Why Look Back? Arguments for a History of Computing in Education

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Abstract

Studying the history and development of computing in education will improve future practice in advanced learning technologies. First, the author reviews two exemplar issues that are still unsolved: what kind of educational material should be presented via computer and how interface complexity can interfere with educational "payload." Thereafter, the History of Computing in Education virtual museum (HCE) is introduced as a resource to make primary source materials for such study more accessible.

Introduction

> **"Progress, far from consisting in change, depends on retentiveness…Those who cannot remember the past are condemned to repeat it.**
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> -*George Santayana, The Life of Reason [1905-1906], Volume I, Reason in Common Sense, Chapter 12, 1906*

Whenever I attend educational technology conferences today (2006), I am reminded of George Santayana's admonition to learn the history of one's craft. Young researchers and developers struggle with the same problems technology pioneers discussed 30 years ago. In 1976 I was the first to bring Apple I, serial number 1, into a classroom. Soon, I was part of a growing community of educators and learners anticipating the potential benefits and issues of the advent of small, fast computing. We thought and experimented a lot, discussed issues among ourselves and published in now obscure journals, newsletters and personal communications.

Progress since 1976 has been tremendous. We have solved many problems. But some have resisted the march of technology; they are embedded in the nature of human relations and learning, and continue to recur in the discourse of 2006. How can today's young educational technologists remember the past?

What is appropriate to teach through media? This question, older than computing, has come into high relief as computing has developed. During the early twentieth century, only learners far from schools used paper-based correspondence courses or lessons broadcast by radio. Today, with computers and the internet, much of the world has access to powerful, two-way, educational systems. Can we teach everything this way? Probably not.

Unless we intend to live out our lives in isolation, many skills and sensitivities are needed that cannot be learned on a screen. No one learns to swim or ride a bicycle at a computer. Playing in a simulated orchestra is not the same as performing with 100 other musicians. And acts of caring for human beings, animals or plant life require nuances of touch and perception that cannot be transmitted remotely.

To discover what material is appropriate to teach through computer-based media we must assess the "information content" and the "experiential content" of each subject (lecture versus laboratory). Lectures, plus books, are traditional for information-rich curricula where mastery does not require direct contact. Well-designed computer-assisted instruction can be an improvement over lecture and print through interactivity and individualized branching.

Computer-based modules cannot replace laboratories, sports facilities, art studios, stages or gardens. As we produce simulations of natural environments we risk forgetting why we bring learners together. and may accidentally eliminate crucial aspects of the lessons in these areas.

Subject matter delivered by wire or broadcast is the "Open Portal Curriculum." Technology has made this cheaper than the classroom and it reaches a worldwide community who understand the language of instruction. Experiential lessons, requiring touch, are part of the "Face-to-face Curriculum" which is much more expensive to deliver, requiring meeting places, additional equipment and bringing people together at specific times.

Another issue is how to create an input-output environment that requires less skill to operate than the instruction offered. "Toy" computers such as Speak and Spell, Big Trak, or LeapPad are excellent examples of technology-rich learning appliances that appeal to children and present age-appropriate material. See
http://www.99er.net/spkspell.html
http://www.bugeyedmonster.com/toys/bigtrak/
http://www.leapfrog.com

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Robustness and complexity are major factors in ensuring the effectiveness of these devices. In both home and classroom settings, these toys fail easily without parent or teacher intervention. There is little field research on the effectiveness of such devices for mastery of the embedded lessons. Designers are often more alert to the interaction between user cognitive level and device interface with pre-reading children than with young and adult readers.

Robustness refers to device response to both rough treatment of the physical object, and to unanticipated input. Today's "user-friendly" software is still not designed to respond well to unrecognized key sequences. "Please contact system administrator," is not an improvement over the older "Error 572".

Complexity also has both hardware and software components. Early hardware often required installing keyboard overlays, changing cartridges or setting physical switches to enable levels of difficulty or to change subject matter. Today, these functions are usually embedded in software but the cognitive ability to successfully select from menu options is often beyond the unsupervised learner's ability.

Selecting appropriate material at user log-in is now feasible, but initial set-up and learner profiling is still clumsy, often requiring intervention from others. Once the software recognizes the student, all may go well if the student religiously follows instructions and does not intentionally make errors. However, should the learner choose to explore beyond the scope of the lesson, even carefully crafted systems are likely to break down.

Suppose a learner decides entering wrong answers will be more amusing than giving correct ones. Most computer-managed systems do not accommodate such behavior. An other user might wish to cooperate with the software but have difficulty interpreting the instructions. When the user interface presents insurmountable cognitive obstacles the value of the device is lost.

HCLE -- a learning objects repository

Seasoned educational technology developers can often call upon their personal memories of early explorations into problems like robustness and complexity. Young practitioners may find themselves in unfamiliar territory. The History of Computing in Education Project (HCLE; www.computingineducation.org) aims to remedy this. Its mission is:

To preserve and interpret documents and artifacts related to the history of computing in education; to make them accessible and usable by educational and computer leaders, historians, practitioners and the public.

The debate over what to teach by computer is critical today as more investment is made in computer platforms and complex courseware. Revisiting the historic discourse on educational technology provides important guidance for effective design and use of instructional technology (see http://loopcntr.xwiki.com/xwiki/bin/view/Main/OpenPortalSchools).

The Web presents a rich literature of recent developments in computer-augmented learning but the lessons from earlier times are hidden on dusty shelves and in the minds of now "senior" educators. By conducting oral history interviews, scanning original documents, collecting personal notes, and obsolete software, HCE preserves artifacts from the educational computing landscape of the 70s and 80s.

The project hosts community discussions on topics of interest to HCLE patrons. We will develop "guided tours" for visitors of various ages. We invite all visitors to tell us how they use the virtual museum and contribute to its emerging design. Later, a traveling exhibit recreating a computer learning laboratory from the 1980s, complete with Apples, Pets, and other antique computers, will be built. It will be available for hands-on display by museums, libraries, and science centers.

By capturing the lessons learned and offering them to newer designers, HCLE ensures that effective solutions are preserved while ineffective ones are eliminated or improved, but not reinvented.

This enables us to stand on the shoulders of those pioneers and thereby see the present and future more clearly.