EFFECTS OF PRESENCE, COPRESENCE, AND FLOW ON LEARNING OUTCOMES IN 3D LEARNING SPACES

Martin D. Hassell, MISM
University of Arkansas
Sandeep Goyal, Ph.D.
University of Southern Indiana
Moez Limayem, Ph.D.
University of Arkansas
Imed Boughzala, Ph.D.
Institut TELECOM Sud Paris

The level of satisfaction and effectiveness of 3D virtual learning environments were examined. Additionally, 3D virtual learning environments were compared with face-to-face learning environments. Students that experienced higher levels of flow and presence also experienced more satisfaction but not necessarily more effectiveness with 3D virtual learning environments. There were no significant differences between satisfaction and effectiveness of 3D virtual learning environments and face-to-face environments. These findings suggest that 3D virtual learning environments can be made to provide high levels of learning satisfaction. Additionally, these findings suggest that 3D virtual learning environments may be a viable delivery method for instruction and training because they compare favorably with face-to-face learning environments.

Keywords: virtual learning, virtual worlds, presence, copresence, flow

Technology mediated learning (TML) (commonly referred to as e-learning) provides a way for people to learn at their own time, pace, and location. Individuals often can study topics of their own choosing and customize the depth of the learning. In some instances, learners interact only with the technology and do not actively work with other people. In other instances, learners utilize environments that are representative of physical classrooms. These settings allow individuals to interact with the class instructor and other learners. Individuals likely do not give thought to how learning outcomes may be influenced in different TML environments.

Unfortunately TML may result in less effective learning and less satisfaction with the learning. If learners experience less effective learning and less satisfaction, they may choose to abandon TML systems and choose a traditional learning environment. A further issue, moreover, is that in many instances, learners may not have a choice of the type of learning system they use and must learn through TML systems. Typically, people that do not self-select into e-learning 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, & Ives, 2001; Sitzman, Kraiger, Stewart, & Wisher, 2006). In order for TML to be successful, all individuals, whether they self-select into e-learning courses or not, should find the learning experience satisfying and effective. Organizations spend a lot of money on TML, over $16 billion in 2006 (Johnson, Hornik, & Salas, 2007); therefore, they expect the e-learning to be effective and satisfying. Additionally, universities are facing increasing enrollments in online courses (Allen & Seaman, 2007), and they also rely on having effective and satisfying TML. For these reasons, there is a continuing need for research that focuses on understanding and improving TML effectiveness and satisfaction.

Over the last several years, there has been an increasing interest in better TML development. Specifically, there has been a focus on 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 are Internet-based (Anohina, 2005). One particularly interesting environment for virtual learning is 3D virtual worlds. These are technology-based environments that allow users to participate in a digital 3D world. When individuals are logged into the virtual world, they can interact with other people inside the virtual world.

Virtual worlds have the potential to overcome some of the challenges of traditional e-learning systems. Because users can see representations of and interact with other learners and instructors, the level of frustration that typically comes from remote learning is likely to be reduced. Also, virtual worlds provide opportunities for learners to become more involved in the learning process and the discussion. This research is intended to help justify and motivate the use of virtual worlds for learning and training by universities and organizations.

Two potentially important concepts that relate to virtual worlds are presence and copresence (Hendaoui & 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, & 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 that they are present in the learning environment with other learners.

This research addresses 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 & 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; for example, they can walk, run, and perform 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 & 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 newly acquired knowledge.

In prior research on learning in asynchronous virtual environments, researchers found that students experienced similar learning effectiveness as 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 may even be 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 literature 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, & Burgoon, 2003; Schroeder, 2006; Schubert et al., 2001). Flow has been used to explain why some

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activities are more enjoyable and compelling 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 copresence (e.g., Biocca et al.,; 2003Schroeder, 2006; Schubert et al., 2001). Presence is a sense of actually 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 objects, users within virtual worlds can perceive that they are actually interacting with these objects and places.

Presence is related to the concept of immersion. Slater & 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 forget about the outside world and begin to act in the virtual environment as they do in the real world (Slater & 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 & Benbasat, 2004; Suh & Lee, 2005) and to influence product beliefs and attitudes (Klien, 2003).

Learners likely 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, most 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 & 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 ac-

tion 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, & 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 & Webster, 1992; Webster, Trevino, & Ryan; 1993), and telepresence (Novak, Hoffman, & 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 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 & LeFevre, 1989). Flow experience has also been found to increase positive 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.

Figure 1. Research Model

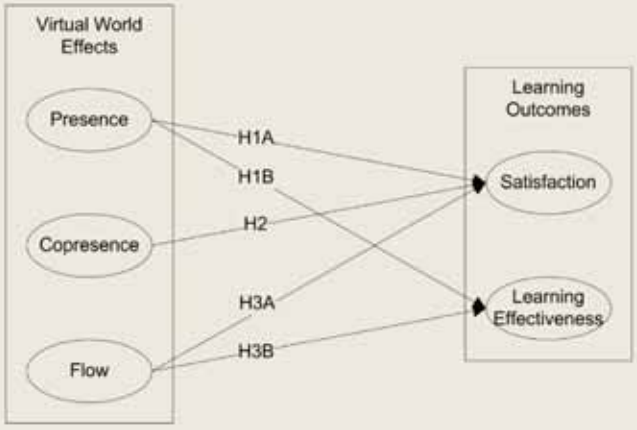

Figure 1. Research model. The figure shows constructs and hypothesized relationships.

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 in the face-to-face learning environment.

H4B: Learners will experience greater learning effectiveness in the virtual world learning environment than 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, eight (30%) were female. Some of the students had prior experience with TML courses. Nine (33%) had taken at least one TML course in college. Very few of the students (six or 22%) had previous experience with virtual worlds. Of those students with experience with virtual worlds, only two (33%) had been using virtual worlds for more than three 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 three (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.

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 for 1B. Hypothesis 2 was not

Table 1
Descriptive Statistics and Correlations

n = 27	Mean	SD	α	Learning Effect.	Satisfact.	Presence	Copres.
Learning Effectiveness	4.33	1.209	NA				
Satisfaction	5.05	1.104	.81	.035			
Presence	4.13	.945	.76	.029	.585**		
Copresence	4.36	1.025	.68	-.017	.610**	.531**	
Flow	5.12	1.053	.87	-.146	.826***	.561**	.472*

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

Table 2
Predicting Satisfaction in Virtual Worlds

Variable	Model 1 B	Model 2 B
College Experience	.029	.174
Virtual World Experience	.039	-.037
TML Experience	.129	.007
Innovativeness with IT	.010	.339
Computer Playfulness	.782	.139
Flow		.550***
Presence		.443*
Copresence		-.076
r^2	.615	.869

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

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 Virtual Worlds

Variable	Model 1 B	Model 2 B
College Experience	-.193	-.167
Virtual World Experience	.043	.039
TML Experience	-.067	.039
Innovativeness with IT	.426	.479
Computer Playfulness	-.221	.220
Presence		.734
Copresence		-.463
Flow		-.542
r^2	.078	.249

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

Table 4
Descriptive Statistics of Virtual World (VW) vs. Face to Face (Ftf)

Variable	n	Mean	SD
VW Satisfaction	27	5.05	1.104
FtF Satisfaction	26	5.58	1.161
VW Learning Effectiveness	27	4.33	1.209
FtF Learning Effectiveness	26	4.23	1.070

Table 5
ANOVA Table

Variable	d.f.	Mean Square	F	Sig.
Learning Satisfaction	1	3.693	2.88	.096
Learning Effectiveness	1	.139	.107	.745

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 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 that they are 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 in which 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 the media-rich, immersive nature of the environment. Another reason is 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 should increase learners' satisfaction with the experience. Those people who experience flow while learning should 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.

APPENDIX 1

Measures

Satisfaction

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

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

- Coordinated/Uncoordinated
- Confusing/Understandable
- Satisfying/Dissatisfying

Presence

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

- 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)
- How real did the virtual world seem to you? (strongly real/very unreal)
- 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)
- I was not aware of my real environment.
- In the virtual world I had a sense of "being there."
- Somehow I felt that the virtual world surrounded me.
- I felt present in the virtual world.
- I still paid attention to the real environment.
- The virtual world seemed more realistic that the real world.
- I felt like I was just perceiving pictures.
- I was completely captivated by the virtual world.

Copresence

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

- I perceived that I was in the presence of other people in the virtual world with me.

- I felt that people in the virtual world were watching me and were aware of my presence.
- People in the virtual world appeared to be sentient (conscious and alive) to me.
- 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).

APPENDIX 2

REFERENCES

Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly, 24,* 665-694.

Allen, I. E., & Seaman, J. (2007, October). Online Nation: Five Years of Growth in Online Learning. Retrieved from http://k20.internet2.edu/files/userfiles/108-online_nation.pdf

Anohina, A. (2005). Analysis of the terminology used in the field of virtual learning. *Educational Technology, & Society, 8*, 91-102.

Bailenson, J. N., & Yee, N. (2006). A longitudinal study of task performance, head movements, subjective report, simulator sickness, and transformed social interaction in collaborative virtual environments. *Presence: Teleoperators and Virtual Environments, 15*, 699-716.

Barnes, S., & Mattson, J. (2008). Brand value in virtual worlds: An axiological approach. *Journal of Electronic Commerce Research, 9,* 196-206.

Biocca, F. (1997). The cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication, 3*(2), 0-0.

Biocca, F., Harms, C., & Burgoon, J. K. (2003). Toward a more robust theory and measure of social presence: Review and suggested criteria. *Presence: Teleoperators and Virtual Environments, 12,* 456-480.

Choi, D. H., Kim, J., & Kim, S. H. (2007). ERP training with a Web-based electronic learning system: The flow theory perspective. International *Journal of Human-Computer Studies, 65*, 223-243.

Csikszentmihalyi, M. (1975). Play and intrinsic rewards. *Journal of Humanistic Psychology, 15*, 41-63.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row, Publishers, Inc.

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology, 56,* 815-822.

Hendaoui, A., & Limayem, M. (2008). Understanding consumer virtual shopping behavior in 3D virtual worlds: A theoretical and empirical investigation. *Proceedings of the Twenty Ninth International Conference on Information Systems,* December 14-17, Paris, France, paper 78.

Jiang, Z., & Benbasat, I. (2004). Virtual product experience: Effects of visual and functional control of products on perceived diagnosticity and flow in electronic shopping. *Journal of Management Information Systems, 21*, 111-147.

Johnson, R. D., Hornik, S., & Salas, E. (2007). An empirical examination of factors contributing to the creation of successful e-learning environments. *International Journal of Human-Computer Studies, 66,* 356-369.

Klien, L. R. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing, 17,* 41-55.

Koufaris, M. (2002). Applying the technology acceptance model and flow theory to online consumer behavior. I*nformation Systems Research, 13,* 205-223.

Novak, T. P., Hoffman, D. L., & Yung, Y.-F. (2002). Measuring the customer experience in online environments: A structural modeling approach. *Marketing Science, 19*, 22-42.

Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly, 25*, 401-426.

Schroeder, R. (2006). Being there together and the future of connected presence. *Presence: Teleoperators, & Virtual Environments, 15*, 438-454.

Schubert, T., Friedmann, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic insights. *Presence: Teleoperators and Virtual Environments, 10,* 266-281.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of Web-based and classroom instruction: A Meta-Analysis. *Personnel Psychology, 59,* 623-664.

Slater, M. and Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): Speculations on the role of presence in virtual environments. *Presence: Teleoperators, & Virtual Environments, 6,* 603-616.

Suh, K.-S., & Lee, Y. E. (2005). The effects of virtual reality on consumer learning: An empirical investigation. *MIS Quarterly, 29,* 673-697.

Trevino, L. K., & Webster, J. (1992). Flow in computer-mediated communication: Electronic mail and voice mail evaluation and impacts. *Communication Research, 19,* 539-573.

Webster, J., & Hackley, P. (1997). Teaching effectiveness in technology-mediated distance learning. *Academy of Management Journal, 40*, 1282-1309.

Webster, J., Trevino, L. K., & Ryan, L. (1993). The dimensionality and correlates of flow in human-computer interactions. *Computers in Human Behavior, 9*, 411-426.

Martin Hassell (mhassell@walton.uark.edu) is a Ph.D. student at the University of Arkansas. He enjoys conducting research on virtual learning and virtual worlds. He also does research on communication media and communication performance.

Sandeep Goyal, Ph.D. (sangoyal@usi.edu) is Assistant Professor of Computer Information Systems at the University of Southern Indiana. His research interests include the design of online recommendation agents and user evaluations and behavioral issues in electronic commerce and information technology acceptance and use.

Moez Limayem, Ph.D. (mlimayem@walkton.uark.edu) is the Associate Dean for Research and Graduate Programs at the Sam M. Walton College of Business at the University of Arkansas. His current research interests include IT adoption and usage, CRM, knowledge management, and electronic commerce.

Imed Boughzala, Ph.D. (imed.boughzala@it-sudparis.edu) is an Associate Professor at the Department of Information Systems at the Business School of the Mines-Telecom Institute in Paris, France. His research interests are related to e-collaboration (technology adoption and evaluation, and collaboration maturity) and knowledge management (knowledge sharing and co-creation).