Chapter 16
An Exploration of Developing Mathematics Content for Mobile Learning

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ABSTRACT

In this chapter, the authors explore the development of mathematics content for mobile learning. Firstly, some key factors which affect the development of mathematics content for mobile learning are considered. The development of content is challenging because of the limitations of a mobile device and the diversity of the mathematics content. The diversity of the content refers to the different types of mathematics content such as text, numbers, algebraic equations or graphs. The main challenge is determining the most effective way to represent this content on a mobile device. The need to consider factors such as the type of mathematics content, mobile device limitations, and the inclusion of mathematics pedagogy are discussed. The reason why each of these factors is significant is explained and a method for developing mathematics learning content is presented. The chapter closes with an example of a learning activity developed using this method.

INTRODUCTION AND BACKGROUND

There has been a rapid increase in the usage of mobile devices resulting in a surge of mobile learning research throughout the world. Mobile learning is learning across many contexts through social interactions using a personal electronic device (Crompton, 2013). Meeker (2012) illustrates the increase in usage of mobile devices in India where the users of the Internet via mobile devices were greater than that of desktop computers in 2012. Mobile device capabilities have improved drastically and its usage have increased, in some cases even more than that of the desktop computer. This increase a large number of mobile learning studies have been conducted throughout the world and several have reported learning gains in different subject areas, as well as learner preferences

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for this method of learning. Mobile learning has been used for many different subject areas such as history, English, mathematics and science (Andrews & Rayner, 2008). Hartnell-Young and Heym (2008), Attewell (2005) and van't Hooft, Swan, and Bennett (2009) all conducted research using mobile learning and reported that the learners were motivated to learn, and some even showed improvements in performance. These projects have shown that mobile learning for mathematics has received positive feedback, learning gains and preferences from the students. However, they are based on a limited subset of the mathematics curriculum, therefore there is a need to develop more mobile learning content for mathematics.

Teaching and learning mathematics can be complex and therefore the use of mobile learning for mathematics can be challenging. Learning mathematics requires numerical calculations, reasoning, abstraction, drawings and logical deduction. Representing criteria such as this is challenging on a mobile device because the device is limited in screen size, processing power and input capabilities among other challenges. Koole (2006) highlighted some of these limitations. These are small screen size, awkward input methods, limited output capabilities, weak processing power, limited memory, difficulty navigating and difficulty scanning through text.

Therefore, given that the mobile device is limited compared to a desktop computer and that mathematics is a complex subject, a problem arises. The problem is the difficulty of developing mathematics content for a mobile device while still ensuring that the learner is motivated to learn.

LITERATURE REVIEW

The literature review focuses on some of the methods used to facilitate mobile learning in research studies conducted. Duncan-Howell and Lee (2007) discussed several different methods in which mobile learning content has been presented to learners. These are Short Messaging Service (SMS), audio based content, Java quizzes, image capture via the camera, online publishing, blogging using Multimedia Messaging Service (MMS), e-mail, web browsers, field trips using GPS positioning tools and concept maps. Researchers have utilized one or several of these methods to deliver content via the mobile device. In the earlier days of mobile learning, the main features of the phone were used for learning. It was actually used to assist students in organizing their learning rather affect their learning directly. Some projects used the mobile device as an organizer while others used its GPS features for navigating historical sites and to find random items in a scavenger hunt. Some used the camera and video features to collect data in the field while studying geography or agriculture. Later, many researchers incorporated the use of SMS especially for target groups in difficult-to-reach areas without Internet access. SMS was used for delivering short lessons, quizzes and competitions. More recently, specific mobile applications are being developed for the mobile phone in an effort to help people learn. Trifonova (2003) also reported on several mobile learning studies categorizing the different uses of mobile learning. Trifonova described mobile learning studies which used SMS, WAP portals, tourist and museum guides, lifelong learning, collaborative learning and video for recording data on the field. Franklin and Peng (2008) reported on a study using the iPod Touch to help middle school students learn algebraic equations. Valk, Rashid, and Elder (2010) reported on several mobile learning studies which were conducted in Asia. The studies took place in the Philippines, Mongolia, Bangladesh Thailand and India. In these studies, SMS quizzes and games were the main features used for learning English. Several of the studies reported enthusiasm from the students and they showed improvements in their grades at the end.

Mobile games have also been used for learning and have received positive feedback from many students. Shin, Norris, and Soloway (2006) in-