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Learning in Virtual Worlds: Understanding Its Impact on Social and Cognitive Processes in Learning

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ABSTRACT

This study responds to the call for systematic knowledge and understanding related to virtual world learning environments (VWLEs). We propose a research model of VWLEs and explore the use of a VWLE on key social and cognitive process in learning during on-going interaction in the learning environment.

KEYWORDS

Virtual Worlds, Second Life, Collaborative Learning, Presence, Social Presence.

INTRODUCTION

Technology-mediated learning (TML) is gaining interest from both academic researchers and industry professionals as learning and training with internet technology and Web-based distance learning become more and more popular. While interest in TML has grown rapidly, very little research focuses on the role of technology and its influence on the learning process. A number of researchers point out that TML research lacks studies of certain important issues, such as how the role of information technology enables individualized learning methods and the consideration of the interactions of technology, instructional method, and the psychological processes of student learners (Alavi & Leidner 2001; Arbaugh & Benbunan-Finch 2003; Hodgson & Watland 2004). In a recent literature review of TML (Wan et al. 2007), the authors noticed that only two out of 39 papers they reviewed studied technology and the learning process. Clearly, the processes by which technology influences students' cognitive and information processing activities remain inadequately understood. Wan et al. also argued that a comprehensive theoretical framework on relevant constructs and their relationships to technology and the learning process has not yet emerged.

More and more new information technologies have been developed and used as platforms for learning. A virtual world learning environment (VWLE) can be defined as a computer-based simulated environment resembling the real world in which learning takes place through simulation and interaction among avatars and with virtual objects. An avatar is a two- or three-dimensional graphical representation of a humanoid that represents the computer user but may or may not resemble the user in "real life." Virtual objects are artifacts in a virtual world that are created, used and interacted with by the computer users. A virtual world environment was chosen as the context of interest for several reasons. Virtual worlds have become a recent breakthrough technology that has potential to reshape learning and business. They can also

provide a unique platform for collaborative education, simulation based instruction, and new methods for learning evaluation.

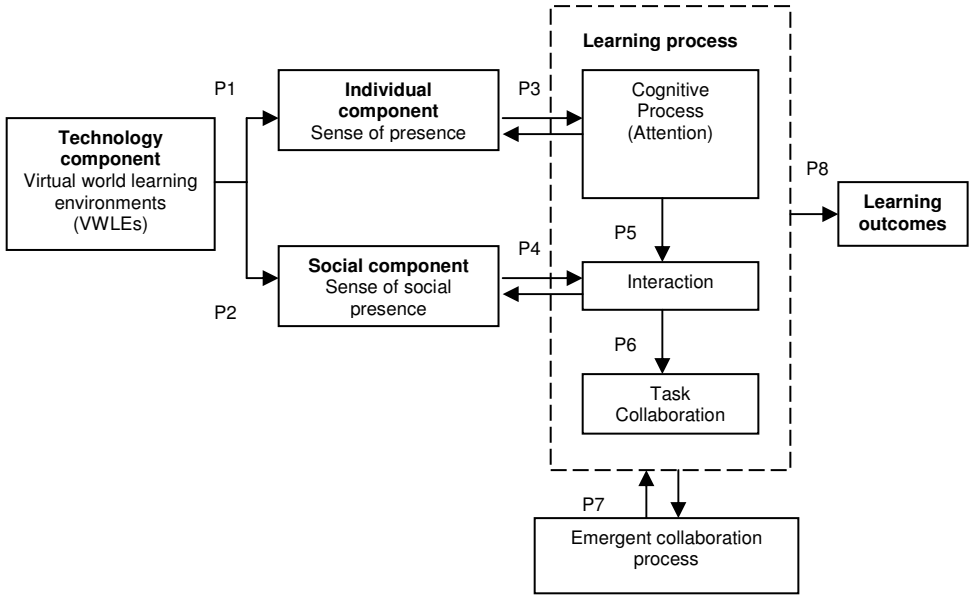
Online virtual worlds such as Second Life (SL) are gaining increasing attention. Second Life is a 3-D virtual world entirely built and owned by its residents. Since opening to the public in 2003, it has grown explosively and today is inhabited by more than 12 million residents from around the globe. SL has also been used as a learning environment by hundreds of institutions and organizations. However, there appears to be little research to support its effectiveness. The educational potential of virtual worlds needs to be examined for people to realize the strengths and challenges of this type of simulation environment for education and learning.

Drawing on previous research in the foundational disciplines of education, social psychology and information systems (IS) and the characteristics of virtual world learning environments, we propose a theoretical model and propositions to understand how VWLEs enable learning processes and outcomes – how people learn, how technology enables social interaction, how social interaction affects learning, and how learners and technology function best together. Three major categories of theories – collaborative learning theories, social and psychology theories, and technology theories – contribute to these important dimensions of TML.

THEORETICAL MODEL FOR LEARNING IN VIRTUAL WORLDS

Figure 1 presents a theoretical model of the learning process in a virtual world learning environment. The following section discusses the constructs in the model and captures relationships between the constructs in propositions for research.

Figure 1. Research Model of Learning Processes in VWLEs



Virtual World Learning Environments (VWLEs), Immersion and Presence

Presence refers to the natural perception of an environment (Steuer 1992; Beer et al. 2005). Presence is defined as "a psychological state in which virtual objects are experienced as actual objects in either sensory or nonsensory ways" (Lee 2004, p.37). The concept of presence has great practical relevance to many areas including education. In virtual learning environments (VLE), presence refers to a student's sense of being in a place and belonging in a course and the ability to interact with other students and an instructor (Picciano 2002).

In general, as users focus more attention on VLEs, they become more involved in the VE experience, which leads to a higher sense of presence (Witmer and Singer 1998). Similarly, a virtual environment that produces a greater sense of immersion will provide an increased level of presence (Witmer and Singer 1998). Immersion is the experience of inclusiveness and vividness of the VLE. Second life, an example of a virtual world, is an immersive environment. Within this environment a student will normally perceive presence by means of an avatar, where the virtual body is both part of the environment and represents the participant within the environment.

The learner has a sense of "being there" or the experience of presence in an environment by means of a communication medium (Reeves 1991). Virtuality can create a communication environment that brings the immediate and sensually rich domain of the face-to-face encounter into the imaginative and control-oriented domain of the computer (Palmer, 1995). Information and communication technologies make virtuality possible. One of the properties of VWLEs – immediate interaction – makes the environment highly vivid and highly interactive. Therefore, with respect to sense of presence, we propose:

> ***Proposition 1****: The learning environment in a virtual world provides a high perception of presence.*

Virtual World Learning Environments and Social Presence

Learning is closely associated with a connection with people and the environment. Numerous researchers suggest that sense of presence may increase with the existence of other individuals or virtual actors (Steuer 1992; Welch et al. 1996). One goal of technology-mediated learning is to increase the amount of social presence to provide students with the sense and benefits of a traditional classroom or seminar room (He et al. 2004).

Social presence is defined as the "degree of salience of the other person in the (mediated) interaction and the consequent salience (and perceived intimacy and immediacy) of the interpersonal relationships" (Short et al. 1976). VWLEs provide a highly social experience with multi-way interactions. Being able to actually "see" the person (avatar) with whom you are talking in a VWLE can have a great effect on the conversation. On a continuum of social presence, the face-to-face medium is considered to have the most social presence, whereas written, text-based communication has the least. A VWLE provides "face-to-face" communication through avatars facilitated by multiplicity of cues and immediacy of feedback. A VWLE can be assumed to provide a greater sense of social presence, which enhances the sense of "being with others."

Social presence is related to two important concepts originally applied to non-mediated interpersonal communication: intimacy and immediacy (Weiner and Mehrabian 1968; Lombard and Ditton 1997). Intimacy is an indicator of the social presence of the medium, being a function of proximity and eye contact (Short et al. 1976). Close proximity and sustained eye contact convey greater intimacy during communication, which can be achieved in VWLEs through avatars' interaction. With respect to sense of social presence, we propose:

Proposition 2*: The learning environment in a virtual world provides a high perception of social presence.*

Learning Models and Learning Theories

Five learning models have been identified by Leidner and Jarvenpaa (1995): objectivism, constructivism, collaborativism, cognitive information processing, and socioculturalism, each with different basic premises, goals, major assumptions and implications. Leidner and Jarvenpaa suggest that the impact of technologies on learning is important. Although technology itself does not produce desired learning outcomes, it facilitates intentional changes in teaching and learning processes and so operates as an enabler (Leidner and Jarvenpaa 1995; Piccoli et al. 2001).

Among five identified learning models, collaborative learning "involves social (interpersonal) processes by which a small group of students work together (i.e., cooperate and work as a team) to complete an academic problem-solving task designed to promote learning (i.e., get actively involved and participate in problem solving)" (Alavi 1994, p. 161). With the communication and interaction mediated by the rich virtual world environment, the collaborative learning model should fit for learning in a virtual world. A virtual world environment also supports constructivist and sociocultural learning.

Cognitive Process

Advanced technology-mediated learning environments include a blend of direct instruction with opportunities to use technology as a cognitive tool (Jonassen and Reeves 1996). Attention is a cognitive science term commonly used in education, psychiatry, and psychology. Attention can be defined as "an ability to focus and maintain interest in a given task or idea, including managing distractions" (from Cognitive Science Dictionary Web site: University of Alberta).

Attention is important because it is often considered a core cognitive process, a basis on which to study other cognitive processes, most importantly learning. DeGangi and Porges (1990) illustrate this by arguing that only "when a person is actively engaged in voluntary attention, functional purposeful activity and learning can occur" (p. 6). In the context of virtual environments (VE), attention refers to orienting one's senses toward information sources and selectively processing the available information (Witmer and Singer 1998). The experience of presence in a VE may have aspects similar to the concept of selective attention.

On the other hand, involvement is a "psychological state experienced as a consequence of focusing one's energy and attention on a coherent set of stimuli or meaningfully related activities and events" (Witmer and Singer 1998, p.227). In general, as users focus more attention on VE stimuli, they become more involved in the VE experience, which leads to an increased sense of presence in the VE. Witmer and Singer (1998) argued that the levels of immersion and involvement experienced in a virtual environment are interdependent. That is, increased levels of involvement may lead users to experience more immersion in an immersive environment and vice versa. We argue that the combination of increased immersion and involvement leads to a high sense of presence at the individual level.

P3*: A high perception of presence is associated with high levels of attention of students.*

From a student's perspective, high social presence will help increase interaction activities between students, with instructors, and with learning content, which in turn enhances students' collaboration and participation. Interaction also influences students' cognitive development process from conceptualization, comprehension, application, to evaluation and synthesis.

> ***P4****: A high perception of social presence is associated with high levels of interaction among students, instructors, and with learning content.*

With the high sense of attention, immersion and involvement enabled by VWLEs, the students perceive themselves to be included in the VWLE, which is expected to result in more participation in learning tasks and interaction with peers, instructors, and learning content.

> ***P5****: A high level of attention (enabled by immersion and involvement) of students is associated with high levels of interaction among students, instructors, and with learning content.*

There have been a number of studies and opinion papers on the relationship of interaction to learning. Many researchers have supported the concept that student-to-faculty and student-to-student interactions are important elements in the design of a Web-based course (Kumari 2001; Picciano 2002). Interactions among group members can be collaborative. Hence we propose:

> ***P6****: A high level of interaction during the learning process enhances group collaboration.*

Nachmias et al. (2000) observed that emergent collaboration is the process by which group configurations and transactional patterns evolve among participants during the course of learning in a TML course. In these activities, the preliminary definitions relate mainly to the goals, as well as constraints (e.g., technology to be used, time-tables, group members) of the learning activity. Then the collaboration situations evolve in correspondence with the extent and quality of students' involvement in the learning process and their commitment to different aspects of the task (Ogata & Yano 1999). Therefore, we propose:

> ***P7****: Emergent collaboration processes evolve during learning in correspondence with the extent and quality of students' involvement in the learning process.*

Learning is an active, social process. Learners learn more effectively and efficiently when they are in control of the pace, feedback is a critical part of effective learning, and active involvement leads to more effective learning than passive involvement. It is likely that highly technical courses will require more social interaction (Abler and Wells 2005), since it has been shown that increased social presence in technology-mediated courses aids in the successful delivery of complex and highly technical course content (He et al. 2004; Stafford 2005). Therefore, we propose:

> ***P8****: The learning process enabled by VWLEs with high interaction and collaboration enhances learning outcomes.*

RESEARCH IMPLICATIONS

The research model and propositions lay a foundation for the systematic study of learning in virtual worlds. With further development and refinement, the propositions can yield testable hypotheses for research in virtual world learning environments. Both quantitative and qualitative approaches can be used in exploring and testing, including observation, content analysis of text (e.g., chat log, self reports), and surveys.

Many questions for the benefit of educators, learners, and virtual world designers have yet to be examined. How does the use of a virtual world learning environment affect key social and cognitive processes during on-going interaction in the environment? How effective is learning in a VWLE in terms of performance, sense of community, satisfaction, and technology perception? How do VWLE capabilities impact participation, communication and interaction? How should course materials be designed and used in VWLEs to achieve better learning outcomes? What is the role of the instructor with regard to motivating students and reducing possible distractions in a VWLE for students? What features best suit teaching requirements in a VWLE? What are the strengths and challenges of this type of simulation environment for education?

CONCLUSION

We proposed a research framework of virtual world learning environments (VWLEs) and explored the role of technology and social components in VWLEs, especially the learning process mediated by the environment. Theoretical drivers and constructs of learning in VWLEs were presented, along with the relationships between the constructs and how the technology influences the learning process. The questions for future research have potential to enhance understanding of how students learn and the evolution of learning processes in VWLEs. The results may have strong practical application to the development of more effective learning environments using leading-edge technologies.

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