Multiple effects of collaborative mobile inquiry-based learning

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Abstract: This paper presents a study on mobile learning that could be viewed as a manifestation of strong voices calling for learning in natural contexts. The study was based on a sequence of inquiry-based mobile learning activities within the domain of natural sciences and mathematics education. We questioned *the effects of collaborative scaffolding, and the effects scaffolding provided by technology have on learning and performance*. Based on a quantitative interaction analysis, findings are presented illuminating, on the one hand, the interesting potentials of mobile learning, and on the other, some serious challenges that need to be met in order to realize those potentials meaningfully. For instance, some of the findings presented shows that low-achievement students benefits from this kind of activities; that learning technologies have multiple effects on learning, both positive and negative, and that the roles of teachers is as important as before the introduction of learning technologies.

Introduction

Since the Industrial Age, and as a response to a need for mass-education, learning has, to a high extent, been considered to take place in traditional classroom environments of lectures and books. As a consequence of the mechanical spirit of the industrial era, learning traditions were developed describing knowledge not as something that can be constructed by learners in appropriate contexts, but rather as information that should be transferred from textbooks and teachers into the minds of learners (Figueiredo & Afonso, 2005).

As time has elapsed, many strong voices have emphasized the importance of natural contexts (Dewey, 1916; Lave & Wenger, 1991). In the beginning of the 20th century, one of the first authors warning about the de-contextualized nature of learning and challenging the assumption that the classroom is the optimal place for learning to occur was John Dewey (1916). He proposed the idea that "*there is an intimate and necessary relation between the processes of actual experience and education*" (p.20), advocating that meaningful learning should take place in the setting of real-world activities. Since then, several theories on learning and cognition have been introduced, such as situated learning (Lave & Wenger, 1991) and situated cognition (Brown et al., 1989), which emphasize authentic problems and natural contexts as powerful learning resources for learners' generalization process. Also, since the emergence of the mobile learning field, more and more research projects are investigating learning outside of the classroom, in the world and in authentic contexts –facilitated by mobile technology.

The step out of the classroom into more dynamical environments, combined with the increased mobility of the students and the utilization of technology, changes the conditions for providing scaffolding support. In such environments, teachers may not be as accessible due to the mobility of the students, and the dynamical contexts can constrain the possibilities for social interactions (Winters and Price, 2005). From our own experiences, we have also observed that the design of mobile learning activities and learning technologies can dramatically restrict young students' opportunities to share knowledge and scaffold each other (Nouri, 2012; Nouri et al. (2011).

Thus, in the empirical study reported on in this paper, we attempted to further question *the effects of students scaffolding each other in field activities, what scaffolding needs these situations create, and the effect collaborative scaffolding and scaffolding provided by technology have on learning and performance*. In doing that a sequence of inquiry-based learning activities were designed within the domain of natural sciences and mathematics education. The designed learning activities were aimed at a group of primary school students using mobile technology with the objective to collaboratively explore a natural phenomenon, namely the characteristics of species of plants and trees and their biotopes.

Findings

For mobile learning to become an asset to the educational system, the gap between theories of learning in contexts and practical and successful implementations must be reduced. Although some of the findings of this study, to some extent, emphasize the potentials of mobile learning, other findings have illuminated that the gap is still there with many challenges waiting to be addressed.

In regards to the potentials of mobile learning, the findings indicate that some learning certainly occurs. For instance, a 44 % mean increase in performance is not inconsiderable, although it can be gradated with the

Hawthorne effect and discussions regarding the need for control group studies and comparison to learning occurring with more traditional pedagogical models in the frame of the classroom. Obviously, one could also question what learning we assessed and how we did that in the first place, calling for richer assessments focus beyond performance scores. In terms of performances scores however, the most noteworthy finding is the impressive performance increase of otherwise low-achievement students. It seems that these students are particularly responsive to learning situations of this kind, characterized by structured activities that allowed and guided both individual and collaborative work, also providing concrete experiences of the learning material supported by the mobile technology that highlighted and captured critical features.

On the other hand, the findings also demonstrated that we, as researcher, designers, and teachers, should not rely on collaboration to unfold satisfactorily in a way that provides the students the required scaffolding. In fact, some of the findings indicate that collaborative scaffolding amongst young students can have negative impact on learning, if the students are not capable and knowledgeable enough to provide the required scaffolding. These findings emphasize two things; firstly, the still important role of teachers in these kinds of activities, and secondly, the importance of a thoughtful technology- and primarily - activity design.

After all, our analysis suggests that the mobile technology used, with all its utilized positive affordances, also gave rise to problems among students managing the technology, and to scaffolding interactions that had significant negative influence on performance scores. Bearing in mind that the technology was designed rather thoughtfully together with researchers, students and teachers, guided by usability considerations, there are reasons to believe that this issue can become more pronounced if teachers are to design or choose learning technologies on their own for educational purposes.

Our analysis also suggests that designers, whether its researchers or teachers, should thoughtfully consider how learning activities across contexts are planned for, taking account of the scaffolding needs that different tasks, learning processes, and learning contexts can give rise to. One should, for instance, not put to much focus on conceptual learning in outdoor contexts, where teachers are not as readily available, and the concerned students are believed to be incapable of providing required conceptual scaffolding to their fellow group members.

Along this line, and in terms of mobile inquiry-based learning, the goals of tasks in outdoor field activities could be limited to concretely experience the contextualized learning material, and to collect multi-modal data for further analysis in indoor environments. Essentially, designers of mobile learning activities across contexts should thoughtfully ask which learning tasks are suitable for different contexts and how learning tasks can be distributed across contexts in order to provide students with the required scaffolding for meaningful learning to occur – for as many as possible. More on this study and its findings is documented in Nouri et al. (2013).

References

Brown, A. L., Collins, A., & Duguid. (1989). Situated cognition and the culture of learning. *Educational Researcher*.18 (1989), 32-42.

Dewey, J. (1916). *Democracy and Education.* New York: The Free Press.

Figueiredo, A. D. & Afonso, A. P. (2005). Context and Learning: A Philosophical Framework. In Figueiredo, A. D. & Afonso, A. P. (eds.). *Managing Learning in Virtual Settings: The Role of Context.* Information Science Publishing, Hershey, USA, pp. 1-22.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* New York: Cambridge University Press.

Nouri, J. (2012). *Eliciting the potentials of mobile learning trough scaffolding learning processes across contexts.* International Journal of Mobile Learning and Organisation.

Nouri, J., Cerratto Pargman, T., Eliasson, J., & Ramberg, R. (2011). *Exploring the Challenges of Supporting Collaborative Mobile Learning.* International Journal of Mobile and Blended Learning, 3(4), 54-69.

Nouri, J, Cerratto Pargman, T, Zetali, K. (2013). Mobile inquiry-based Learning, A study of Collarborative Scaffoldng and Performance. HCI International, Las Vegas, 2013.

Winters, N. and Price, S. (2005). Mobile HCI and the learning context: an exploration. In: *International Workshop on Context in Mobile HCI*. MobileHCI05. Salzburg