Designing for Interactive and Collaborative Learning in a Web-Conferencing Environment

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Abstract

This study investigated learning design in a web-conferencing environment based on three semesters of lessons conducted as part of an introductory programming subject. As well as characterizing the nature of discourse and interaction, the study focused on how the design of the interface, activity and task type affected collaboration and learning. Engeström's (1987) Activity Theory based upon a socio-constructivist view of learning was used to frame the analysis.

Interface designs incorporated theory relating to graphical user interface design, multimedia learning, and findings from the cognitive sciences. Activity designs were differentiated based on the degree of student ownership, from teacher-centred (transmissive) approaches, to teacher-led (guided interaction) approaches, to student-centred (collaborative group-work) designs. Types of tasks were considered on the basis of their level of knowledge (declarative, procedural and conceptual), their character (authenticity, situatedness) and their domain specific nature (in the field of computer science education). The effects of the different interface, activity and task designs on collaboration and mental model formation were explored.

A mixed method approach to analysis was adopted, incorporating a design-based research study and a multimodal discourse analysis. The design-based research allowed a broader, more interpretivistic and process focused analysis to be conducted, based on the strategic redesigns that occurred between iterations of the subject. The multimodal discourse analysis enabled more detailed, objective and outcomes based measurements of the subject of discourse, the nature of interactions and the types of modalities used to mediate learning. Triangulating data from the design-based research study and the multimodal discourse analysis provided a more complete description of phenomena and promoted greater reliability.

Results include the way in which different modalities afforded different possibilities for representing, and how combinations of those modalities could be effectively integrated by applying multimedia learning principles. Student-centred learning designs increased student involvement, allowing them to take greater ownership over the content and to more fully share their mental models. Authentic, meaningful problem solving tasks promoted greater student engagement. The capacity to dynamically redesign the interface based on the collaborative and cognitive requirements of the learning episode supported more effective implementation of conversational (Laurillard, 2002) approaches to learning.

More effective interaction and collaboration resulted from prescribing patterns of engagement, managing activity and technology so that student discourse could focus on content, and providing guidance regarding semiotic representational forms so that students could concentrate on applying those representations rather than inventing them. Teacher and student virtual classroom competencies critically influenced collaboration and learning.

Based on the findings in this study, a framework of nine pedagogical patterns for teaching and learning in web-conferencing environments is proposed. The framework provides an integrated approach to learning design that relates the interface design with the activity design and the level of knowledge (task type).

Statement of Candidate

The work contained in this thesis has not been submitted for a higher degree to any other university or institution. The contents are original and all reference to the work of others has been appropriately cited.

Macquarie University Human Ethics Committee approval was obtained for all aspects of this study (Ref: HE27MAY2005-DO4143, HE24FEB2006-DO4428, HE22JUN2006-DO4786).

Signed,

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Matthew Bower

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