The impact of 3-D based group interactions in an on-line problem-based learning environment

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Abstract: The purpose of this article is to present the results of a study conducted to investigate how the attributes of 3-D technology influence the group interactions toward problem solutions and how it impacts the instructional practice in on-line PBL. Results suggested that the attributes of 3-D technology, if used properly, would promote students' social presence and their meta-cognitive awareness.

Introduction

One of the recent trends in research on cyberinfrastructure focuses on 3-D based on-line communities where the emphasis is to promote community participants' social presence and collaborative inquiry. (CRA, 2005; Dalgarno, 2002; Dickey 2005; Jones, 2004; Jones, Morales, & Knezek, 2005). Learners in such environments often have the opportunities to experience real lifelike social interaction while at the same time, engaging in meaningful learning activities. For instance, Barab et al. (2005) created a 3-D multi-user virtual environment (3-D MUVE), *Quest Atlantis*, to support participant-centered collaborative inquiry by providing interactive quests and social games through animated avatars and virtual scenes. The resulting 3-D real life interaction metaphor, pedagogical driven quests, and on-line collaborative features incorporated in this 3-D MUVE provide learners and instructors with opportunities for community building and for engaging in meaningful educational activities.

The characteristics of collaborative inquiry and animated social interaction appear to make them ideal for problem or inquiry based learning (PBL). PBL is structured around problems or challenges that the learner is motivated to solve. There is an emphasis on the process of learning rather than the acquisition of facts. PBL as an instructional strategy is increasingly being used for on-line learning (Garrison & Anderson, 2003; Orrill, 2002; Uribe, Klein, & Sullivan, 2003)

The purpose of this study was to investigate the effects of 3-D based on-line group interaction in an on-line problem-based learning environment from the lens of Garrison and Anderson's (2003) community of inquiry model which aims to build a cohesive on-line community of participants and instructors. The model's main components are cognitive presence, social presence, and teaching presence. The community of inquiry model helps us understand students' higher levels of thinking during online collaborative learning by providing indicators for interpreting outcomes of online discussions.

The element of cognitive presence within the community of inquiry model contains four main categories. These are: triggering event; exploration; integration; and resolution. In the PBL process, these categories may support findings related to problem identification, problem analysis, and performance presentation, since PBL is an instructional strategy that engages learners in critical thinking. The element of social presence within the community of inquiry model has three main categories. These include affective, open communication, and group cohesion. In PBL, these categories of social presence may help to support data related to all the PBL stages of group formation, problem identification, problem analysis, and performance presentation, since PBL as an instructional method is intended to engage learners in collaborative problem solving. The final element of the community of inquiry model, teaching presence, is broken down into the categories of design and organization, facilitating discourse, and direct instruction. In PBL, the indicators from this element may help to support findings related to the role of the facilitator.

Garrison and Anderson (2003) suggest that PBL activities are a part of assessment activities which could be supported by the community of inquiry framework. However, for PBL activities to be successful in online learning, Garrison and Anderson state that "since most PBL activities are structured to allow group investigating, the needs for supporting group synchronization, document management, discussion, and task assignment must be supported"

(p. 100). If these design concerns are taken into account, 3-D MUVEs may be a suitable platform for collaborative online PBL group activities.

Research Questions: How do 3-D attributes such as avatars and bubble dialogue chat boxes (LDHRG, 1992) impact students' social interaction and presence at the early stage of problem solving activity (i.e., group formation and problem analysis) and how does this interaction impact their later stage of problem solving activity (i.e., action planning and presentation)?

Methods

Exploratory Case Study methodology – Case studies "identify problems of practice" by providing a "holistic account" of the phenomenon under investigation (Merriam 1998; Yin, 1994). The study used online observation, interviews and transcript analysis to collect data.

Participants and Procedure

The participants in this study consisted of 2 groups of 8 graduate students in a 500-level, three-credit hour introductory instructional technology course at a mid-western university.

The 3-D virtual environment used in this study is called *ActiveWorlds*®, an online virtual community where users can appear as a 3-D based "avatar", that is, a graphical representation of the user (Dickey, 2005). Participants travel (either by foot or time travel) to various virtual regions, and interact socially with other avatars. Participation in the online PBL activity using *ActiveWorlds*® was entirely voluntary and the participants who took part in this study gave consent to use *ActiveWorlds*® for their online group discussion. The course instructor divided the students into 2 groups.

Participants who agreed to use *ActiveWorlds*® were asked to use the system over the course of four weeks, as often as they desired. A follow-up group interview occurred after the four week period to explore the participants' willingness and ability to use the system and the system's potential to enhance their problem-solving performance. The focus group discussion was transcribed and coded into 3 three thematic findings. Transcripts generated form the participants' *ActiveWorlds*® interactions were analyzed and used to reflect and validate the interview findings. Interviews with the course instructor were also conducted to elicit the instructor's perspectives and outcomes of using *ActiveWorlds*® as a tool to support on-line collaborative inquiry.

Findings

1. The 3-D based communication metaphor enhanced the students' on-line social interaction experience and promoted better on-task discussion at the beginning of the problem solving process.

2. The embedded bubble chat box along with the 3-D scene provide an authentic and non-linear collaborative environment allowing students to better organize discussions and respond to questions prompted. Therefore students have a greater opportunity to reflect on the issues and problem to be solved.

3. Potential barriers to using the 3-D virtual environment:
While all subjects had a positive reaction to using Active Worlds, they expressed concerns about the use of the system's technical features. Its limited functionality (i.e., avatar gestures, sitting, and so on) caused the avatar to be a minimally used system function. Similarly, some students found the background sounds to be distracting while some reported that aimless movement by their colleagues sidetracked their discussion.

Discussion

The online experience may become realistic in the sense that it mimics a face-to-face experience whereby learners interact with other avatars synchronously online. The focus group data revealed that the bubble dialogue chat box allowed some learners to reflect on their problem-solving process.

Sounds, animations, colors, movement etc

Sounds, movement in the 3-D environment may overwhelm learners as they interact in the 3-D environment.

Adult Learners and the design of the 3-D environment

If an online collaborative activity is intended for adult learners, designers of 3-D MUVEs should take adult learning principles into consideration so as to make the online experience meaningful for adult learners.

Conclusion

The study findings suggested that 3-D virtual environment have the potential to become a usable collaborative tool for the participants. Areas for improvement: (1) Provide instruction and feedback so learners can fully exploit more advanced system features (e.g., provide participants prompts or wizard function), (2) a facilitator to guide the process of the collaborative inquiry to ensure all voices are heard, and (3) a problem support repository either embedded in or exist outside of the 3-D virtual environment to allow learners to access, track, and present their problem analyses and ideas solving during the discussion.

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