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Key instructional design issues in a cellular phone-based mobile learning project

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ABSTRACT

Adding flexibility to the learning process, mobile learning offers great opportunities for education, especially for teenagers, who show great attentiveness to mobile technologies. Thus, the need to focus on design aspects of such learning is growing. This study aims to reveal critical issues in designing mobile learning based on a program for 11th graders and to unfold students' perceptions about reasons for participation, satisfaction, implementation processes, and specific content representation types. Reflections on insights gleaned from the instructional design process of the project and students' perceptions are presented with related recommendations.

1. Introduction

Mobile technologies can be regarded as the most widely used information and communication technologies of today's world. More and more individuals tend to own at least one mobile device and use the advanced multimedia capabilities of their devices in their social lives. The World in 2010 Report remarks that 90% of the world population has available access to mobile networks, with 80% in rural areas (International Telecommunication Union, 2010). In this context, using mobile technologies in learning environments can offer diverse opportunities for educators and learners. They offer control over learning, mobility in terms of time and place, and wide communication and interaction (Jones, Issroff, Scanlon, Clough, & McAndrew, 2006; Schwabe & Göth, 2005; Sharples, Milrad, Arnedillo, & Vavoula, 2009; Traxler, 2009). These advantages have the potential to be even more significant in developing countries where mass mobile technologies may exceed their educational qualities. The term, mobile learning (m-learning), has emerged in line with such concerns and characterizes the use of mobile technologies in education.

A study on American teen mobile phone usage by the Pew Research Center showed that, as of 2010, some 75% of 12–17 year-olds owned cell phones, a high increase from 45% in 2004. The other key findings of the study revealed that 87% of teens owning a cell phone used text messaging at least occasionally and they typically sent and received 60 text messages a day. The Pew Research Group (2010) indicates that the most popular uses include taking (83%) and sharing (64%) pictures, playing music (60%), playing games (46%), exchanging videos (32%) and instant messages (31%), going online for general purposes (27%), and accessing social network sites (23%). This increasing use of mobiles by American teens has a global parallel (e.g., Livingstone, Haddon, Görzig, & Ólafsson, 2010; Livingstone & Helsper, 2007; Samkange-Zeeb & Blettner, 2009). As of June 2010, mobile penetration in EU counties had increased to 126% from 85% in 2004 (Information and Communication Technologies Authority, 2011).

Similarly, the use of mobile phones has also increased in Turkey. As of March 2011, mobile penetration rate in the country was 84% (61.7 million users), which was calculated to be 49% in 2004 (Information and Communication Technologies Authority, 2011). When Internet technologies used in households are examined, the ratio for connection over mobile phones with WAP and GPRS technologies is 23.8% and the connection over mobile phones with 3G technology is 5.6%. Mobile connection over 3G modems is 2.3% (State Planning Organization, 2011). The total number of mobile Internet users has increased to 1.863 million as of first quarter of 2011, up from 640,580 in first quarter of 2010, a 190% growth rate with the highest rate among other Internet users. The total number of 3G users as of first quarter of 2011 was 21.4 million—this number was only 7.1 million in 2009 when 3G was first introduced (Information and Communication Technologies Authority, 2011). A survey on

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computer and Internet use by age groups in early 2010 revealed that almost 65% of people aged 16–24 use the Internet (Turkish Statistical Institute, 2010). This rate is likely higher for younger ages. Considering the 16,137,436 students in formal education and 7,062,429 students in non-formal education as of 2009–2010 (MoNE, 2010), use of mobile technologies for learning presents great potential for both environments.

Despite a proliferation of studies on m-learning projects and applications, no consensus has been reached on the definition and design of m-learning environments (Peng, Su, Chou, & Tsai, 2009), as the literature emphasizes different aspects. Some scholars see m-learning as a subset of e-learning (Chinnery, 2006), whereas others define it by focusing on mobile technologies (Aderinoye, Ojokheta, & Olojede, 2007; Clarke III & Flaherty, 2002; Quinn, 2000). Still others highlight location and type of activity (Hsu, Ke, & Yang, 2006; Traxler, 2007) in their definitions. Traxler (2007) criticizes explicit definitions of mobile learning because they "are constraining, techno-centric and tied to current technological instantiations" (p. 4). In their simplest and most common forms, learning mediated through mobile technologies can be characterized as mobile learning (Winters, 2006). Mobility, portability, connectivity, and situated context are critical features of mobile learning (Jeng, Wu, Huang, Tan, & Yang, 2010; Kakihara & Sorensen, 2002; Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009; Sharples, Taylor, & Vavoula, 2005; Traxler, 2007).

When designing m-learning, the major focus needs to be on the highly contextualized nature of the learning environment (Divitini & Morken, 2007; Gregson & Jordaan, 2009; Sharples et al., 2009). Characterized by more conversations and interactions across context compared to traditional learning (Sharples, 2006), m-learning places an emphasis on design considerations for contextual and unstable deliverables and components. That is, the design of mobile learning is a complex venture that requires rethinking the role and relationships between organizations, pedagogy, technology, and learners.

M-learning applications offer diverse benefits for education at all levels (Frohberg, Göth, & Schwabe, 2009). This manuscript aims to present the critical instructional design issues and challenges found in developing a cellular phone-based mobile learning covering the excretory system for an 11th grade biology program and to investigate students' perceptions pertaining to content representations, reasons for participation, implementation processes, and satisfaction. Reflections on insights gleaned from the instructional design (ID) process of the project are provided below with related recommendations. Two research questions guided the study:

1. What are the major issues and challenges in designing m-learning instruction?
2. What are students' perceptions on m-learning instruction pertaining to content representations, reasons for participation, implementation processes, and satisfaction?

2. Background of the project

M-learning can offer important learning potential for high school students keen on using cellular phone-based mobile devices. Therefore, the researchers designed this project with the notion that lessons learned from an actual implementation of an m-learning project would shed light on future projects in this field.

The project was conducted in a private tutoring institution known as a dershane, a common institution in Turkey where students study for the university entrance exam. The major reason for this context was that the target audience of 17 and 18 year-olds regularly use mobile devices. Also, they face great stress preparing for the exam while attending both school and dershane.

The project was carried out under the supervision of an expert Instructional Designer (IDer). The team was composed of three IDers, one of whom was experienced in preparing multimedia elements. The project underwent the following phases: (a) an analysis period in which the ID team visited the dershane to determine the context of the project and conducted meetings with students and their teachers and mentors to define needs, (b) a design and development period where instructional materials were designed and developed, (c) an implementation period with face-to-face (f2f) and mobile pilot testing, followed by application, and (d) an evaluation period. During the ID process, iterations occurred within all stages; hence, the steps often overlapped. The timeline of the project is shown in Fig. 1. Analysis, design and development, and implementation are described in the following sections. The evaluation period includes both within process (i.e., formative) and end of process evaluations (i.e., summative), which are documented in the findings section.

In this study, instruction takes an eclectic approach rooted in three psychological foundations: behaviorism, cognitivism, and constructivism. More specifically, multiple choice questions apply to the drill and practice strategy of behaviorism, a multimedia learning approach indicates cognitivism, and open-ended questions represent the scaffolds of constructivist learning. Learning Object (LO) and ARCS motivation model components (Keller, 1987)—attention, relevance, confidence and satisfaction—were used to integrate these theoretical foundations to mobile instruction.

2.1. The analysis period

As an initial step, the project team visited the dershane to determine needs and context in terms of students' workload, student-mentor-teacher relationships, and major issues concerning the administration, participant teachers, and students. In these visits, an initial

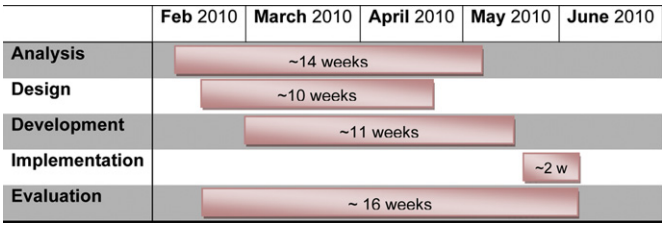

Fig. 1. The timeline of the instructional design process of the project.