Chapter 18
Design and Development of Educational Multimedia: The Software Development Process for Mobile Learning

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ABSTRACT

The decision to implement new technologies such as smart glasses, smart phones, and tablets in an educational setting without determining optimal use scenarios is an evident universal problem as the adoption of such mobile platforms becomes widespread. Semi-structured interviews are conducted with two Science and Technology (S & T) and three Information Technology (IT) public school instructors to further investigate this significant problem. The constant comparative method was used to analyze the qualitative data resulting from these interviews. Preliminary results demonstrate the educational use of tablet computers has several advantages, along with a few limitations needing to be addressed. Specifically, one of the main limitations of these new instructional technologies is the lack of interactive content, embodied in the audio, video, and pictorial multimedia. The urgent need to address this limitation has motivated the development of multimedia software to work seamlessly on tablet computers.

INTRODUCTION

In this study, a design and development research methodology included the ADDIE model of analysis, design, development, implementation, and evaluation. During the implementation phase collaboration included students, experts, and teachers. During the evaluation phase a questionnaire was completed by 40 elementary students identified as target users' typical of the characteristics and readiness needed for adoption and utilization of tablet computers. In all, a triangulated approach, including semi-structured interviews, literature review, and, most importantly, software analysis was employed to identify both functional and non-functional requirements. In conclusion, an effective multimedia software solution for tablet computers was advanced for fifth grade elementary students, with the primary objective of

DOI: 10.4018/978-1-5225-0783-3.ch018

increasing overall success rates. Finally, a pilot testing was conducted with 17 elementary students to detect possible usability issues in the utilization of the software. In addition, implications for practice are provided with limitations of the study discussed. We begin with a review of the literature surrounding mobile technologies.

Mobile Technologies

The mobile telecommunications industry has experienced appreciable growth during the recent decade. The significant growth has led mobile device manufacturers and service providers to develop new smart technologies such as glasses, watches, phones, tablets and a new array of data-contingent applications such as the mobile web, cloud computing, and multimedia streaming. With the introduction of these user-centric devices and interactive services, it appears a new mode of learning has arisen through modern mobile devices.

Mobile learning can be defined as a new form of personal learning taking place anytime and anywhere with the aid of mobile devices such as notebooks, tablets, and smart phones (Kadirire, 2009). Mobile learning provides greater individualism, flexibility, and most importantly, ubiquity, contrasting sharply with traditional learning methods (Arpaci, 2015). Moreover, it enables an "always-on" connectivity for learners and provides mobility, interaction, and portability (Jeng, Wu, Huang, Tan, & Yang, 2010; Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009; Sharples, Milrad, Arnedillo, & Vavoula, 2009; Traxler, 2009).

The advantages provided by mobile technologies have prompted instructional technologists and researchers to take a pedagogical view toward developing educational multimedia applications for mobile devices to promote teaching and learning (Wu, Wu, Chen, Kao, Lin, & Huang, 2012; Kukulska-Hulme & Traxler, 2007). For example, Güler, Kılıç, and Çavuş (2014) compared the difficulties novice instructional designers experience during the instructional design processes using mobile devices and desktop computers for learning content. Sixty-eight sophomore students developed learning content for mobile devices and desktop computers using the instructional design model of; Analysis, Design, Development, Implementation, and Evaluation (ADDIE). The results showed both development processes had similar difficulties, while the development process for mobile content requires some specific adjustments.

Doolittle and Mariano (2008) examined the effects of individual differences in Working Memory Capacity (WMC) on learning from a historical inquiry using multimedia tutorials in a stationary environment versus mobile learning environments using a portable digital media player. The results showed students in the stationary instructional environment performed better, while interaction effects demonstrated the low-WMC students performed poorly in a mobile instructional environment. In a similar study, Gedik, Hanci-Karademirci, Kursun, and Cagiltay (2012) investigated critical issues in designing a cellular phone-based mobile learning environment for 11th graders to examine students' perceptions on reasons for satisfaction, participation, and implementation processes. In the analysis phase, researchers gathered information about students' cellular phone usage habits, brands of phones, mobile network operators' names, and students' mobile learning preferences with regards to content, time, and methods used. In the design and development period, researchers designed the content using examples, explanations, and interpretive multiple-choice questions. The content and open-ended questions were based on the high school curriculum, textbooks, with input from the biology teachers. They found the limitations of regular cellular phones (i.e., storage, screen size, bandwidth) made it difficult to provide full instruc-