Design Guidelines for Location-Based and Contextual Learning Supported by Mobile Devices

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ABSTRACT

In location-based and contextual mobile learning, students are continually mobile in the virtual, social, and physical environment. A common problem in this view of mobile learning is that students spend time focusing on the mobile devices at the expense of interacting with other students or exploring the physical environment. The authors approach this problem from an interaction design perspective, where they design and analyse geometry-learning activities in two iterations. Based on video data from groups of students participating in the learning activities, the authors analyse when mobile devices are in the foreground and background of their interaction. The authors present six guidelines for designing location-based and contextual mobile learning activities, where mobile devices support rather than distract students from contents and contexts relevant to the learning goals. Finally, the guidelines are evaluated using a model of interaction, which represents mobile device interaction as one of four different modes of human interaction with technology.

Keywords: Human-Computer Interaction, Interaction Design, Location-Based and Contextual Mobile Learning, Mobile Learning, Taxonomy of Telematics

INTRODUCTION

Outside the classroom, mobile devices are used for example in learning mathematics and for scientific inquiry on field trips, for studying local history and for guiding on museum visits. In these kinds of activities, described by Brown et al. (2010) as ‘location-based and contextual mobile learning’ activities, learners are continually mobile in the virtual, social and particularly in the physical environment. The mobile devices are used for guiding students to locations relevant for the learning goals or for exploring the environment by capturing aspects of it. Reasons for introducing mobile devices to learning outside the classroom may be that they enable new learning experiences in that the mobile devices can be used to support learning in authentic contexts, support peer collaboration and motivate learning (Wijers, Jonker, & Drijvers, 2010). In learning mathematics and science, the mobile devices may be used to complement the often decontextualised learning

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in the classroom with contextualised learning outside the classroom (Tangney et al., 2010).

While new learning experiences outside the classroom may lead to contextual learning, the mobile devices may also distract students from contents and contexts relevant to the learning goals (Figure 1). This problem, of mobile devices distracting rather than supporting students, can be observed in a majority of the mobile learning research projects studying learners that are mobile in the physical environment (Göth, 2009).

We approach this problem from an interaction design perspective, where our aim is to design learning tasks and activities, where mobile devices are supporting students rather than distracting them. Against this background, we suggest to investigate the following question: ‘how should we design for location-based and contextual learning, supported by mobile devices?’, where the expected outcome is guidelines for designing tasks and activities for location-based and contextual learning, where mobile devices support rather than distract students from contents and contexts relevant to the learning goals.

This article reports on the design and analysis of mobile geometry-learning activities in two iterations. The article contributes with guidelines for designing location-based and contextual mobile learning activities allowing students to balance their focus between mobile devices and the learning tasks. The mobile geometry-learning activities were designed together with teachers, designers and developers. The analysis of episodes of the activity observed were performed using interaction analysis (Jordan & Henderson, 1995), and evaluated using the task model (Sharples, Taylor, & Vavoula, 2007) and the taxonomy of telematics (Buxton, 1995).

In this article, we argue that the question of balancing visual focus on devices with the learning goals given by the task is fundamental to pedagogies using mobile devices from a socio-cultural perspective (Säljö, 1999, 2010). Furthermore we suggest that balancing visual focus on devices with the learning goals given by the task needs to be taken into account from a design perspective. From a socio-cultural perspective there is a need to search for solutions on how the design of location-based and contextual mobile learning activities can help students balance their visual focus between devices and the physical context relevant to the learning goals.

While this article represent an interaction design perspective, we have also analysed the geometry-learning activities from the perspectives of learning support (Nouri, Eliasson, Rutz, & Ramberg, 2010), collaboration support (Nouri, Eliasson, Cerratto Pargman, Ramberg,
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