0.46	0.19	0.23
CA3	0.04	**0.84**	0.33	0.36	0.16	-0.05
CP1	0.20	0.30	**0.96**	0.03	0.25	0.20
CP2	0.17	0.35	**0.95**	0.04	0.20	0.13
CP3	0.18	0.27	**0.95**	0.03	0.31	0.14
CSE1	0.21	0.55	0.07	**0.91**	0.27	0.17
CSE2	0.13	0.48	-0.02	**0.90**	0.34	0.16
CSE3	0.26	0.43	0.04	**0.92**	0.27	0.22
CSE4	0.22	0.37	0.05	**0.84**	0.27	0.17
PEOU1	0.44	0.15	0.20	0.29	**0.88**	0.48
PEOU2	0.41	0.13	0.09	0.29	**0.81**	0.44
PEOU3	0.43	0.16	0.16	0.16	**0.83**	0.42
PEOU4	0.41	0.06	0.33	0.34	**0.75**	0.58
PEOU5	0.42	0.34	0.32	0.30	**0.86**	0.44
PEOU6	0.45	0.13	0.24	0.20	**0.87**	0.49
PU1	0.74	0.07	0.13	0.16	0.58	**0.94**
PU2	0.74	0.06	0.15	0.17	0.54	**0.94**
PU3	0.80	0.05	0.10	0.21	0.52	**0.93**
PU4	0.75	0.07	0.15	0.19	0.46	**0.95**
PU5	0.72	0.14	0.19	0.22	0.59	**0.95**
PU6	0.77	0.16	0.20	0.17	0.55	**0.93**

Table 5 - Convergent Validity and Factor Loadings (bolded)

	Anxiety	BI	PEOU	PU	Playfulness	Self-Efficacy
Anxiety	**0.84**					
BI	0.19	**0.91**				
PEOU	0.19	0.51	**0.84**			
PU	0.10	0.80	0.58	**0.94**		
Playfulness	0.32	0.19	0.27	0.16	**0.95**	
Self-Efficacy	0.51	0.22	0.32	0.20	0.04	**0.89**

Table 6 - Discriminant Validity of Measurement Model

on BI. Two strong antecedents to PEOU were found: computer playfulness (beta = .29, p<.01), and computer self-efficacy (beta=.35, p<.01). The impact of computer anxiety on PEOU was insignificant.

Thus the hypotheses testing results are:

H1. Perceived Usefulness (PU) will positively affect Behavioral Intention (BI) to use Second Life for education. - *Supported*

H2. Perceived Ease of Use (PEOU) will positively affect Behavioral Intention (BI) to use Second Life for education. - *Not Supported*

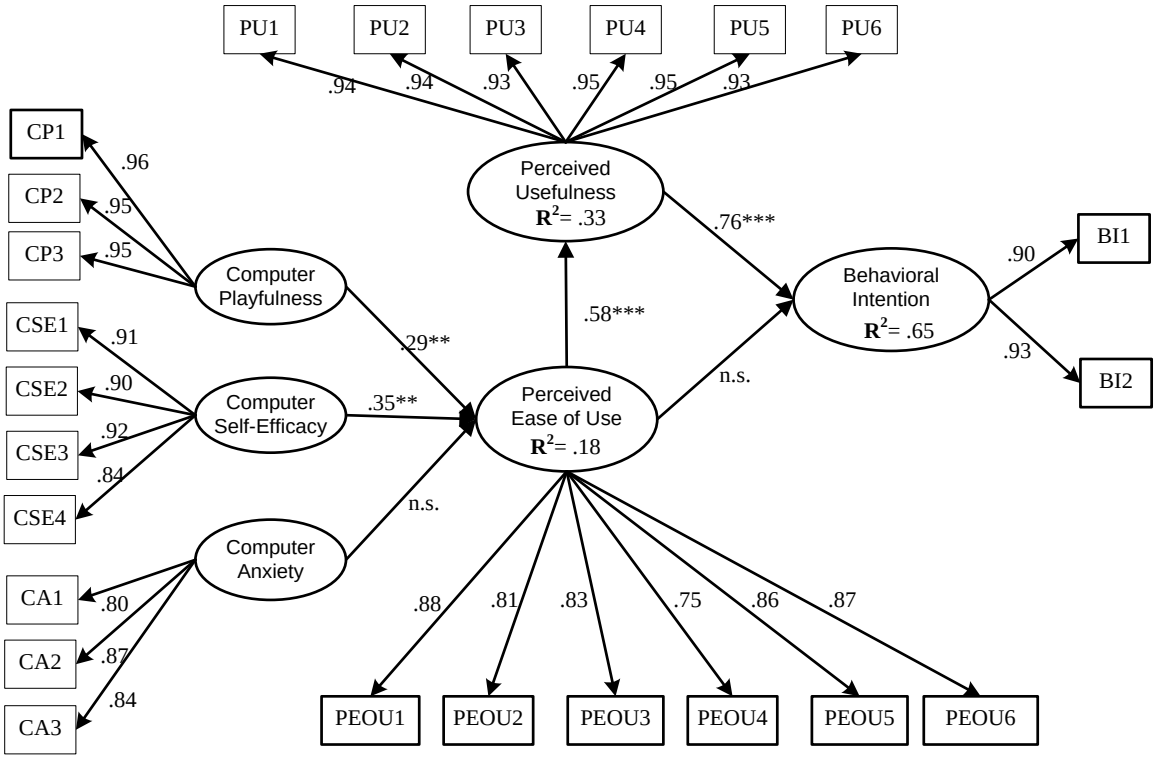
H3. Perceived Ease of Use (PEOU) will positively affect Perceived Usefulness (PU) of Second Life. - *Supported*

H4. Computer Playfulness (CP) will positively affect Perceived Ease of Use (PEOU) of Second Life. - *Supported*

H5. Computer Self-Efficacy (CSE) will positively affect Perceived Ease of Use (PEOU) of Second Life. - *Supported*

H6. Computer Anxiety (CA) will negatively affect Perceived Ease of Use (PEOU) of Second Life. - *Not Supported*

The results indicate that in the context of adopting SL for educational purpose, the causal path from PEOU to PU and from PU to BI hold as indicated in the original TAM model. Additionally, CP and CSE affected PEOU as the extended TAM studies suggest. However, the causal path from PEOU to BI was not found, nor was the path from CA to PEOU.



Note: Path Coefficients:
*** path is significant at the .001 level
** path is significant at the .01 level
* path is significant at the .05 level
n.s. insignificant at the .05 level

Figure 3 - Research Model with Results

6. DISCUSSIONS

This study examined factors associated with student's intention to accept and use Second Life for education. With survey data from 77 respondents, our research model with six factors was proposed and analyzed. Overall the model explained 65% of variance in BI. Using PLS, the results supported the causal path from PEOU to PU, and from PU to BI. Two significant antecedents to PEOU were found: computer playfulness, and computer self-efficacy.

6.1 Perceived Ease of Use

An unexpected finding was that perceived ease of use did not affect behavioral intentions directly. Instead, the effect of PEOU was mediated through PU. Interestingly, this result has also been found in other TAM studies (Venkatesh, 1994; Keil, Trues, and Mixon, 1995). Davis himself once indicated that "ease of use operates through usefulness" (Davis, 1989). Gefen and Straub (2000) theorized that PEOU directly affects IT adoption only when the primary task is directly associated with intrinsic IT characteristics, i.e., when the task is an integral part of the IT. He conducted an experiment in the context of E-commerce, and showed that when a website was used to purchase products, PEOU did not affect IT adoption directly; however a direct effect was found when the website was used to inquire about products.

6.2 Perceived Usefulness

In educational settings, our results suggest that students perceive the achievement of learning tasks as extrinsic to the use of the virtual world. In other words, the use of SL is perceived as only the means, or interface to achieving learning, as opposed to the central component of the process. On the other hand, perceived usefulness takes central stage in affecting behavioral intention. This important finding suggests that emphasis should be placed on increasing the perceived usefulness of virtual worlds for education, which is possible through the creation of effective course content. These findings support what other researchers have argued in terms of leveraging the uniqueness of the virtual world environment to enhance the learner's experience, such as its ability to create the sense of presence, and capability to support collaborative learning (Cross, O'Driscoll, and Trondsen, 2007).

6.3 Computer Self-efficacy

Our findings also reveal that computer self-efficacy is a strong antecedent to PEOU, followed by computer playfulness. Interestingly, computer anxiety is not significant to PEOU. This may be explained by the fact that with the increasing pervasive use of computer technology in every aspect of our lives, particularly in the sample population that participated in our study, negative emotions associated with computer have been reduced in general. Overall the results of the antecedents suggest that the user's confidence in technology use and the feeling of control still plays a large role in perceptions of how easy it is to use SL. Additionally, those who are more "playful" with technology perceive the use of SL to be easier, probably because they are more willing to invest more time for the sake of using new technology, and perceive the use to be fun. In fact, when asked what was the most interesting aspects of using SL in the open-ended sections of the survey, students reported many activities such as teleporting to various islands in SL, doing impossible things in real life (such as flying), and meeting people around the world. They also reported that creating an avatar was fun. As one student wrote in the survey, "The most interesting aspects of using SL are the ability to present a unique, personalized representation of one's self to interact in a collaborative environment. This may remove some of the 'loss of social skills' experienced by the computer generation, as etiquettes will still have to be adhered to in professional situations."

7. IMPLICATIONS FOR EDUCATORS

Understanding the factors associated with students' behavioral intentions to accept and use virtual worlds for education has practical implications for educators. To maximize the potential of the virtual world platform as a learning environment, educators should recognize its perceived value to students. In addition, they should consider their students' opinions on their ability to use the system. Our findings also indicate that the "fun factor" is significantly related to acceptance and use. Taken together, educators can proactively design the educational activities to ensure a greater likelihood of successful learning outcomes. Below are some additional recommendations to educators interested in designing learning activities in virtual worlds.

7.1 Maximize the Immersive Potential of Virtual Worlds

First, create course content to maximize the media-rich and immersive potential of virtual worlds. For example, given the vibrant virtual economy, SL can be successfully integrated into business courses such as E-commerce and Project Management, where students can actively participate in setting up a virtual business and practice marketing, entrepreneurship, and management skills (e.g., Wagner 2008). This not only encourages active participation in learning activities, but also potentially increases the perceived usefulness of virtual worlds for learners, which is a significant factor in adopting the technology. For educators planning to use SL, there is a detailed section of their website now devoted specifically to education (Secondlifegrid.net, 2009).

7.2 Encourage Social Engagement in the Virtual World

Second, design learning activities to enable social engagement and encourage collaborative learning among the learners. Literature dealing with online learning has demonstrated that social engagement among learners and the creation of a learning community are the most important factors associated with the success of online learning (Hiltz and Goldman, 2004; Shen, Hiltz, and Bieber, 2006). Extending these findings to the 3D virtual worlds, Mennecke, Hassall and Triplett (2008) observed that while students experienced immersion in SL and appreciated the 3D interface, they did not display intense signs of social engagement, nor did they acknowledge any value in the presence of other learners, both of which are keys to success in creating an online learning community. Slater (2003) differentiates immersion from presence by pointing out that immersion relies on technical capabilities such as 3D technology to render sensory stimuli, whereas presence

draws from the individual's subjective psychological response to virtual reality. Some researchers are already experimenting with learning activities that allow emotional connections of learners to the content, event and other learners (e.g., Robins, 2008; Balkun, 2008). Team-based learning activities that are designed to encourage rich social interactions among learners are likely to be the most effective in virtual worlds.

7.3 Students Associate Virtual Worlds with Fun

Third, to most effectively enhance social engagement and collaborative learning, educators should consider the enjoyment factor when designing the learning activities. When asked about the potential of SL for learning in the open-ended questions in our study, many students brought up the "playfulness" factor. "I think SL may add fun to learning." "Similar to E-learning but with a game feel to it". Given the similarities in the interfaces between SL and other MMO (Massively Multiplayer Online) games, it is not surprising to see that students associate the virtual world with online games, and anticipate some elements of fun when using it. Our findings suggest that virtual worlds have the potential to provide a rich, engaging, collaborative, and enjoyable learning environment for students.

8. LIMITATIONS AND FURTHER RESEARCH

One limitation of the study was the network speed and restriction of the campus network through which many students tried to connect to SL. The graphic-intensive nature of SL requires high-speed Internet access in order to have a reasonable experience interacting with the system. While many students tried to use the wireless campus network to access SL, the connections were weak and slow in the classrooms used by the classes. Some students also had problems creating accounts on SL due to the firewall restrictions on campus servers. These network difficulties may have discouraged students, and could have contributed to some negative perceptions of SL. Additionally, the sample size (n=77), while sufficient for the exploratory nature of this project, may have limited the generalizability of the findings.

There are many areas for additional research in this area. Further studies can be conducted to examine the impacts of these same factors over time. Will learners become more likely to accept use virtual worlds for education when they are more familiar with the system? Will the impact of PE, PEOU, and the antecedents change over time, and if so, how? A longitudinal study with measures at different times will be helpful to answer these questions. Another area worth further study is the voluntary use of virtual worlds after the studies are completed. It would be interesting to explore what motivates people to participate in virtual worlds other than the requirement of a class activity. The results may further provide insight on factors that contribute to intention to adopt this technology.

9. ACKNOWLEDGEMENTS

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