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An Appraisal of the SMART Board for Collaborative Learning

A dissertation presented in partial fulfilment of the requirements for the degree of Master of Computer Science in Computer Science at Massey University, Palmerston North, New Zealand.

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Abstract

Being a potential learning paradigm for the current decade, Computer Supported Collaborative Learning will blossom with the support of hardware technologies such as digital whiteboards along with suitable software. We investigated the effectiveness of a kind of digital whiteboard (SMART Board) for supporting collaborative learning. Our study reveals that the key features necessary for group learning such as floor control mechanism and interaction guidance are not supported by the current SMART board software. We designed and implemented software to overcome the important drawbacks of the existing systems which includes facilities to guide written and verbal contribution during the learning with the help of mini-vocabulary and to manage floor control.

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Chapter 1

Introduction

1.1 Overview

Rapid technological advances in computing have paved the way for innovative thinking in learning and teaching. Research linking human cognition with knowledge acquisition and knowledge representation has also contributed much in this area. In the early 1960s, the influence of behaviourism theory was at its height. This led to the emergence of the computer-assisted instruction (CAI) paradigm from the paper-based programmed instruction models (O'Shea and Self, 1983). Learning occurs via CAI as a passive acquisition or absorption of an established (and often rigidly defined) body of information.

The application of artificial intelligence (AI) techniques in CAI systems (ICAI) (Carbonell, 1970) and Micro-world systems (Taylor, 1980) led to other kinds of educational systems. In intelligent tutoring systems (ITS) (Sleeman and Brown, 1982), learning occurs as a process in which the learner acquires a proper understanding of the problem space. In micro-worlds, new information interacts with prior knowledge and triggers a process of assimilation and accommodation (Koschmann, 1996).

Most recent developments in constructivist theory, based on earlier sociocultural theories, introduced a new paradigm known as computer supported collaborative learning (CSCL). In 1996, Koschman declared that CSCL was being recognised as an emerging paradigm of educational technology.

The instruction model behind CSCL is that of collaborative learning. Collaborative learning is a kind of group learning process which is based on the idea that learning is a naturally occurring social act in which the participants talk among themselves. According to (Gerlach, 1994, p. 8) "It is

through the talk that learning occurs". Collaborative learning can be enhanced by computer and communication technology, which includes the hardware and related software such as groupware. Special hardware devices such as digital whiteboards may be effectively used to promote the collaborative learning process. For example, the hardware technology such as SMART Board (iThink, 2001), a touch-sensitive interactive digital whiteboard where the image of a computer screen is projected onto it, when used along with some suitable software such as SMART Notebook, would provide a suitable environment for collaborative learning. To provide an efficient collaborative learning atmosphere, those environments need to include facilities for at least the following tasks: basic editing, documentation, visualizing ideas, importing and exporting from other resources, communication guidance/ interaction support, knowledge building, problem solving, and resource allocation.

In this document, we describe research, where we have critically analysed the effectiveness of the hardware technology SMART Board along with the supporting software SMART Notebook for collaborative learning tasks.

1.2 Motivation

With the advanced technological support provided by computers for communication, several tools have been developed to facilitate group learning. Some educational institutions use whiteboards for group learning tasks. Now the digital whiteboard is being used in various countries for education. According to MirandaNet (2002), from their SMART Board evaluation, the students were motivated and stated that their learning had benefited with the help of SMART Board. However, there has been no research reported on the effectiveness of using SMART Board for collaborative learning. Firstly, though, the advantages and disadvantages need to be established for using the SMART Board environment for the collaborative learning tasks. Identifying the strengths and weakness of this environment for group learning process will eventually help us to establish the essential requirements for this type of environment for the group learning

process. Finally we could use a suitable prototype implementation to demonstrate our findings.

1.3 Research Objectives

The aim of this research is to give an appraisal of the SMART Board for group learning and to identify the essential requirements for this type of environment for the group learning process. Finally, we will demonstrate those features using a prototype implementation. Though various kinds of group learning processes are discussed in the literature, in this research we will concentrate on collaborative learning.

The objectives of the research can be summarised as:

- Literature Review: To study the important literature related to collaborative learning and computer supported collaborative learning
- SMART Board Analysis: Investigating the effectiveness of the SMART Board for supporting collaborative learning activities, and then identifying the essential requirements for designing the enhanced software.
    - Interaction Guidance: To investigate the facilities for efficient communication in the SMART Board Environment for collaborative learning activities
    - Resource allocation: To determine whether the SMART Board environment allows maximum utilization of resources and whether it supports even participation among members.
- Enhanced Software Design and Prototype: Designing software that incorporates the essential facilities necessary for collaborative learning with the SMART Board. Implementing a prototype to demonstrate some important features of this enhanced software.

1.4 Thesis Outline

Chapter two contains a discussion of the relevant literature for our project. Firstly, it presents group learning, and then collaborative learning as an important kind of group learning process. After that, CSCL and the essential

features of various kinds of software that support CSCL are also documented. This chapter also talks about some previous research into the CSCL paradigm.

Chapter three describes digital whiteboards and their current usage as a teaching tool. In particular, the features of the SMART Board environment, and SMART notebook software are discussed. The usage of SMART Board for collaborative learning tasks is considered.

Chapter four mainly reports on the experiments conducted to assess the SMART Board environment for supporting collaborative learning. The experiments are conducted in two phases: the pilot experiment and the main experiment.

Chapter five describes the system design for the enhanced SMART Board software. Also a proposal for enhancing the SMART Board software is given. A prototype is implemented to demonstrate the design of the enhanced software. The justifications for design decisions are given. Using a scenario, an evaluation is carried out and the results are given in detail.

Chapter six concludes the thesis with the findings from this research and suggestions for further work.