From Laddie Pencils and Big Chief Tablets to Blogs and Wiki's

Larry J. Kelly and Allison M. Huie
Texas A&M University

Abstract

Throughout American education, several periods of technological change occurred in the last two centuries. Each educational innovation or technology normally took approximately fifty years to trickle down to the nation's schools. However, the last several decades have witnessed a communications revolution. This rapid expansion of communication technology has changed challenged teachers' existing methods of instruction, selection of curricular materials, approaches to discipline and effectiveness in the classroom.

Education Technology as a Necessity of Life

In an 1838 meeting convened to study the Normal School of Plymouth County, Daniel Webster suggested that teaching apparatuses (technology) should be a part of American education. Speaking to an audience that included Horace Mann, George Putnam, and John Quincy Adams, he made the following statement: "We teach too much by manuals, too little by direct intercourse with the pupil's mind; we have too much of words, too little of things. Take any of the common departments, how little do we know of the practical detail, say geology. It is taught by books. It should be taught by excursions in the field" (Webster 1856, 590).

As schools transitioned from academies to private schools, and then to public education, a strong motive developed to provide an adequate education for all, rather than the college-bound, privileged few. In 1865, one magazine editorial stated, "We ought to be doing something to keep up our reputation for running faster, flying higher, diving deeper and coming up drier than all other people in creation" (Editorial, 1865, 121). New subjects such as physics, mechanics and chemistry were introduced that had practical benefit to all pupils, whether attending college or entering the work force (Editorial, 1868). Herbert Spencer continued the momentum for practical courses in the last twenty-five years of the nineteenth century, placing a premium on educational experiences in the present and in subjects that are useful in the present (Cremin 1961). The foundations of education were formed not only to pass on to new generations the culture, principles, ethic and lessons of the past, but also to prepare each student for the world in which he or she would live (Molnar 1997).

These early calls to include technology in an effort to enhance educational experience were brought to new significance through the work of John Dewey. In Philosophy and Civilization, (1931), Dewey illustrates "the revolutionary nature of science and technology" and argues, "that they could create new possibilities in life were they to be redirected from commercial to humanistic goals" (Vartan 2005, B3). Dewey, arguing against the objectivist principles that had previously driven American education, promoted a system of education grounded in learning through experience. He called for an educational experience that taught not just facts and figures, but how one should and could possibly interact with his own environment in such a way that he could derive such truths. Dewey advocated teaching students not *what* to learn, but *how* to learn. While early views on technology in education extolled only its production-related virtues, it is essential that we continue to view the use of technology in education as Dewey and others would have it: as a "necessity of life" for the opportunities it provides in allowing our

students to develop the *ability* to learn (Dewey 2005). It is in this light, that one must consider the current and future roles of technology in education.

Brief History of Educational Technology Innovation

American education has been marked by several periods of technological change throughout the last two centuries. Early technological innovations sometimes took as long as fifty years to trickle down to the nation's schools and universities (Murphy and Gross 1966). During these periods of change, the intended aim of each innovation was to enhance the efficiency or quality of learning (Percival and Ellington 1988).

Many of the first technological innovations were aimed at improving or increasing student work product. The first blackboard was used in 1809 in a Philadelphia school, and by 1850-1853, chalkboards and erasers became widely used in schools. This allowed the teacher to quickly illustrate lessons to the entire class (PBS 2007). These first blackboards were pine lumber covered with carbon from charred potatoes and egg whites. Students used chunks of chalk and cloth rags to erase the board. Students used smaller-sized slate boards with slate pencils. White chalk eventually replaced the slate pencil and was among the first innovations for student writing. After the end of the Civil War (1861–1865), manufactured wooden pencils were available, allowing students to create a more lasting record (PBS 2007). Further developments to writing utensils included the advent of the eraser, and the introduction of the thicker, sturdier, graphite–cored device commonly known as the "Laddie" pencil. . Mass-produced paper in the 1870's provided the opportunity for students to create longer documents, allowing for more self-expression (PBS 2007). The advances in production-oriented technology continued with the Remington No. 2 typewriter, introduced in 1878. The Remington possessed the capability to type both lower and upper case, allowing students to prepare formal papers (Early Office Museum 2007). Now, whiteboards have largely replaced blackboards, eliminating the chalk dust that generations of mothers scrubbed from jumpers (PBS 2007).

Continuing the development of teacher-led instructional technologies, the first commercial radio broadcast occurred on Christmas Eve 1906. By 1923, Haaren High School in New York City had introduced radio in the classrooms. Soon after, other school districts and universities followed suit. In the years from 1925-1935, radio came into real prominence as an instructional tool. Formal courses in radio education were offered including radio instruction on subjects such as "penmanship, accounting, arithmetic, and history" (PBS 2007). The U.S. Office of Education even established a radio section to meet the increasing needs of radio education. Radio had found a place in the classroom as one of the best teaching tools and became a useful aid to the classroom teacher. However, any thought of the radio displacing teachers was quickly dispelled (Brodie 1935). While radio use in classrooms peaked in the 1930's, its use virtually stopped during World War II, and never recovered quite the same popularity. In fact, it would be difficult to find regular curricular inclusion of radio in most classrooms in today's schools (Saettler 1990).

From Radio Waves to TV Waves

The first publicly accessible electronic television transmission occurred in 1936, when the opening ceremonies of the Berlin Olympics in the summer of 1936 were broadcast (Winston

1998). The U.S. armed forces were the first to experiment with this technology, utilizing it for training to meet mass instruction requirements. During the early 1950's, many thought television would provide solutions to educational problems such as teacher shortages, overcrowded classrooms, and poorly prepared teachers. Therefore, it was not surprising when administrators, given available Title I funds, began purchasing television and videotape recording equipment. It was hoped that cable television in the 70's might provide flexibility of choice for teachers. However, as with previous television programs and equipment there was no common standard for the television broadcasting equipment hindering broad acceptance. Educational television use reached a peak in the 1960's, but has since declined. Today, the television is the most widely used form of technology in the classroom; however, it serves mostly to supplement teacher-led classroom instruction (Saettler 1990).

While radio and television were making their mark in classrooms, computers were quietly beginning development as large, room-sized expensive machines in the U.S. military branches. The first operational computer was the MARK I in 1944 at Harvard, followed by the University of Pennsylvania's ENIAC computer in 1946. PLATO, (Programmed Logic for Automated Teaching Operations) at the University of Illinois marked the first large-scale use of computer-assisted instruction in education (Molnar 1997).

These huge machines were primarily limited to uses in the mathematics, science and engineering disciplines Improvements in the size and price of computers (both decreasing) became possible with Intel's introduction of the 1103 RAM chip in 1970 which substantially reduced the cost of memory. With each new version of the Intel chip, the enhanced chips reputation for reliability improved, finally opening the door for broad public acceptance and availability (Winston 1998). Xerox introduced the smaller Alto computer in 1973; however, it was never sold to the public. The development of smaller, more versatile computers also made way for further developments, such as the WYSIWYG (what you see is what you get) editor, the mouse, the word "internet", and the first flat bed scanner. Software programs, such as VisiCalc, the first spreadsheet application, were created for new small personal computers such as the Atari and Apple IIe, Radio Shack entered the market with the TRS-80 and Commodore International introduced the PET, a true microcomputer, in 1977. IBM, one of the larger companies mainly interested in the large, expensive computers, soon joined the microcomputer market. IBM began offering a smaller computer, the 1500, but it was more expensive than the Atari or Apple IIe's (Winston 1998). In 1981, IBM began marketing the PC, and sold 35,000 the first year. While only a few hundred households had microcomputers in 1975, that number increased to just under a million machines by 1982. Initially, these new microcomputers but were limited to replacing cookbooks, balancing checkbooks, recalculating home mortgages and keeping track of personal investments. However, when word processing programs became available the personal computer enjoyed a change of status, shifting from the role of a fancy calculator into that of a very effective typewriter. This shift, along with the introduction of the modem and email positioned the personal computer as a powerful device for communication. Thus, the business market for PC's experienced a dramatic boom. (Winston 1998). However, with the limited programs offered, retail consumers had trouble seeing a clear purpose for the machines in the home. These design deficiencies allowed new software

companies to take advantage of the market by developing new operating systems. Market focus then shifted from the manufacturing companies to smaller systems companies like Microsoft. As the sales focus gradually shifted to households, education became the next market demographic to be targeted (Winston 1998).

By the 1990's, most classrooms had at least one computer. Radio took thirty-eight years to reach 50 million users. It took TV thirteen years to reach 50 million viewers. By contrast, it took the Internet four years, iPod three years and Facebook less than nine months to reach one hundred million users (Real Time Marketing Group 2009). In fact, the utilization of computers in the classroom has sparked a swift pace of change in an educational climate that has previously been relatively resistant to substantive change through technological innovation. Computers connected to the World Wide Web have facilitated the rapid exchange of information and afford individuals the freedom and ability to manipulate this information. This openness of information and increased communication has had real and lasting effects.

Educational Technology in the Digital Age

Educators and their pupils now have access to a truly interconnected world. The personal computer, Internet, and fiber optics, have increased the speed of communication and the pace of advancement in teaching and learning. Individuals can now send and receive messages with the push of a virtual button, or investigate a wealth of data and ideas at the click of a mouse. Once, of the dissemination of new information could have taken 80 years or more. Information sharing can now take place in terms of minutes, or seconds (Marx 2006). The impact of such swift advances in technology and communications is being felt strongly in the world of education. Distance learning is fast becoming an important part of university, college and public school teaching. Curriculum and instruction are supported through the World Wide Web, on-line courses, MP3's, satellite communication and, audio/video conferences.

For example, Curriki, a new on-line community, allows educators from anywhere in the world to publish curricula and lesson plans for review and use by fellow teachers. Curriki encourages contributors to access the content presented, upgrade it, and revise it to suit the needs of students (Reuters 2007). Massachusetts Institute of Technology, (MIT), now offers MIT OpenCourseWare a free and open educational resource (OER) for educators, students, and self-learners around the world. The goal is to provide free, searchable access to MIT's course materials for educators, students, and self-learners around the world. Students around the world can view course materials in subjects such as Aeronautics, Astronautics, Writing, and Humanistic Studies (Tapscott 2006). A book-scanning project begun by Google two years ago now includes twelve major library systems, including Princeton, The University of Texas at Austin, University of California, New York Public Library, Harvard, Oxford, Stanford, and the National Library of Catalonia. This ambitious project will provide the world's great literary works available and searchable over the Web (Reuters 2007).

The ability to search vast amounts of ideas and information on the Web has opened new avenues for collaboration using blogs a user-generated website where entries are made in journal style. Blogs provide commentary or news on a particular subject, such as food, politics, or local news. Some function as personal online diaries. A typical blog combines text, images, and links to other blogs, web pages, and other media related to its topic. The ability for readers to leave

comments in an interactive format is an essential feature of most blogs. A wiki is another simple, easy-to-use user-maintained database website that allows visitors to add, remove, edit, and change content. It can allow links to other pages, making a wiki an effective tool through ease of interaction and opportunities for collaboration. A defining characteristic of wiki technology is the ease with which pages can be created and updated. Generally, there is no review before modifications are accepted with many wikis open to the public without the need to register (Wikipedia 2007).

The California Open Source Textbook Project plans to use collaboration, insights, and spare time of its teachers to create high-quality educational materials freely available to each student. The first project is to create a world history book for tenth grade. This project will use the advantages of open-sourced content to help reduce the cost of textbooks (Tapscott 2006). Pedagogy and technology can create a community of instructors and students constructing knowledge building communities, thus creating a highly interactive environment.

Impact on Teaching & Learning

Whereas the previously discussed early schoolhouse technologies such as Laddie pencils and Big Chief tablets were focused on enhancing student work-product, these new these technologies are opening classrooms to the world and requiring teachers to address an entirely new literacy. Collaboration through use of new technologies encourages critical and creative thinking while helping students to transfer data into usable knowledge and wisdom. Developing communicative skills while building connections in an educative environment will encourage active learning, making thinking and reasoning basic to education. These connections help to fit curricula to the needs and interests of various learners (Marx 2006). In teaching and learning with technology and about media literacy, educators and students develop higher-order thinking skills, and highlight real-world problem-solving skills to fit students' capacities. These activities shift the importance from *learning* to *thinking* (Molnar 1997).

Big-Picture Implications

The leveling power of the World Wide Web has created a new world economy, international trade, shift in balance of capital and labor, restructuring the U.S. workplace through technological innovation and globalization (Kirsch 2007). Technology, science and economies are interconnected creating new industries and jobs, all requiring a more highly skilled, educated workforce. Each innovation depends on rapid dissemination throughout the education system and workplace (Molnar 1997). This rapid pace and speed of communication has created competitive playing fields between industrial and emerging countries (Friedman 2006). The cell phone today is about a million times cheaper and a thousand times more powerful than the MIT's computer in 1965. Today, one can carry in their pocket a computer that used to take an entire building to house (Kurzweil 2008).

An Ideological Return

Current educational practices rely on creating an environment where learning consists of what can be conveyed and assessed only in a standardized state or national curriculum (Sutherland 2004). However, we can no longer rely on the Industrial Age's banking model of education (Friere, 1972). The usual model where teachers' simply transfer knowledge to students, no longer serves our students (LaMonica 2009).

Educators should consider a more hands-on approach in participatory form stemming from interaction with all of the new resources available. The emphasis now should be on collaborative utilization of the connecting technologies in the world, and should lead to students learning whatever they want, whenever they want, from whomever they want. Students and teachers should now press forward to extend the capabilities of educational tools in order to work across time zones, cultures and technologies (Richardson 2008). One of the main challenges associated with the new literacy is determining how to help students become full participants in each new learning field while creating and collaborating in transparent online groups and networks (Richardson 2008). Such communicative, yet individually oriented, activities afford a wealth of opportunity for each individual student. In this new educational model, students become self directed, editing, organizing and publishing on their own. The previously work-product oriented educational culture becomes a collaborative, creative, communicative environment, where the focus is on the *process of learning* rather than *product*. This is especially ideal when we must consider that global product demands change with increasing rapidity. It is not sufficient for us to train students with a single work-product, or singular set of skills in mind. For Dewey, "democratic education was an experiment in intercultural and international living, intended to provide a potential model for global democratic order" (Waks 2007, 34). Similar logic should now be applied to the role of technology in education. We must allow the creative, communicative and connective possibilities of new technologies to lead to a "fusion of horizons" in an ever-globalized world (Dewey 2005). In the new, digital age of education (and existence), we must return to our modern educational roots and are called to embrace the educational charges set by Webster, Spencer and Dewey: let us teach how to learn, not what to learn; let us emphasize and utilize technological innovation as an individually-motivated mode to learn (everything) rather than teacher-led tool to teach (particular things); and let authentic experience within the realities of today's environment be our students' most influential teacher. In this way, will we prepare students who are truly prepared to participate as full members of the global society.

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