Chapter X
Participatory Simulation for Collaborative Learning Experiences

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ABSTRACT

In traditional education, most of the communication is one-way, where the teacher teaches and the students listen. The students are therefore less motivated to learn. In this chapter, we use the scaffolding technique to design an interactive simulation framework called SPS (scaffolding participatory simulation) for collaborative learning. Based on the SPS framework, a system called PLASPS (PDA-based learning algorithm system using participatory simulation) was developed to help students learn about sorting algorithms. Using this system, the teacher can assign tasks to their students and ask them to sort a list of numbers according to a certain algorithm. Learners then collaborate together to complete the task. The system checks the result and provides feedback to the students if there is a mistake with the positions of the numbers. The learners then correct the number positions and send the result back to the system. The collaborative activities and discussions, along with information about any errors, help the students to understand the sorting algorithm.

INTRODUCTION

In traditional education, most of the communication is one-way, where the teacher teaches and the students listen. With knowledge transmission from teacher to student based on instruction, students are not required to be active learners and can be only passive recipients: all the information or knowledge related to learning is automatically given through a teacher irrespective of the stu-
students’ needs or problems, even if they are in their classrooms. In such situations, learners are less motivated to learn. In contrast, if learners solve their own problems for their own sake, they will try to actively acquire the required knowledge and skills (Gerhard & Masanori, 2006). Traditional education is passive, lacks interaction, and makes complicated content hard to teach and understand. Poor communication between students and teachers is one of the major problems of mass lectures. However, mobile devices can help to address this problem and improve interactive communication to increase the motivation of students (Kopf et al., 2005). Innovative educational projects are evolving in response to the new opportunities that are becoming available by integrating advanced technologies (Barak, Harward, & Lerman, 2007).

To encourage more active participation and interaction among the learners, we designed a research framework to support collaborative learning. A prototype of a mobile learning object on Java programming for the PDA was developed to help the students learn sorting algorithms with PLASPS (PDA-based learning algorithm system using participatory simulation). The research framework is applied to the PLASPS. This system was then implemented and evaluated.

**BACKGROUND**

In the near future, we believe, with the evolution of improved wireless telecommunications capabilities, open networks, continued increases in computing power, battery technology, and the emergence of flexible software architectures, that these technologies can be commonly used in mobile learning. The world becomes more fluid, networked and complex, and organizations will continue to become more mobile than ever before (Liebowitz, 2007). Mobile technology is associated with any device that is designed to provide access to information in any location, or while on the move. Specifically, this includes, but is not limited to: wireless notebooks, tablet computers, mobile phones and personal digital assistants (PDA). One important field where mobile technology can make significant contributions is in education (Barak et al., 2007).

Mobile devices (e.g., PDAs or notebooks) provide different services aiming at the improvement of interactivity and creating additional, computer-moderated channels of communication between the learner and the teacher. Mobile devices can therefore reduce the problem of lack of communication between students and teachers, and by improving interactive communication we may help to increase the motivation of the students (Papert & Harel, 1991).

Further, mobile handhelds can easily be used in any classroom or field site; hence they can be used more often than computer labs (Vahey & Crawford, 2002).

Using mobile devices for supported collaborative learning is known as MCSCL (mobile computer supported collaborative learning). There has been an increasing amount of research about MCSCL in order to enhance learning and teaching (Chen et al., 2002; Okada et al., 2003). Many studies have examined the use of wireless mobile devices in learning. According to Roschelle (2003), “90 percent of teachers in a study of 100 palm-equipped classrooms reported that the handheld was an effective instructional tool with the potential to impact learning positively across curricular topics and instructional activities.”

There are many projects using MCSCL in Tokushima University, such as CLUE (Ogata & Yano, 2003a, b) and JAPELAS (Yin, Ogata, & Yano, 2004). CLUE is a prototype system for embedding knowledge awareness maps, and facilitates the sharing of individual knowledge and learning through collaboration. Learners provide their own knowledge about language learning in their everyday lives, and share and discuss them with others. JAPELAS also addresses language learning. It is very difficult for overseas students to learn Japanese polite expressions because these
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