Chapter 13
Exploring the Challenges of Supporting Collaborative Mobile Learning

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ABSTRACT
Mobile technology opens up opportunities for collaborative learning in otherwise remote contexts outside the classroom. A successful realization of these opportunities relies, however, on mobile learning activities providing adequate collaboration structures. This article presents an empirical study aimed at examining the role played by mobile devices, teachers and task structures as a means for collaborative learning in geometry. The study focused on the analysis of the nature of collaboration that unfolded when students measured areas outdoors in the field. The analysis of the mobile learning activity was conducted from an Activity theory perspective. The findings obtained indicate that the collaboration observed may be impaired if: 1) the functionalities needed for collaborative problem-solving are asymmetrically distributed on a number of mobile devices; 2) task-related information is not accessible to all learners; 3) the task structure is not sufficiently complex; 4) teacher scaffolding is too readily available; and 5) necessary collaborative skills are not developed.

INTRODUCTION
Over the past decades, a large number of studies have demonstrated that collaboration can benefit learning from various theoretical and methodological perspectives. In fact, findings from over 1200 research studies have consolidated and refined theories of collaborative learning (Johnson & Johnson, 2009). Against this background, a strong consensus is asserting the higher achievement effects of collaborative learning on individual cognitive development as compared to individual-
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istic learning and traditional instructional methods (Johnson & Johnson, 1985, 2009; Slavin, 1996). Along with previous and ongoing research, collaborative learning has also increasingly gained momentum in educational systems (Johnson & Johnson, 2009).

As a pedagogical technique, collaborative learning can be considered as an effective strategy to promote student achievement, higher order thinking, argumentation and explanation skills, autonomy, interdependence, retention, problem-solving, self-regulation, and use of metacognitive strategies (Mevarech & Kramarski, 2003; Nichols, 1996; Roseth, Johnson, & Johnson, 2008).

Since the foundation of the field of Computer supported collaborative learning (CSCL), a substantial body of research has also provided evidence on the positive effects of introducing technology into collaborative learning tasks. Several large meta-analyses indicate that participants who collaborate making use of information technology show greater increases in motivation, elaboration, dialogue and debate, higher-order thinking, self-regulation, meta-cognitive processes, and divergent thinking (Dillenbourg, Järvelä, & Fisher, 2009; Tutty & Klein, 2008). Furthermore, some of the CSCL environments developed have been proved to promote higher order social interaction and better learning in terms of deep understandings (Lehtinen, 2003).

With the emergence of the research field of mobile learning, the relevance of collaborative learning has increased even more, and that not exclusively because mobile technology can enhance collaboration (Pachler, 2010), but also because teacher availability may be an issue outside the classroom in outdoor mobile learning activities. In contexts where students are many and the distances larger than they are in ordinary classrooms, reducing teacher availability, the importance of effective collaborative scaffolding increases.

As a result of acknowledging the value of collaborative learning, the conceptual debates about the opportunities and affordances of mobile technology for collaboration have been both frequent and discussed in considerable depth (e.g., Pachler et al., 2010; Sharples, 2006; Winters & Price, 2005). Mobile technology is often presented as a means of stretching the affordances of human communication and collaboration and has repeatedly been claimed to provide greater opportunities to promote collaborative learning (Pachler et al., 2010; Sharples, Taylor, & Vavoula, 2007).

In line with this, several studies have utilized the opportunities for collaborative learning with mobile technologies, for instance those aimed at children in primary school, such as *Treasure Hunt* and *Ambient Wood* (Rogers & Price, 2009). In particular, Zurita and Nussbaum (2004) and Huizenga et al. (2009) have presented findings demonstrating higher achievement scores using mobile technology for collaborative learning when compared to traditional learning activities. Other researchers have presented findings showing that collaborative mobile learning can support student’s development of collaboration skills (Cortez et al., 2009; Sanchez et al., 2009), and increase student motivation and engagement (Facer et al., 2004; Schwabe & Göth, 2005). Common to these studies, and mobile learning studies in general, is a strong focus on evaluating the learning outcomes and the effects of collaboration, with few studies analyzing the mediating learning processes (Sharples, 2009).

While the discussions about the opportunities of mobile technology are rich, collaboration has rarely been the main focus of analysis. This can be seen in the relatively limited documented empirical understanding about how we best design support for collaborative mobile learning (Stanton, 2002). Simply put, little is still understood about how we support the processes of collaboration and how we design the conditions necessary for fostering and promoting effective collaboration in mobile learning situations.

Effective collaboration is rarely a spontaneous phenomenon but rather the result of orchestration and scaffolding of productive interactions (Cer-
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