Chapter 20
Mobile Learning: An Economic Approach

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ABSTRACT
Today, mobile devices have become an integral part of their possessor’s life. Learning using mobile devices has the advantage of receiving educational content at the moment when it is actually needed, or when the learner feels like s/he is able to study. Moreover, mobile devices used in education can augment the learning experience by delivering further information to the learner, depending on the learner’s context. However, there are still challenges to overcome in order to achieve a widespread adoption of mobile learning. One of these is the high cost of delivering educational content over wireless networks, especially when multimedia content is transmitted. This research proposes a solution that predicts the learner’s economic behaviour and takes it into account when delivering educational multimedia content. A mechanism for reducing the cost of the educational content delivery over wireless networks is also presented.

INTRODUCTION
Due to their ubiquitous presence in their possessors’ life, mobile devices have the capability of being important tools for learning. They can deliver educational content to their possessors when they need it. In this way, learners can have access to the right information at the right time. Mobile devices can enrich the learning process. For example, information delivered to the learner is adapted to the context in which the learning takes place (displaying information about the paintings in a museum or on a historic site the learner visits).

Even though mobile devices offer different advantages compared with the desktop PCs, several
challenges occur for students when using them for learning. Different factors come into play, such as the small screen, their limited battery life, poor wireless network performance, the high cost of accessing the content over the wireless network, etc. This paper focuses on the content delivery cost issue that is considered by Dyson, Raban, Litchfield, and Lawrence (2009) to be one of the key factors that limits the widespread adoption of mobile learning.

This research enhances the learner model (user model) built by an e-learning system, by taking into account the learner’s spending behaviour in a learning context. The prediction of the learner’s spending behaviour is used to select the most suitable content from different alternatives. A change in the size of multimedia content affects the amount the learner has to pay, and the quality of the content. The results of a preliminary study are also presented.

Multimedia educational content is considered in this research because it is increasingly used in education. The use of multimedia can improve learning by encouraging user interactions (Neo & Neo, 2004). Moreover, Demetriadis, Triantfillou, and Pombortsis (2003) reported that multimedia can enhance students’ interests, and can help them to better understand the content. However, despite these advantages, multimedia applications stream big files, as a result they take up large bandwidth when downloaded, which can affect the delivery cost.

Multimedia clips also present significant issues when transmitted to mobile devices over wireless connections. This results in high cost for the user on limited bandwidth telco plans. In addition the download speed can be severely reduced for learners in remote and rural areas. Therefore, a mechanism that will reduce the cost of content delivery is important to be implemented within an e-learning system.

The rest of this paper is organised as following: next section presents the state of art in the following areas: mobile devices content delivery issues, consumer behaviour, and multimedia content adaptation. Delivery cost issues are also discussed in this section. After that a framework of the e-learning system, focusing on modeling the learner spending behaviour, is presented. The next section presents the results of a case study, while the last section presents the conclusions.

**STATE OF THE ART**

Content Delivery Issues with Mobile Devices

The monetary cost for accessing educational content through mobile networks is considered to be one of the most important problems hindering the widespread adoption of mobile learning (Dyson et al., 2009). Accessing data over mobile devices is normally more expensive than accessing the same information via personal computers (PCs). Concerns related to the cost of accessing the Internet from mobile devices have been raised in various mobile learning projects (Dyson et al., 2009; J. Chen, Kinshuk, N-S., Chen, & Lin, 2008; Lindquist, Denning, Kelly, Malani, Griswold, & Simon, 2007).

J. Chen et al. (2008) reported that for 58% of survey participants the most important concern when using mobile phones for learning purposes was the overall high cost. This concern significantly surpassed any other concerns such as the educational content, multimedia effect or downloading speed. Tan and Kinshuk (2009) suggest that when designing mobile learning systems, there should not be too much communication between the mobile device and the server. The reason given was that the cost of communication on mobile networks was “paramount”.

Alternatively, García, Casañ, Conde, and Alier (2009) proposed the use of a mobile application that can work online as well as offline. The application stores the relevant server data directly on the learner’s device. Updates are sent from
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