Web Clippings

The solution to enhancing your students' access to computers and online resources may soon rest in the palms of their hands.

Figure 1. The Palm m100 handheld computer.

Figure 2. Handspring's Visor handheld computer.

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Sometimes it is possible to see the glint of the future over the horizon. A new generation of portable handheld computers that fit in the palm of the hand may represent a future in which there is a computer in each student's pocket.

Despite a quarter century of progress in educational technology, today's K–12 students have limited access to computers in schools. There are few truly "personal" computers in public schools—only institutional machines shared by many students. The average student's access to school computers is typically measured in minutes per week. Teachers report that limited access to computers is one of the most significant barriers that many classes face.

Meanwhile, the price of handheld computers has been dropping rapidly. Both Palm (Figure 1) and Handspring (Figure 2) now offer handheld computers for less than $150. More advanced models offer features such as color and wireless Internet connectivity at additional cost. As prices continue to drop, it soon will be possible to equip an entire class for the price of two or three PCs, allowing each student access to his or her own personal, pocket-sized computer at any time. The affordable cost—less than most printers—makes this an ideal time for teachers to begin exploring educational uses of handheld computers. By the time schools begin equipping entire classrooms, teachers in those classrooms will have a good sense of the educational capabilities of these devices and will be comfortable using them.

Handheld computers also have a great potential for mining the Internet. They are designed to be linked to the Internet through a desktop computer. Wireless modems such as OmniSky are also available as accessories, but their use involves a monthly service fee that makes them better suited for business applications than school use. When the hand held computer is dropped into a cradle connected to the desktop computer or connected through an infrared link, information from the Internet is transferred to it. If you are a teacher or administrator who is exploring the use of a handheld computer, or if you are about to acquire one, what are some of the educational possibilities?

Web Clippings

Handheld computers can be used to clip Web sites, or parts of sites, just as a pair of scissors is used to clip articles from newspapers or magazines. *Web clippings* is a phrase that has been adopted to describe information transferred from the Internet to the handheld computer in this manner. Many services can be used to secure Web clippings. AvantGo's free mobile Internet service is one of the more popular.

The newest Palm model, the m100, is sold with the AvantGo software pre-installed. (If you have another model, a handheld that uses Microsoft Pocket-PC, or even a wireless Web phone, you can download the software at no charge at AvantGo's Web site.) To clip a Web site from the Internet, specify the address of the Web site, the depth of

links that should be transferred, and the maximum amount of information (in KB) that should be transferred (Figure 3).

AvantGo also offers the choice of including or omitting images. Though handheld computers can display images, they are better suited for display of text except in the case of sites developed for mobile devices.

Web Channels

AvantGo offers a number of Web services designed specifically for mobile devices such as handheld computers. The AvantGo service checks selected Web sites (termed "Web channels" in its nomenclature) and updates the handheld computer to reflect the

most recent information from that site. Web channels currently offered directly from the AvantGo Web site include the front page of *The New York Times* and other news services from around the world (BBC, *The Economist*, *USA Today*, etc.). A class equipped with hand-held computers could compare headlines around the world in current events or civics class.

The technology offers forecasts from The Weather Channel, connections to Web portals (Yahoo!), science and technology information (*Wired* News, ZDNet, *PC World*), and a host of other services. Some of the services offered are interactive; for example, MapQuest (Figure 4) allows users to enter a location on the handheld com-

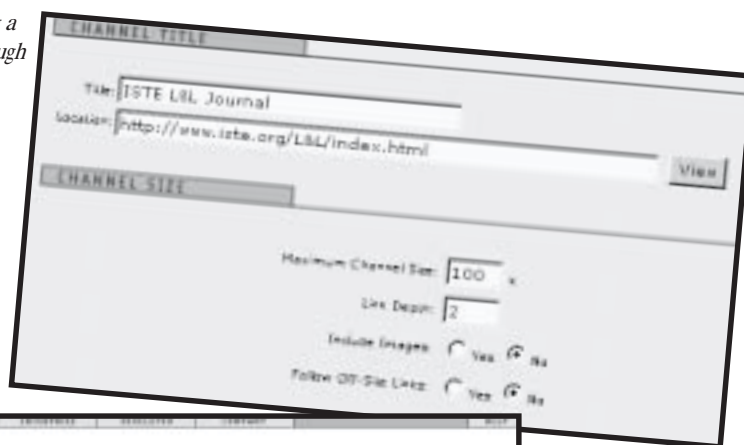*Figure 3. Creating a Web clipping through AvantGo.*

Figure 4. The MapQuest Web channel.

puter once this channel has been added. Students could access maps of the local area as they follow a planning commission session or even use a global positioning satellite (GPS) module in an interdisciplinary class integrating science, mathematics, and government.

The LearnLots Web channel offers online tutorials. When a tutorial (ranging from general computing to business and finance) is checked on the Palm, the information is transferred to the handheld computer the next time it is synchronized. The Hi-Ce Educator channel invites users to access "inquiry-driven, technology pervasive middle/high school science curricula from the University of Michigan."

In addition to existing channels, the AvantGo service allows users to create their own Web channels, which entails entering a Web address and a corresponding name. This can be used to transfer existing Web sites to the handheld computer or to access Web sites developed specifically with handheld devices in mind.

Classroom Applications

A classroom in which every student has a handheld computer would offer a number of options and opportunities. A class Web channel, for example, would allow the teacher to provide students with a class calendar offering schedules and assignments. Students could access this calendar anywhere, anytime, and the teacher could update it almost immediately when necessary.

A typical classroom scene today consists of a teacher writing information on the chalkboard while students copy it. Students in these classes become human recording machines, concentrating more on the documentation of a lesson than the lesson itself. A class fully equipped with mobile computing devices would allow teachers to post study guides and outlines using the class Web channel, saving time for inquiry-driven discussion.

A lightweight handheld device weighing several ounces can contain the equivalent of several thousand pages, making it feasible to include examples and resources that go beyond the information that schools now distribute. It is also possible to include interactive forms that might allow students to complete a self-test once they have reviewed the materials.

Pupils in science classes could use their computers to record information and observations during experiments and post the results to a common database, which would tally the statistics. The data could even come from other regions of the world, allowing students in diverse geographical regions to work together on a common project.

In the majority of today's classrooms, a significant cost is associated with dissemination of information. This cost is either measured in the time required for teachers to copy information onto the blackboard or the cost of duplicating materials. Once the initial investment of providing each student with a personal computing device is made, the cost of disseminating information drops markedly. Several states have already provided graphing calculators for each mathematics student, demonstrating the feasibility of providing each student with a portable handheld device. For instance, three years ago the Virginia Legislature allocated funds to provide every high school student with a graphing calculator. And in Iowa, the state Board of Education established a plan with the same goal in mind, just as many school districts in other states have done. Acquisition of general purpose devices that incorporate graphing calculator software as well as other applications is the next logical step.

Devices equipped with document readers would allow teachers to distribute almost any reading material electronically. Infrared printers could allow documents to be transmitted to the printer through an infrared link.

Because handheld computers are also general-purpose computing devices, they could be used in a variety of other ways. For example, the next generation of graphing calculators is now being translated into software programs that will run on handheld computers. As a result, when new enhancements and refinements are made, students will be able to acquire them through a software upgrade, rather than by replacing the hardware. The current generation of handheld devices also incorporates text editors that can be used for notes and outlines. Notes can be entered with a stylus on the screen of the handheld computer or through a folding portable keyboard that can be acquired as a peripheral. Probes and sensors are available for the current generation of handheld computers for use in science class. Administrative applications are also available; Handango offers several. Teachers can, for instance, use gradebook programs that can also be synchronized with a database on a desktop computer.

Modern-day electronic libraries provide access to many classic works of literature in downloadable form without charge. Sites such as Memoware offer works by Charles Dickens, Jane Austen, Chaucer, Edgar Allan Poe, and other authors in formats designed for handheld computers. Other documents such as the U.S. Constitution, the Declaration of Independence, and the Bill of Rights are also readily available in this format (www.memowave.com).

Acquiring a Handheld Computer

Currently, two types of handheld computers dominate the market. Devices that use the Palm OS (operating system) constitute approximately three-fourths of all handheld computers. Devices with this operating system are sold by Palm and by Handspring, which makes the Visor. The Microsoft PocketPC (formerly Windows CE) represents the other market force in this arena. Devices with the MS PocketPC operating system are sold

by companies such as Hewlett-Packard, Casio, and Compaq.

The two operating systems represent differing design philosophies. The majority of the Palm PC models are small, compact, and have monochrome screens that can run for several months on two penlight batteries. The entry-level models can be purchased for $150. Color is a desirable feature but comes at the cost of a higher price and shorter battery life.

Most PocketPC computers have color screens but consequently have a battery life that is measured in hours rather than months. They are designed as multimedia machines that can also play MP3 songs and short digital movies, and they can be acquired for about $500. Because more handheld computers currently use the Palm OS, a greater range of applications has been developed for this market. This could change if Microsoft is successful in increasing its market share in the future.

If you purchase either a Palm/Visor or a PocketPC, you will find a wide range of software available on the Web. Because handheld computers were designed in the age of the Internet, most programs are distributed this way rather than through traditional outlets such as bricks-and-mortar stores. Many applications are available in freeware and shareware versions as well as in commercial formats.

The Gadgeteer is a useful starting point for information about Palm and PocketPC hardware and software as well as a host of other personal digital assistants (such as the Newton, the Franklin, the REX PC, the Psion, and others). *PalmPower Magazine* provides information and reviews of Palm-based applications. Extensive, downloadable software libraries can be found at Handango, PalmPilotWare, and ZDNet.

The Future of Classroom Computing

The future of classroom computing is one in which every student has his or her own personal computer. The drop-

ping price of handheld computers will make this both affordable and inevitable. The difference between access to an institutional computer a few minutes per week and access to a portable personal computer 24 hours a day, seven days a week, will result in a qualitative shift in the types of educational options that will be possible.

The form factor of handheld computers may change as the price of LCD screens drops. A handheld computer with a screen the size of a paperback book, similar to the electronic book readers now available on the market, might be better suited to school use. Wireless technologies such as Bluetooth will make it economical to connect handheld computers to the local area network without cables or hardwired connections. In this school of the future, students will have access to any reference work at any time throughout the school day. As this transition occurs, the focus may shift from rote memorization to the ability to identify, access, and evaluate information.

Summary

The high cost of desktop computers is a significant barrier limiting student access to computers in schools. One promising solution is a classroom in which every student has a handheld computer. These mobile devices can readily access and retrieve Internet-based information. With this capability, handheld computers offer a wide range of possibilities for both educational and administrative uses in the classroom. Teachers could readily track student information and could quickly create resources available to all students. Students themselves could access these resources almost instantly, and they could use their handheld computers for academic endeavors ranging from simple notetaking to cross-country collaborative projects.

The ancient Greeks were concerned that widespread use of writing would result in deterioration of the ability to

memorize classic works, as readers would be able to retrieve information in letter-perfect form by picking up a book. They were correct—the world did change as a result of spreading literacy. Invention of the printing press by Gutenburg made these works affordable, further reducing reliance on memorized information. A future in which everyone has continuous access to information through mobile personal computing devices may also change the world in as yet unforeseen ways.

Resources

AvantGo, Inc., software and services: www.avantgo.com.
Bluetooth: www.bluetooth.com.
The Gadgeteer: www.the-gadgeteer.com.
Handango: www.handango.com.
Handspring's Visor: www.handspring.com.
Memoware: www.memoware.com.
OmniSky modems: www.omnisky.com.
Palm's m100: www.palm.com.
PalmPilotWare: www.palmpilotware.com.
PalmPower Magazine: www.palmpower.com.
ZDNet: www.zdnet.com.

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