Multimedia Information Design for Mobile Devices

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INTRODUCTION

There is a rapid increase in the use of mobile devices such as cell phones, tablet PCs, personal digital assistants, Web pads, and palmtop computers by the younger generation and individuals in business, education, industry, and society. As a result, there will be more access of information and learning materials from anywhere and at anytime using these mobile devices. The trend in society today is learning and working on the go and from anywhere rather than having to be at a specific location to learn and work. Also, there is a trend toward ubiquitous computing, where computing devices are invisible to the users because of wireless connectivity of mobile devices. The challenge for designers is how to develop multimedia materials for access and display on mobile devices and how to develop user interaction strategies on these devices. Also, designers of multimedia materials for mobile devices must use strategies to reduce the user mental workload when using the devices in order to leave enough mental capacity to maximize deep processing of the information. According to O'Malley et al. (2003), effective methods for presenting information on these mobile devices and the pedagogy of mobile learning have yet to be developed. Recent projects have started research on how to design and use mobile devices in the schools and in society. For example, the MOBILearn project is looking at pedagogical models and guidelines for mobile devices to improve access of information by individuals (MOBILearn, 2004). This paper will present psychological theories for designing multimedia materials for mobile devices and will discuss guidelines for designing information for mobile devices. The paper then will conclude with emerging trends in the use of mobile devices.

BENEFITS AND LIMITATIONS OF MOBILE DEVICES

There are many benefits of using mobile devices in the workplace, education, and society. In mobile learning (m-learning), users can access information and learning materials from anywhere and at anytime. There are many definitions of m-learning in the field. M-learning is the use of electronic learning materials with built-in learning strategies for delivery on mobile computing devices to allow access from anywhere and at anytime (Ally, 2004a). Another definition of m-learning is any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies (O'Malley et al., 2003). With the use of wireless technology, mobile devices do not have to be physically connected to networks in order to access information. Mobile devices are small enough to be portable, which allows users to take the device to any location to access information or learning materials. Because of the wireless connectivity of mobile devices, users can interact with other users from anywhere and at anytime to share information and expertise, complete a task, or work collaboratively on a project. Mobile devices have many benefits, because they allow for mobility while learning and working; however, there are some limitations of mobile devices that designers must be aware of when designing multimedia materials for delivery on mobile devices.

Some of the limitations of mobile devices in delivering multimedia materials include the small screen size for output of information, small input devices, low bandwidth, and challenges when navi-

gating through the information (Ahonen et al., 2003). Designers of information and learning materials have to be aware of the limited screen size and input device when designing for usability. For example, rather than scrolling for more information on the screen, users of mobile devices must be able to go directly to the information and move back and forth with ease. Information should be targeted to the users' needs when they need it and should be presented efficiently to maximize the display on the mobile device. To compensate for the small screen size of mobile devices, multimedia materials must use rich media to convey the message to the user. For example, rather than present information in textual format, graphics and pictures can be used in such a way to convey the message using the least amount of text. For complex graphics, a general outline of the graphic should be presented on one screen with navigation tools to allow the user to see the details of the graphic on other screens. To present procedures and real-life situations, video clips can be used to present real-life simulations to the user. Also, the interface must be appropriate for individual users and the software system should be able to customize the interface based on individual users' characteristics. When developing multimedia materials for mobile devices, designers must be aware of psychological theories in order to guide the design.

PSYCHOLOGICAL THEORY FOR DEVELOPING MULTIMEDIA MATERIALS FOR MOBILE DEVICES

According to cognitive psychology, learning is an internal process, and the amount learned depends on the processing capacity of the user, the amount of effort expended during the learning process, the quality of the processing, and the user's existing knowledge structure (Ausubel, 1974). These have implications for how multimedia materials should be designed for mobile devices. Designers must include strategies that allow the user to activate existing cognitive structure and conduct quality processing of the information. Mayer et al. (2003) found that when a pedagogical agent was present on the screen as instruction was narrated to students, students who were able to ask questions and receive feedback interactively perform better on a problem-solving transfer test when compared to students who only received on-screen text with no narration. It appears that narration by a pedagogical agent encouraged deep processing, which resulted in higher-level learning. According to Paivio's theory of dual coding, memory is enhanced when information is represented both in verbal and visual forms (Paivio, 1986). Presenting materials in both textual and visual forms will involve more processing, resulting in better storage and integration in memory (Mayer et al., 2004). Tabbers et al. (2004) found that in a Web-based multimedia lesson, students who received visual cues to pictures scored higher on a retention test when compared to students who did not receive the cues for the pictures. Also, strategies can be included to get the user to retrieve existing knowledge to process the information presented. For example, a comparative advance organizer can be used to activate existing knowledge structure to process the incoming information, or an expository advance organizer can be presented and stored in memory to help incorporate the details in the information (Ally, 2004a; Ausubel, 1974).

Constructivism is a theory of learning that postulates that learners are active during the learning process, and that they use their existing knowledge to process and personalize the incoming information. Constructivists claim that learners interpret information and the world according to their personal realities, and that they learn by observation, processing, and interpretation and then personalize the information into their existing knowledge bases (Cooper, 1993). Users learn best when they can contextualize what they learn for immediate application and to acquire personal meaning. According to Sharples (2000), mobile learning devices allow learners to learn wherever they are located and in their personal context so that the learning is meaningful. Also, mobile devices facilitate personalized learning, since learning is contextualized where learning and collaboration can occur from anywhere and anytime. According to constructivism, learners are not passive during the learning process. As a result, interaction on mobile devices must include strategies to actively process and internalize the information. For example, on a remote job site, a user can access the information using a mobile device for just-in-time training and then apply the information right away.