

## Chapter 23

# Development of Cellular Phone Software to Prompt Learners to Monitor and Reorganize Division of Labor in Project-Based Learning

**Toshio Mochizuki**  
*Senshu University, Japan*

**Kazaru Yaegashi**  
*Ritsumeikan University, Japan*

**Hiroshi Kato**  
*The Open University of Japan, Japan*

**Toshihisa Nishimori**  
*The University of Tokyo, Japan*

**Yusuke Nagamori**  
*Tsukuba University of Technology, Japan*

**Shinobu Fujita**  
*Spiceworks Corporation, Japan*

### **ABSTRACT**

*The authors have developed a cellular phone application called ProBoPortable that displays information regarding the progress and achievement of tasks and division of labor in project-based learning (PBL) for higher education. ProBoPortable works as wallpaper on the screen of the learner's cellular phone, and it cooperates with Web-based groupware. When a learner activates his/her phone, ProBoPortable immediately retrieves the current status of the appropriate project from the groupware database and*

DOI: 10.4018/978-1-60960-040-2.ch023

*displays it on the screen. A classroom evaluation was performed in an undergraduate course; the evaluation confirmed that ProBoPortable enhanced mutual awareness of the division of labor among learners, who modified their own tasks by monitoring the overall status of the PBL. Using ProBoPortable increasingly fostered the sense of a learning community among the subjects. Moreover, social facilitation encouraged the learners to proceed with their own task due to the presence of others who are mutually aware of each member's status.*

## **INTRODUCTION**

In recent years, project-based learning (PBL) has been used extensively as a major educational method for higher education (Gijbels et al., 2005). PBL is a type of learning activity in which a learner studies along with other learners while working toward a common goal and collaborating on tasks as a group. This trend results from the fact that undergraduate students are expected to enhance their creativity and social skills before they graduate and commence participating in the society.

Throughout PBL, learners rarely perform the same task simultaneously. They prefer to divide a certain part of the task into smaller tasks and allocate each task to individual group members. Even in cases in which the rules for the division of labor are institutionalized by a teacher or an organization, group

members sometimes cross the borders of the division and coordinate their tasks with other members across these borders as the occasion may demand. For instance, if the task monitor provides a task performer with some instructions and then notices the task performer's errors, it is implied that the monitor becomes involved in performing the task. Thus, the division of labor is reorganized in a more or less ad lib and ad hoc manner such that the task progresses uninterrupted and error free (Hutchins, 1990). Kato et al. (2004) termed such a crossover of division of labor as the "emergent division of labor (EDL)" and argued that EDL should provide extensive opportunities for learning in situations where scaffolding (Wood et al., 1976) takes place naturally. According to

Kato and his colleagues, EDL has the following three characteristics.

- *Emergence of division of labor*: One can interactively negotiate the border of the division of labor by taking into account what others are doing in their regions. This is called "awareness" in the context of computer support for collaborative work (CSCW).
- *Maintenance of division of labor*: One can continue coordinating the division of labor with others through a continuous monitoring of their task status. Since stability is achieved through constant negotiation in ever-changing situations, maintenance is a dynamic and aggressive idea.
- *Reorganization of division of labor*: Based on the monitoring of the status of others' tasks, one can flexibly reorganize the division of labor as required (*ibid*, p. 2654).

However, undergraduate students in PBL get very little time to interact with each other on campus for working together or sharing and discussing their progress or situation. For example, they can meet only in the classroom, while eating lunch, etc. Therefore, PBL in higher education sometimes faces social problems such as social loafing (Latané et al., 1979) and process loss (Steiner, 1972), or it may result in the learners dropping out of the project. Such problems are attributed to a lack of collective cognitive responsibility (Scaradimalia, 2002), social presence (Short et

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