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Understanding Collaborative Activities: A Distributed Cognition Perspective

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Abstract. Using a Distributed Cognition framework, this work aims to extend our understanding of how groups of learners collaborate in a learning environment rich in technologies.

Keywords. Human-Computer Interaction, CSCW, CSCL, Distributed Cognition, DiCoT

1 Introduction

Technology's evolving nature has brought new possibilities to the design of technology-rich learning environments for collaborative activities. Tablets and smartphones together with personal computers become part of a device ecology in which each device acts as a specialized portal into users' personal or shared information space [3]. In a collaborative learning environment these devices may be used for a variety of tasks while each individual may perform a task differently. Therefore, learners, tasks and use of technology in a learning environment cannot be studied independently or in isolation. To design effective technology-rich collaborative learning environments we need to acquire a deep understanding of the complex relations and interactions between collaborators and information technologies. Our work focuses on exactly this, using Distributed Cognition (DC) as a theoretical framework to guide data collection, analysis and interpretation of findings. Researchers have identified DC as a powerful tool for understanding the interdependencies of learners, tasks, and technologies in collaborative environments and for highlighting aspects for redesign [5]. The work is supervised by Dr. Andri Ioannou.

2 Theoretical framework

As a theoretical framework DC analyses cognition in a distributed manner [4], while it considers an activity taking place across individuals, tools and representations as one cognitive system, instead within an individual's mind.

Researchers in HCI (Human-Computer Interaction) and CSCW (Computer Supported Cooperative Work) communities have identified DC as a valid framework for understanding the interdependencies between users, tools and tasks [2]. In order to design effective technology rich learning environments, each tool must allow the distribution of an individual's cognition to the wider cognitive system, e.g. the classroom [7]. Furthermore, DC can provide a detailed identification of issues with existing work practices and mediating artefacts [6], allowing researchers to identify aspects of re-design of the environment.

However, there is no established methodology towards applying DC in the case of collaborative learning environments. In this work, we adopted the Distributed Cognition of Teamwork (DiCoT) methodology introduced by Blandford and Furniss [1] for collaborative work to extend our understanding of how groups of learners collaborate in a learning environment rich in technologies. This methodology draws together ideas from DC and conceptual design, including 22 principles classified loosely in three models; physical layout, information flow, and artefacts.

3 Proposed Research

Through the lens of DC, this work aims to extend our understanding of how groups of learners collaborate on design problems in a learning environment rich in physical and digital technologies and blending face-to-face content-and-activity with digital content-and-activity. Further, we aim to highlighting what is salient in the existing collaborative learning environment design and practices and indicate aspects of redesign of the learning environment.

For the purpose of this work, we enriched a postgraduate HCI course with four identical technology rich settings that aimed to support student collaborative activities around a design problem. Following an ethnographic approach, both qualitative and quantitative data were collected in active HCI courses over three consecutive years resulting in a rich dataset for analysis. In the sections that follow the progress achieved so far as well as the future plans for the current dissertation are outlined.

3.1 Work to date

3.1.1 Study 1: Understanding attitudes and technology use in a technology rich learning environment

This study included a pilot investigation of the technology rich learning environment, situated in a post-graduate HCI course. In order to understand learners' attitudes and technology use, we administrated questionnaires assessing students' motivational beliefs and overall satisfaction with the learning experience. Our results show that students' overall satisfaction was highly rated, while the technology rich learning environment contributed to students' engagement and collaboration [8].

3.1.2 Study 2: Understanding users' flow experience in a technology rich learning environment

This study focuses on the relationship between flow experience and the technology rich learning environment. The purpose was to explore learners' flow experience and to understand the affordances that engage users in the collaborative activities. Findings suggest that flow experience does exist in collaborative activities within the learning space, revealing individual affordances of the collection of devices used in the learning environment [9].

3.1.3 Study 3: Validating distributed cognition as a suitable framework for understanding collaborative learning activities in a technology rich environment

Using distributed cognition framework this study analyses learners' behaviour and how the technology rich learning environment supports collaboration and cooperation. The analysis allowed an in-depth understanding of the interactions among learners and tools during collaborative activities. Furthermore, the study validates distributed cognition as a suitable framework for understanding collaborative learning activities in a technology rich environment [10].

3.2 Future Research

3.2.1 Study 4: Constructing group profiles through the lenses of distributed cognition

The study will focus on constructing the individual profiles for each group validated distributed cognition as a modelling tool for collaborative learning activities through observation and video analysis.

3.2.2 Study 5: Distributed cognition in technology rich learning environments: Expanding the framework

Drawing from all the results of the previous studies, this study will expand the distributed cognition framework, including aspects referring to users' experiences and collaborative learning.

4 Expected Contributions

The completion of this project is expected to supply researchers a better understanding of how groups of learners collaborate in a learning environment rich in technologies. Furthermore, we aim to enrich and guide technology designers and practitioners on constructing effective technology rich environments for collaborative learning activities.

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