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). This paper proposes a research model of VWLEs and explores 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.
1 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 few research studies focus 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 papers out of 39 papers they reviewed studied IT and the learning process. This clearly shows that 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 IT 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 worlds learning environment (VWLE) can be defined as a computer-based simulated environment resembling the real world in which learning is taking place through simulation and interaction among avatars and with virtual objects. An avatar can be a two or three dimensional graphical representation of a humanoid that resembles the computer user or does not at all. Virtual objects are the artifacts in a virtual world that are created, used and interacted with by the computer users. A virtual world environment is chosen to be the context of this study for several reasons. Virtual worlds have become a recent breakthrough technology that has potential to reshape learning and business. Virtual worlds can 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 a total of more than 12 million residents from around the globe. It 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 explored for people to realize the strengths and the challenges of this type of simulation environment for education.

Drawing on previous research, the research question for this study is: How do VWLEs enable learning processes and outcomes? Specifically, how does the use of a VWLE affect key social and cognitive processes during on-going interaction in the learning environment?

This paper aims to propose a theoretical research 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.
2 THEORETICAL RESEARCH MODEL FOR LEARNING IN VIRTUAL WORLDS

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

2.1 Virtual World Learning Environments (VWLEs), Immersion and Presence

In a virtual learning environment (VLE) students can have the experience that they are both located in an environment where they can find resources, including other students and instructors, to support their learning and that they are actually present in that environment. The first experience is known as ‘immersion’ and the second as ‘presence’ (Beer, Slack and Armitt, 2005). Immersion is known as the experience of an inclusiveness and vividness of the VLE. Presence refers to the natural perception of an environment (Steuer, 1992). Second life, an example of virtual worlds, is an immersive environment. Within this environment the student will normally perceive their presence by means of an avatar, where the virtual body is both part of the environment and represents the participant within the environment.

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, and SL is one example of an implementation of the virtuality concept. One of the properties of VWLEs – immediate interaction – makes the environment highly vivid and highly interactive.

The learner has a sense of “being there” or the experience of presence in an environment by means of a communication medium (Reeves, 1991). Reeves argues that the automatic perceptual processes, mindful direction of attention, and conscious processes all contribute to our perceiving mediated experiences as real. Therefore, with respect to sense of presence, we propose:
**Proposition 1:** The learning environment in a virtual world provides a high perception of presence.

### 2.2 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). The 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, Zhang and Cheng, 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 media, 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.

### 2.3 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.
2.4 Cognitive Process

Advanced technology mediated learning environments include a blend of direct instruction with opportunities to use technology as a cognitive tool (Jonassen & 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 website: 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 the VE stimuli, they become more involved in the VE experience, which leads to an increased sense of presence in the VE. Wittmer 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 lead to a high sense of presence at the individual level.

**Proposition 3:** 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.

**Proposition 4:** 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.

**Proposition 5:** 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:
Proposition 6: 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 the students’ involvement in the learning process and their commitment to different aspects of the task (Ogata & Yano, 1999). Therefore, we propose:

Proposition 7: Emergent collaboration processes evolve during learning in correspondence with the extent and quality of the 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 TML courses aids in the successful delivery of complex and highly technical course content (He et al., 2004; Stafford, 2005). Therefore, we propose:

Proposition 8: The learning process enabled by VWLEs with high interaction and collaboration enhances learning outcomes.

3 RESEARCH DESIGN

This study is an in-depth process study. It is exploratory in that the overall goal is to provide better understanding of virtual world learning environments (VWLEs). To verify the above propositions and provide implications for learning in virtual worlds, three research techniques are planned: (1) observation, (2) content analysis of text, and (3) a survey.

A pilot study was conducted with an introductory MIS course and was completed in May 2008. The data collected is being analyzed. The pilot study teams are using Second Life as the learning environment to work on several case studies as group projects. The relationships of interest proposed in the research framework will be verified using “in world” observation.

Observation. The researcher plans to join the course and the student groups as an observer to record (with minimal disturbance to the group) direct information about the behavior of individuals and groups in the environment events, as well as the researcher’s reflection of the observation. This technique should help provide a preliminary understanding of the dynamic learning process in a VWLE.

Content analysis of text. All the online documents related to the course context, the synchronous chats and asynchronous discussion transcripts will be collected for content analysis and categorized in terms of the type of the content.

Survey. A survey is planned to be carried out both before and after the observation, ideally to be sent out in several similar course modules or course projects to test whether the relationships
among different components and constructs hold as suggested by the research model developed by this dissertation.

It is planned to have data collection and data analysis processes in parallel and in iterations. Thus, the research process will include looking at data, identifying possible themes or categories, reading more literature, and then revisiting the data or looking at new data, in order to have a descriptive picture of the phenomenon of VWLEs. The research question and propositions serve as a guide to collect, analyze, and discuss data. The information obtained from the observation and analysis of documents is useful for further developing the proposed theory and underlying structures.

Coding survey data. As data are collected and reviewed, research journals, chat logs, correspondence e-mails, and relevant documents are compared and examined repeatedly to identify reoccurring issues and emergent themes. The documents will be read numerous times. Key issues will be summarized and the data will be grouped and categorized. The emerging themes or categories will be compared across the different data sets and grouped into emerging themes. The subsequent readings and analysis of different data sets will continuously refine the categories. During the analysis phase, the researcher will continuously link the themes that were found to the theoretical model of this study. The research model is used as a tool to organize the categories and an analytical tool to form an in-depth view of the conceptual meaning of the category.

4 CONCLUSION

This paper proposes a research framework of virtual world learning environments (VWLEs) and explores the role of technology and social components in VWLEs, specially the learning process mediated by the environment. The paper explores the theoretical drivers and constructs of learning in VWLEs, the relationships between the constructs, and how the technology influences the learning process. This paper also proposes future research possibilities. The research of these possibilities will have potential to enable researchers to gain a better 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 technology developments.
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