Chapter 1.12
Mobile Educational Technology

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INTRODUCTION

Mobile devices such as *laptop computers*, *personal digital assistants (PDAs)*, and *cell phones* offer many features useful for learning both inside and outside classrooms. These devices offer access to Web pages and e-mail, and provide other functions such as textual noting and video cameras. They promise a single, easily learned device that can be useful in a variety of educational settings. When used appropriately, these devices can enrich the learning experience by connecting learners with each other, their environment, and with information providers. They can enable collaborative problem solving by providing easy face-to-face sharing of data through infrared (IR) beaming or distance sharing through e-mail and Web interfaces. For learners who require repetitive practice for skills development, mobile devices offer a personal tool that can be used anytime, anywhere for quick review. Because of their low cost and ease of use, mobile devices have the potential to bring the power of a computer to every learner.

MOBILE DEVICES: DEFINING THE TECHNOLOGY

Mobile devices, which we define as small portable networked computers, can be categorized as laptops, PDAs, or cell phones. Laptops can be further categorized as clamshells, with keyboards mounted below display screens, or tablets, with touch-sensitive screens but no keyboards. Laptops are miniature desktop computers, so they run the same programs and use the same peripherals as desktops, but laptops require a desk and cannot be used while walking. In contrast, PDAs are pocket-sized tablets, that is, computers with touch-sensitive screens operated like paper notepads; some also have tiny keyboards operated by thumbs, but

even these are designed to be used while walking around and require no desk. Cell phones are the smallest devices, and almost all are operated entirely by one hand using a tiny keypad. PDAs and cell phones run their own operating systems and are not compatible with desktop computer software and hardware. In general, mobile devices have less computing power than desktops and so depend on networking to more powerful computers.

The defining characteristic of mobile devices is, of course, their *mobility*: the small size, light weight, battery power, and wireless networking capability that allow mobile devices to be easily carried and used anywhere. Within classrooms, mobility allows students to move around, forming groups, discussing their work, visiting various fixed resources, and making presentations. Outside the classroom, mobility allows students to compute in the field, library, or home, forming groups or making use of time found while waiting or commuting.

Mobile devices use networks to communicate with each other and access the Internet. Four types of *mobile networks* can be found: *peer to peer*, *caching*, *wireless local-area networks (LANs)*, or *wireless wide-area networks (WANs)*. Used by PDAs and laptops, peer-to-peer networks connect similar computers into a small self-contained network, typically covering a single room or building. All PDAs and some laptops can also use caching networks. These work by temporarily connecting to a desktop PC (personal computer; through either a wire or a wireless peer-to-peer connection) and downloading Web pages and e-mail through the PC. Wireless LANs connect computers using a radio technology similar to that in cordless phones. Several computers can come together to form an ad hoc peer-to-peer network, and by adding an access point, can connect to the Internet. Wireless WANs use cell-phone technologies (and their expensive monthly service contracts) to connect mobile devices to the Internet anywhere within a cell phone's service area.

WHY MOBILE EDUCATION?

Mobile devices can profitably replace desktop computers in the classroom, conferring several advantages.

A Computer for Every Learner: Affordable Computers in the Classroom

In the United States (Soloway, Norris, Blumenfeld, Fishman, Krajcik, & Marx, 2001) and Chile (Cortez, Nussbaum, Santelices, Rodriguez, Zurita, & Correa, 2004), researchers are investigating the use of PDAs as affordable alternatives to desktop or notebook computers for elementary and secondary students. They point out the failure of previous initiatives for providing computer access to all students, citing reasons such as high cost and lack of space in existing classrooms. They argue that mobile devices can address those concerns and have the added advantage of mobility. Most PDAs already have word-processing and database programs installed, and simple educational programs are being developed. Some argue that the tiny screens, difficult input methods, and short battery life make these devices a poor alternative. However, researchers are beginning to show that for younger generations, small screens and thumb input are not regarded as usability problems (Houser & Thornton, 2004). Other researchers are designing battery-recharging stations for the classroom (Deng, Chang, Chang, & Chan, 2004).

Mobile devices can replace PCs for many tasks. Although mobile devices are much smaller than desktop PCs and have inferior capabilities, they are sufficient for most educational activities. Modern PDAs, for example, enjoy capabilities similar to 1995 desktops: similar processing power, memory storage, network speed, and display resolution. Modern mobile phones are even smaller and less capable, but still support standard Web pages and e-mail.