Chapter 4.10
Tapping into Digital Literacy: Handheld Computers in the K-12 Classroom*

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ABSTRACT

This chapter describes the integration of handheld computers in K-12 classrooms and its impact on digital literacy. Following a brief description of this new technology for education, teacher stories are used to illustrate what types of educational activities are possible above and beyond what is possible with available technology, what pedagogical changes need to be made to effectively integrate handheld technology in K-12 classrooms, how handheld devices can be adapted to harness their full potential as ubiquitous devices for teaching and learning, and how digital literacy skills influence and are being influenced by this technology. The ultimate goal of the author is to show that handheld computers have the potential to have a tremendous impact on teaching and learning, given the right context.

INTRODUCTION

When it comes to technology, the world in which we live today is very different from the one that existed 10 or 20 years ago. New developments and inventions occur on a daily basis, including phenomena such as hybrid automobiles, human cloning, and nanotechnology, changing the ways in which we go about our lives. Education is affected like any other field through the continuous introduction and integration of new tools such as digital imaging and video, the Internet, wireless technologies, and more recently, personal technologies like mobile phones and handheld computers. These new tools have the potential to fundamentally change teaching and learning when integrated appropriately and under the right conditions.

The development of handheld devices can be traced back to the 1970s, starting with Xerox

PARC's research into the Dynabook concept, a highly mobile, notebook-sized computer with artificial intelligence capabilities. This was followed by the development of related devices such as the Psion I (1984), GRiDPaD (1988), Amstrad's PenPad and Tandy's Zoomer (1993), the unsuccessful Apple Newton, which was in development and production for about 10 years (1993-1995), and the eMate (1997-1998). However, while others struggled, US Robotics (bought in 1997 by 3Com) introduced the Palm Pilot in 1996, featuring a graphical user interface, text input using *Graffiti* handwriting recognition software, and a cradle for data exchange with a desktop computer. This device became the forerunner of several generations of devices powered by the Palm OS, ranging from the Palm Pilot 1000 to current handhelds like the Tungsten E and Zire72 (Bayus, Jain, & Rao, 1997; Williams, 2004), and a plethora of peripherals. During the same time, Microsoft also actively pursued the development of a portable device, modifying its Windows operating system to fit on handhelds produced by such companies as HP, Dell, and Compaq. This development did not have a real impact on the mobile computing market until Microsoft's release of Windows CE 2.0 in 1997, and the Handheld PC Professional and Windows Mobile 2003 Operating Systems (HPC Factor, 2004).

Handheld computing enthusiasts have been advocating the use of these small and portable devices in classrooms in an effort to get closer to a truly ubiquitous computing environment. The term "ubiquitous computing" was defined in 1991 by Mark Weiser from Zerox PARC as an environment in which "a new way of thinking about computers in the world…allows the computers themselves to vanish into the background" and become indistinguishable from everyday life (p. 94). Weiser emphasized that ubiquitous computing in this sense does not just mean portability, mobility, and instant connectivity, but the existence of an environment in which people use many computing devices of varying sizes (which he described as tabs, pads, and boards) that interact with each other, combined with the aforementioned change in human psychology to the point where users have learned to use the technology well enough that they are no longer consciously aware of its presence and do not have to be. While the change in our knowledge and use of a wide variety of computing devices is not yet at the level that Weiser envisioned more than a decade ago, we are much closer to reaching the technological requirements: "cheap, low-power computers that include equally convenient displays, a network that ties them all together, and software systems implementing ubiquitous applications" (Weiser, 1991, p. 99).

Weiser's vision of ubiquitous computing fits well with current visions of technology integration in education and its potential impact on teaching and learning. Academic research has shown that computer use and student learning gains are "closely associated with having computers accessible to all students in teachers' own classrooms" (Becker, Ravitz, & Wong 1999; see also Marx et al., 2000; Norris & Soloway, 2001; Soloway et al., 2001). A 1:1 student-to-computer ratio is needed to make computing in schools truly personal and meaningful, but for many school districts, attaining this ratio is a financial impossibility when desktop or laptop computers are considered (Norris & Soloway, 2001). Handheld devices seem to provide a more realistic alternative for integrating technology into the classroom to create a ubiquitous computing environment and meeting the challenges of improving student achievement, because of their small size and comparatively low cost in acquisition and ownership (Hennessy, 1997, 2000; Robertson et al., 1996; Sharples, 2000a). As a result, handhelds are starting to make their way into classrooms, often supplementing the existing technology infrastructure. Some scholars have defined the resulting learning environment as "handheld-centric," with students having access to and actually using a variety of equipment besides handheld computers, including networked