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Being There: An Empirical Look at Learning Outcomes in 3D Virtual Worlds

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Being There: An Empirical Look at Learning Outcomes in 3D Virtual Worlds

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ABSTRACT

Virtual worlds are a relatively new source of technology-mediated learning. Little is known about the results of learning in virtual worlds, and our knowledge is limited about how virtual worlds may lead to key learning outcomes (i.e., satisfaction and effectiveness). In this research we argue that because users of virtual worlds may perceive themselves as being in the world with others and have a pleasurable experience doing so, they are more likely to experience positive learning outcomes. In a study comprised of 53 participants, we studied learning satisfaction and effectiveness. Presence and flow increased learning satisfaction. We were surprised to find that in our study, flow actually decreased learning effectiveness. Additionally, we compared virtual world learning to face-to-face learning. We did not find significant differences in learning satisfaction or effectiveness.

Keywords  
Virtual worlds, virtual learning, presence, copresence, flow.

INTRODUCTION

Many people are enticed by the idea of learning or training at their own time, pace, and location using electronic learning. Unfortunately, technology-mediated learning (TML) does not always result in more-effective learning or satisfied users. When users become dissatisfied with the learning environment, they lose a desire to utilize such systems. Organizations spend a lot of money on technology-based training, over $16 billion in 2006 (Johnson, Hornik, and Salas, 2007), and universities are facing increasing enrollments in online courses (Allen and Seaman, 2007). For these reasons, it is important for TML to be satisfying and effective.

Many of the students that elect to take TML courses do so because they provide convenience and flexibility. The challenge, however, is that many students and employees do not take TML courses by choice. Typically, people that do not self-select into TML courses are not as satisfied with the learning experience, and they do not find the learning to be as effective as face-to-face learning (Piccoli, Ahmad, and Ives, 2001; Sitzman, Kraiger, Stewart, and Wisher, 2006). In order for TML to be successful, all individuals, whether they self-select into TML courses or not, should find the learning experience to be satisfying and effective.

Over the last several years, there has been an increasing interest in better TML development. One of those developments is virtual learning. Virtual learning encompasses learning systems that provide many resources for learners to communicate with the instructor and with other learners. These systems are relatively open, and they are Internet-based (Anohina, 2005). One particular environment for virtual learning is 3D virtual worlds. These are technology-based environments that allow users to view and act in a digital 3D world. When they are logged into the virtual world, users can interact with other virtual world users.

Using virtual worlds for learning provides an opportunity for users to avoid some challenges of TML. Because users can visualize and interact with other learners and instructors, they will likely not experience the frustration that comes from remote learning. Also, virtual worlds provide a greater chance for learners to become more involved in the learning process and the discussion. This research may help to justify and motivate the use of virtual worlds by universities and organizations.
Two potentially important concepts that relate to virtual worlds are presence and copresence (Hendaoui and Limayem, 2008). Presence is the sense of actually being in a virtual environment. It is a psychological phenomenon that occurs when individuals focus their attention on a constructed environment and lose consciousness of their external environment (Schubert, Friedmann, and Regenbrecht, 2001). Copresence is the perception of being present in a virtual environment with other people (Schroeder, 2006). Individuals will likely feel greater satisfaction with TML if they perceive to be present in the learning environment with other people.

We have three key research questions:

**RQ1:** How does virtual world learning influence learning satisfaction?

**RQ2:** How does virtual world learning influence learning effectiveness?

**RQ3:** How does virtual world learning compare to face-to-face learning in terms of satisfaction and effectiveness?

**BACKGROUND**

Virtual worlds are Web-based, 3D representations of the real world (for a recent review, see Barnes and Mattson, 2008). Users of virtual worlds create 3D characters, called avatars, which they can use to travel throughout the different areas in the world, communicate with other avatars, and perform activities (like driving a car or purchasing virtual clothing for their avatars). With their avatars, users can also perform actions that are similar to those performed by real people; they can walk, run, and do gestures. Virtual worlds are also a source of virtual commerce because virtual goods and virtual real estate can be bought and sold with credits purchased with real currency. Moreover, some organizations are using virtual worlds for marketing or brand awareness, e.g., Mazda (Barnes and Mattson, 2008). Other uses of virtual worlds include virtual meetings, virtual conferences, virtual recruitment, and virtual collaboration.

Because of the capability of bringing physically distant students virtually near, instructors can use virtual worlds to replicate face-to-face classrooms. Within the virtual environment, instructors can supplement their instruction with slideshows, videos, and other electronic media. There may be additional opportunities for instructors to improve the learning experience by utilizing the virtual world technology to create virtual representations of real-world phenomena or by giving trainees opportunities to practice applying the newly acquired knowledge.

In prior research on learning in asynchronous virtual environments, researchers found that students experienced similar learning effectiveness compared to that of students in face-to-face environments. However, students learning in virtual environments experienced less satisfaction than did those learning in face-to-face settings (Piccoli et al., 2001; Sitzmann et al. 2006). Virtual worlds potentially present an environment that is as satisfying as a classroom environment and is more effective.

**THEORETICAL DEVELOPMENT**

Several theories provide information about the effects of virtual worlds that may increase learning satisfaction and effectiveness. In this research, we draw on the presence and copresence literatures and on flow in order to support our claims. Presence and copresence have been studied extensively in social virtual environments (e.g., Biocca, 1997; Biocca, Harms, and Burgoon, 2003; Schroeder, 2006; Schubert et al., 2001). Flow has been used to explain why some activities are more enjoyable than others (Csikszentmihalyi, 1990). We argue that virtual worlds are a type of virtual environment that are likely to have high degrees of presence, copresence, and flow.

**Presence and Copresence**

**Presence**

As virtual technologies have progressed, researchers have studied related issues and implications of these technologies. Much of the research has focused on the concepts of presence and the related copresence (e.g., Schroeder, 2006; Schubert et al., 2001; Biocca et al., 2003). Presence is a sense of being in the virtual world (Shroeder, 2006). When individuals interact with a virtual world, they become stimulated by the experience. As the stimulation increases, they begin to focus their attention toward the interaction with the system, and they lose consciousness of the external environment so that the virtual environment becomes their temporary reality. The perception of presence may be one of the key benefits of 3D virtual worlds. By recreating representations of places and things, users within virtual worlds can perceive to actually be interacting with these objects and places.
Presence is related to the concept of immersion. Slater and Wilbur (1997) describe immersion as the extent to which technology can give a user "an inclusive, exclusive, surrounding, and vivid illusion of reality to the senses" (p. 604). Presence, conversely, is the psychological experience that occurs when individuals remove themselves from the outside world and begin to act in the virtual environment as they do in the real world (Slater and Wilbur, 1997). Prior research on the outcomes of presence has focused much on consumer research. Presence has been shown to lead to greater consumer learning (Jiang and Benbasat, 2004; Suh and Lee, 2005) and to influence product beliefs and attitudes (Klien, 2003).

Learners will perceive themselves as being present in the virtual classroom when they experience high levels of presence; their actions and behavior will be similar to that in the real environment, and their concentration will be focused on the activity taking place in the virtual environment. These experiences should cause individuals to learn more effectively in the virtual environment because of the increase in effort and attention. Furthermore, because higher levels of presence will give learners the perception of being a part of the virtual classroom, they should feel more satisfied with the learning experience.

H1A: The experience of presence will enhance satisfaction with the virtual world learning environment.

H1B: The experience of presence will enhance learning effectiveness in the virtual world learning environment.

Copresence

Related to the concept of presence is the concept of copresence. In a way, it is an extension of presence. Copresence relates to the perception of being present in a virtual environment with others (Schroeder, 2006). Perceptions of copresence are on a continuum, and individuals experience different levels of copresence depending on the psychological involvement of the individuals and the amount of realism of the avatars. Human-like characters that are perceived to be driven by intelligences increase the psychological involvement of individuals. This is because people are able to observe and interact with avatars that they perceive to represent other real people (Biocca et al., 2003). This increased psychological involvement contributes to greater perceptions of copresence.

In virtual worlds, avatars are controlled by actual people. Depending on the psychological involvement of the individual users, this should contribute to perceptions of copresence. Individuals that experience copresence should not feel isolated because they actually perceive that they are in the learning environment with other people. Much of the dissatisfaction that comes from learning in traditional TML environments is the result of isolation and loneliness (Piccoli et al., 2001). By reducing feelings of isolation, virtual worlds will likely contribute to learners feeling more satisfied with the learning experience. Therefore, greater perceptions of copresence should result in greater satisfaction.

H2: The experience of copresence will enhance satisfaction with the virtual world learning environment.

Flow

People participate in activities because of the rewarding outcomes of those activities. Enjoyment is one potential outcome of an activity. Flow is described as a state of intense pleasure that comes from doing something enjoyable (Agarwal and Karahanna, 2000; Csikszentmihalyi, 1990). Typically people participate in these activities because of the pleasure they derive from it, not the external rewards that result from the activities.

Csikszentmihalyi (1975) originally described six elements of the flow experience. These elements are merging of action and awareness, centering of attention, loss of ego, control of action and environment, demands for action and clear feedback, and autotelic nature of flow. Individuals that experience flow while participating in an activity are more likely to experience satisfaction with the activity (Choi, Kim, and Kim, 2007), and they are more likely to repeat the activity (Koufaris, 2002).

Many features of virtual worlds create the potential for learners to experience flow. Some of the elements that must be present for the flow experience to be achieved are control, curiosity, intrinsic interest (Trevino and Webster, 1992; Webster, Trevino, and Ryan; 1993), and telepresence (Novak, Hoffman, and Yung; 1999). Learners in the virtual world have control over the actions and views of their avatars. The virtual world can be perceived as being a game-based learning environment; therefore, users probably will experience some curiosity toward using the system. Users are likely to feel intrinsic motivation toward using the virtual world because they may find it as a novel and enjoyable way to learn. Finally, the virtual world learning environment provides opportunities for users to experience telepresence because of the immersive nature of the system. Based on these reasons, we believe that using a virtual world for learning will contribute to learners experiencing flow while learning.

Because the flow experience includes focused attention and high concentration, individuals learn more effectively when they experience flow (see Csikszentmihalyi and LeFevre, 1989). Flow experience has also been found to increase attitudes toward learning (Choi et al., 2007).
H3A: The experience of flow will enhance satisfaction with the virtual world learning environment.

H3B: The experience of flow will enhance learning effectiveness in the virtual world learning environment.

Based on our predictions that users will experience presence, copresence, and flow in the virtual world learning environment, we believe that individuals learning in a virtual world may experience greater satisfaction and learning effectiveness than do those who are learning in face-to-face classrooms. Furthermore, Webster and Hackley (1997) proposed that greater perceived media richness would lead to greater learning outcomes. Virtual worlds should give learners high perceptions of media richness because of the visual and audio stimuli and the communication capabilities.

H4A: Learners will experience greater satisfaction in the virtual world learning environment than they will in the face-to-face learning environment.

H4B: Learners will experience greater learning effectiveness in the virtual world learning environment than they will in the face-to-face learning environment.

METHODOLOGY

In order to test our first three hypotheses, we conducted a class lecture in Second Life, a popular virtual world. To test our fourth hypotheses, we compared learning in the virtual world with learning in a face-to-face classroom.

Participants

The participants were undergraduate students enrolled in an introduction to information systems course at a large university. The course is required of all business students and is open to any student at the university. A total of 53 students participated in the study. All but one of the students were business majors. There were 27 students that received the lecture in Second Life and 26 students that received it in the face-to-face classroom. Students received extra credit for completing a survey at the conclusion of the lectures.

Of the virtual world participants, 8 (30%) were female. Some of the students had prior experience with TML courses. There were 9 (33%) who had taken at least one TML course in college. Very few of the students (6, 22%) had previous experience with virtual worlds. Of those students with experience with virtual worlds, only 2 (33%) had been using virtual worlds for more than 3 months. The average age of the students in the virtual world group was 21.25. The students in the face-to-face group had an average age of 21.89, and 3 (12%) were females.

Procedure

Students participating in the lecture in Second Life were assigned to one of two classrooms equipped with computers capable of delivering the lecture in Second Life. The students were provided with headsets that allowed them to audibly communicate.
with the instructor and the other students. In order to reduce the likelihood of the students exploring Second Life and not focusing on the lecture, the participants were told that they would have time after the lecture to play around in the virtual world. Also, observers monitored the computer labs during the session.

To compare the virtual world learning experience to the face-to-face learning experience, an additional section of the course received the lecture in a face-to-face classroom. The same instructor presented both lectures to the groups. The topic and the instructional methods were the same in both lectures. A quiz on the lecture material was given to the students at the beginning and the end of the lecture. A posttest survey was administered after the lecture to collect students’ responses.

**Measures**

Learning effectiveness was measured by administering a quiz to the participants before and after the lecture. The difference in scores between the post-quiz and the pre-quiz was taken as the measure for learning effectiveness. Satisfaction was measured using items adapted from Piccoli et al. (2000). To measure presence, we adapted measures from Schubert et al. (2001). Copresence measures were adapted from Bailenson and Yee (2006). We adapted flow measures from Koufaris (2002). Additionally, there are several control variables that are relevant to virtual world learning that we account for. We controlled for computer playfulness, and personal innovativeness in the domain of information technology using measures from Agarwal and Karahanna (2000). We also controlled for years in college, virtual world experience, and TML experience.

**RESULTS**

In order to test the hypotheses, we looked at how presence, copresence, and flow influence learning satisfaction and learning effectiveness. The descriptive information, reliabilities, and correlations are displayed in Table 1. We analyzed the relationships using multiple regression analysis. We ran two models for each learning outcome. The first models contain the regression coefficients for the control variables. The second models include the regression coefficients for the control variables plus the independent variables. The regression results for learning satisfaction and learning effectiveness are displayed in Tables 2 and 3.

<table>
<thead>
<tr>
<th>n = 27</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach’s α</th>
<th>Learning Effect.</th>
<th>Satisfaction</th>
<th>Presence</th>
<th>Copresence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Effectiveness</td>
<td>4.33</td>
<td>1.209</td>
<td>NA</td>
<td>4.33</td>
<td>.035</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5.05</td>
<td>1.104</td>
<td>.81</td>
<td>.029</td>
<td>.585*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence</td>
<td>4.13</td>
<td>.945</td>
<td>.76</td>
<td>-.017</td>
<td>.610**</td>
<td>.531**</td>
<td>.472*</td>
</tr>
<tr>
<td>Copresence</td>
<td>4.36</td>
<td>1.025</td>
<td>.68</td>
<td>-.146</td>
<td>.826**</td>
<td>.561**</td>
<td>.472*</td>
</tr>
<tr>
<td>Flow</td>
<td>5.12</td>
<td>1.053</td>
<td>.87</td>
<td>-.146</td>
<td>.826**</td>
<td>.561**</td>
<td>.472*</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (B)</th>
<th>Model 2 (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Experience</td>
<td>.029</td>
<td>.174</td>
</tr>
<tr>
<td>Virtual World Experience</td>
<td>.039</td>
<td>-.037</td>
</tr>
<tr>
<td>TML Experience</td>
<td>.129</td>
<td>.007</td>
</tr>
<tr>
<td>Innovativeness with IT</td>
<td>.010</td>
<td>.339</td>
</tr>
<tr>
<td>Computer Playfulness</td>
<td>.782</td>
<td>.139</td>
</tr>
<tr>
<td>Flow</td>
<td>.550***</td>
<td></td>
</tr>
<tr>
<td>Presence</td>
<td>.443*</td>
<td></td>
</tr>
<tr>
<td>Copresence</td>
<td>-.076</td>
<td></td>
</tr>
<tr>
<td>( r^2 )</td>
<td>.615</td>
<td>.869</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

Table 1. Descriptive Statistics and Correlations

Table 2. Predicting Satisfaction in VW
Presence did have a significant, positive effect on learning satisfaction; however, it did not have a significant influence on learning effectiveness. Therefore we found support for hypothesis 1A but not 1B. Hypothesis 2 was not supported; copresence did not have a significant effect on satisfaction. Flow had a significant, positive effect on satisfaction, supporting hypothesis 3A. Flow had a non-significant negative effect on learning effectiveness; therefore, hypothesis 3B was not supported.

We conducted an analysis of variance test to determine whether the students learning in the virtual world experienced greater satisfaction and learned more effectively than did those learning in the face-to-face classroom. Table 4 displays the descriptive statistics, and Table 5 displays the ANOVA results. We found no significant differences between the two environments. Therefore, neither hypothesis 4A nor hypothesis 4B was supported.

### Table 3. Predicting Learning Effectiveness in VW

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (B)</th>
<th>Model 2 (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Experience</td>
<td>-.193</td>
<td>-.167</td>
</tr>
<tr>
<td>Virtual World Experience</td>
<td>.043</td>
<td>.039</td>
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<tr>
<td>TML Experience</td>
<td>-.067</td>
<td>.039</td>
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<tr>
<td>Innovativeness with IT</td>
<td>.426</td>
<td>.479</td>
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<td>Computer Playfulness</td>
<td>-.221</td>
<td>.220</td>
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<tr>
<td>Presence</td>
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<td>.734</td>
</tr>
<tr>
<td>Copresence</td>
<td></td>
<td>-.463</td>
</tr>
<tr>
<td>Flow</td>
<td></td>
<td>-.542</td>
</tr>
<tr>
<td>( r^2 )</td>
<td>.078</td>
<td>.249</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

### DISCUSSION

Our key research questions were about identifying how virtual worlds influence learning satisfaction and learning effectiveness. We found that learners who perceived greater presence and experienced more flow were more satisfied with the learning experience. This causes us to believe that virtual world learning environments should be designed in a way to give the users high perceptions of presence. The experience should also be enjoyable and attract the attention of the learners so that they can experience flow. It is likely that in our study, the learners did not actually experience or become comfortable interacting with other learners because the system was new to them; this may be why we did not see evidence of copresence enhancing learning satisfaction. In future research, it may be helpful to give the learners more practice interacting with others.
in the environment. Having more informal interaction would likely increase the users’ satisfaction with the learning system, and it may contribute to greater levels of copresence.

We did not find any significant relationships with virtual world learning and learning effectiveness. Although flow was influential for satisfaction, it actually demonstrated a negative (non-significant) effect on learning effectiveness. In our particular study, the experience may have been novel enough to the students that they may have focused too much on the experience in the virtual world rather than on the lecture. Therefore, students expended most of their resources in interacting with the virtual world environment, leaving little cognitive resources for effective learning.

Presence did not have any significant effects on learning effectiveness. We believe that presence may influence learning effectiveness; however, it may depend upon the context. Learners that perceive to be present in a virtual classroom may not experience more effective learning. This is because in this setting, presence may not contribute to additional learning above what can be achieved through seeing and hearing the instructor and slides. Conversely, learners will probably learn more effectively in situations where they feel present while exploring or examining unfamiliar objects represented by technology. Thus, the influence of presence may be realized in unfamiliar or complex situations.

Finally, we did not find that the virtual world learning environment led to greater satisfaction or learning effectiveness over that of the face-to-face environment. In fact, the face-to-face group appeared to be more satisfied with the learning experience than the virtual world group was. In our study, we did have some minor technical problems with the communication system in the virtual world. It is possible that these problems reduced learners’ satisfaction with the experience. Nevertheless, we support the notion that virtual worlds are a successful system for TML because of the capabilities of the technology to enhance learning.

The lack of evidence for our hypotheses, as may be the case for other hypotheses, could be a function of the small sample size of the study. With only 53 students for testing hypotheses 4A and 4B and only 27 students for the remaining hypotheses, our sample size may not have had enough power to detect significance in the relationships. Despite this shortcoming, we found various significant relationships, demonstrating the possibility of strong relationships among these focal constructs. Additional research, with a larger sample size, is necessary to more fully understand the implications and the outcomes of different uses of virtual world learning technologies. Overall, this research serves as a starting point for other researchers to examine how virtual world environments can ameliorate the factors known to inhibit satisfaction and learning effectiveness.

According to our knowledge, presence has not been studied in a virtual learning context. We make a contribution to the presence literature and the virtual learning literature by showing that presence enhances learning satisfaction in virtual learning environments. We also applied copresence to a learning context. We believe that we did not find any significant copresence results due to the limitations of our study.

This research has practical relevance as well. A better understanding of the outcomes of learning in virtual worlds helps organizations and universities make better decisions about whether or not to use virtual worlds for learning. Knowledge about some of the important characteristics of learning in virtual worlds also contributes to the development of this learning technology. Designers of virtual world learning systems would do well to incorporate characteristics that contribute to presence and flow. In addition, learners will likely experience better results if they are trained to use virtual worlds before the learning experience.

CONCLUSION

Virtual worlds present an environment that appears to have potential for enhancing learning outcomes. One reason is because of the media-rich, immersive nature of the environment. Another reason is because of the capabilities for students to interact richly with instructors and other students. Universities are already using virtual worlds for learning. It is important to understand the outcomes of learning in virtual worlds and to understand how to make the process most effective. Virtual world learning environments that give users perceptions of being present in the virtual world will increase learners’ satisfaction with the experience. Those people who experience flow while learning also feel more satisfaction; virtual worlds should include enjoyable, interesting characteristics.

A virtual world learning environment that imitates a classroom environment does not necessarily lead to better learning outcomes. Nevertheless, there are many possibilities for new uses of virtual world technologies for learning. Benefits will likely come to universities and organizations that experiment with innovative uses of virtual worlds.
REFERENCES


**APPENDIX**

**Measures**

**Satisfaction**

7-point Likert-type scale anchored by the following three descriptions:

How would you describe the learning process in the virtual world?

1. Coordinated/Uncoordinated
2. Confusing/Understandable
3. Satisfying/Dissatisfying

**Presence**

7-point Likert-type scale anchored by strongly agree/strongly disagree except where noted:

1. How aware were you of the real world surrounding you while navigating in the virtual world? (i.e., sounds room temperature, other people, etc.) (very aware/very unaware)
2. How real did the virtual world seem to you? (strongly real/very unreal)
3. I had a sense of acting in the virtual world rather than operating something from the outside. How much did your experience in the virtual world seem consistent with your real world experience? (very consistent/very inconsistent)
4. I was not aware of my real environment.
5. In the virtual world I had a sense of “being there.”
6. Somehow I felt that the virtual world surrounded me.
7. I felt present in the virtual world.
8. I still paid attention to the real environment.
9. The virtual world seemed more realistic that the real world.
10. I felt like I was just perceiving pictures.
11. I was completely captivated by the virtual world.

**Copresence**

7-point Likert-type scale anchored by strongly agree/strongly disagree:

1. I perceived that I was in the presence of other people in the virtual world with me.
2. I felt that people in the virtual world were watching me and were aware of my presence.
3. People in the virtual world appeared to be sentient (conscious and alive) to me.
4. I perceived people as being only a computerized image, not as real people.

**Flow**

7-point Likert-type scale anchored by strongly agree/strongly disagree:
During my virtual world experience...
... I was absorbed intensely in the activity.
... My attention was focused on the activity.
... I concentrated fully on the activity.
... I was deeply engrossed in the activity.
... I found my visit interesting.
... I found my visit enjoyable.
... I found my visit exciting.
... I found my visit fun.
... I felt confused (reversed).
... I felt calm.
... I felt in control.
... I felt frustrated (reversed).

Screen Shots