# MOBILE APPLICATION FOR MOBILE LEARNING

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**ABSTRACT**

The paper presents pilot case study which aims to examine how socio-cultural and situated learning aspects are reflected in learning experiences within a novel mobile learning environment, Math4Mobile, a cellular application for mathematics learning. The case study focused on four students in a mathematics methods course who were engaged in a mathematics project based on the cellular applications. We found that use of the cellular environment enriched the participants' formal mathematical knowledge with real life contexts and contributed to collaboration between participants. These effects can be attributed to the mobility, flexibility, and availability of cellular tools and point to a possible contribution of mobile tools to math education.

**KEYWORDS**

Mobile learning, cellular applications, collaboration, mathematics

## 1. INTRODUCTION

### 1.1 The goal

This paper presents a pilot case study involving learning processes within a novel mobile learning environment, Math4Mobile, a cellular application for mathematics learning. The case study focused on four students in a mathematics methods course who were engaged in a mathematics project based on the cellular applications. Our analysis addressed aspects of mobile learning that according to Sharples et al. (in press) are characterized by the fact that (1) the learners are continually on the move and (2) learning is supported by mobile devices and (3) learning involves the ubiquitous personal and shared use of the technology.

### 1.2 Background and rational

Mobile phones are becoming a part of the daily culture of almost every student and teacher and introduce new types of communication styles that remove spatial and temporal complexities (Alexander, 2004). Handheld devices may improve classroom dynamics owing to their computation and communication capabilities, which augment face-to-face interactions (Liu and Kao, 2007) and may support collaborative learning scenarios (Hoppe et al., 2003). Nevertheless, models for using and developing mobile applications for learning are somewhat lacking (Naismith et al., 2004). There is a need to formulate appropriate pedagogical models and to develop innovative strategies to integrate mobile applications in learning and teaching. Our project aims to address this need by designing learning materials and applications that take advantage of the unique features of the cellular phone rather than replicating those of the PC. In particular, our educational design takes into consideration the socio-cultural, situated learning paradigm. The data connectivity and communication aspects of mobile devices support social interaction, collaboration, and the construction of learning (Low and O'Connell, 2006), and may enhance interpersonal communication (Taylor et al., 2005). Being able to exchange work and applications through MMS and SMS, students and instructors may create a community in which they can work together, share knowledge, inspire each other, and apply active social interactions (Tu and Corry, 2003; Reynolds et al., 2001). Mobile devices also offer opportunities to gain access to learning experiences while being immersed in a learning context – in the real world (Low

and O'Connell, 2006). Embedding the learner in a realistic context at the same time as offering access to supporting tools can enhance the active construction of personal knowledge (Naismith et al., 2004).

## 1.3 The Math4Mobile environment

The Math4Mobile learning environment includes cellular applications for mathematics learning that can be installed in most cellular phones available on the market. The applications enable users to perform mathematical functions at different levels – from elementary school geometry to high school level calculus. For example, the *graph2go* application (Figure 1) supports the dynamic transformation of functions. This medium makes educational opportunities may be as mobile as students are. Moreover, cellular telephones facilitate the creation of a community of learners. The applications enable users to send graphs and formulas to one another as short text messages (SMS), allowing them to work together on solving problems and to involve any number of people in the learning process.

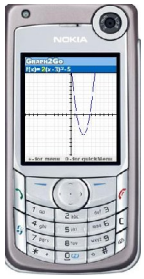

Figure 1: The Graph2Go application

This novel learning environment supports the execution of mathematical tasks that are richer then the traditional ones. Having the mathematical tool in hand at all times and in any place can support the mathematical modeling of real-world phenomena and provide students and teachers with learning experiences that are relevant and meaningful for their everyday experiences.

# 2. RESEARCH DESIGN

This research is design as a pilot case study which aims to examine how socio-cultural and situated learning aspects are reflected in learning experiences within the Math4Mobile environment.

**The learning setting:** We watched two pairs of students who studied in a mathematics methods course using the innovative mobile applications. The course is focused on collaborative project activities supported by use of technological tools. Students were equipped with the necessary mobile phones and encouraged to use them for course-specific tasks as well as for their personal daily communication. The researchers met the participants face to face and introduced them to the cellular applications, then followed the students' work and guided them through cellular communication. At the end of the semester the participants presented their projects to the class.

**The participants** were four female mathematics major students, studying for a teaching certificate. Participants were exposed to technological learning tools in a previous course.

**The project tasks** included the use the cellular video camera to record simple occurrences of motion and to turn their video clip into a mathematical model using the cellular applications.

**Data collection and analysis**: The learning practices of the participants were fully documented. The face-to-face activities were videotaped. The participants kept personal diaries to document their work. In addition, an interview summarizing the project was conducted with two of the participants. The analysis followed the grounded theory approach (Strauss & Corbin 1998), and the data were analyzed inductively to identify common patterns and norms.

## 3. ANALISIS OF THE LERNING EXPERIENCES

Although the experiment was short, we are able to identify some effects of the uses of the environment on patterns of understanding and changing perceptions about teachers' roles and the teaching of mathematics. The innovative use of the cellular applications in the course of the project challenged the students to rethink their mathematical knowledge within the context of modeling of motion. This naturally raised a comparison between their recollection of math and science classes and the method offered by Math4Mobile. Participants indicated that learning with the cellular applications is different from their own learning experience in school. In her interview, Dana said:

> "When we learned mathematics, physics, and chemistry at school we never had such an experience that you can actually feel and conduct all kinds of experiments and solve them. This is a new experience for me."

They also indicated the possibility that tasks such as analyzing motion videos with the cellular applications could contribute to their future work as mathematics teachers. In her interview, Anna referred to the use of mobile tasks from a teacher's point of view and claimed that the traditional school tasks are "Merely technique, without understanding" while tasks such as videotaping a movie or describing motion may contribute to the students' understanding. Participants pointed out three issues that where significant for the Math4Mobile environment to be efficient:

**The communication tools of the cellular device**. Users should be able to share mathematical objects such as graphs through SMS massaging. The device should provide a communication channel that supports collaboration between the learners and between learners and their instructors. This would strengthen student-teacher relationships, support informal communication between them, and help address the students' personal needs.

**The mobility of the learning environment**: Participants used the cellular devices to solve mathematical tasks in a variety of contexts and sites to perform the learning tasks. They also indicated that their learning experiences integrated well with their everyday lives. For example, when one of the participants videotaped motion in a store she visited and other participants solved mathematical tasks while traveling to the university.

**Handy and easy to use applications**: At the beginning of the project participants expressed doubts about using the cellular applications and wondered about the advantage of using them as opposed to solving problems with pencil and paper. By the end of the project they were proficient in using the mathematics tools, and when they presented their project and introduced the cellular applications to the class they persuaded most of their colleagues about the advantages of implementing this environment in schools.

## 4. CONCLUSION

The objective of this paper was to present learning experiences within a novel mobile learning environment and to examine how socio-cultural and situated learning aspects are reflected in these experiences.

Similarly to Sharples at al. (2005), we showed that not only the new technology was mobile but also the participants. Participants functioned as mobile learners in the sense that they used the mathematical application any time and anywhere, in informal setting, in the course of their everyday activities.

Socio-cultural aspects were reflected in the participants' learning practices and in their responses in the interview. The participants collaborated with each other and with the researchers in completing their project. In particular, their ability to send mathematical object by SMS supported social interactions, the sharing of ideas, and the creation of new knowledge.

We found that the contribution of the mobile environment lies not only in making dynamic mathematical application more available, but also in supporting the execution of mathematical tasks that are closer to the students' experiences and more relevant to them, which could enhance experiential learning (Lai et al., 2007).

Although participants were familiar with the use of computers in math education, the access to a personal communication tool, the success of the experiment was due in great part to the easy availability of the application and of the math task, and to the fact that they video application was integrated into the same tool.

The participants were pre-service teachers. Usually when computers are introduced as a way to enhance learning students remain far from being convinced that they would use technology when they'll start teaching. Viewing the patterns of use and the outcomes we think there are grounds to conjecture that they and others would not think that personal tools such as the cellular are presenting such complication.
This was a pilot experiment, supported by limited previous research about learning with cellular phones. We are part of the community of technologist who for over two decades are trying to create solid examples of the important impact of digital culture on mathematics education. The present exploratory study offers a good example of such a technology and help further investigation of the contribution of cellular applications in a wider range of student-centered learning and teaching situations.

## ACKNOWLEDGEMENT

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