Electronic Technology and the Future of Social Studies in Elementary and Secondary Schools[1, 2]

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What is the future of social studies education in schools in the electronic age of knowledge and distributed intelligence? Research on instructional technology suggests that thoughtful curriculum development and careful instructional design are more likely to enhance learning than the particular delivery medium used. Lack of teacher time and training and lack of money are among the many impediments to improved use of technology in social studies classrooms. If our experience with other technologies in the classroom is any guide, the effects of electronic technology will be minimal. Schools and social studies instruction will continue much as they have for decades.

A discussion of possible connections between electronic technology and social studies reform must start with the obvious: By whatever name it is called, this is an age of electronic technology. We are each a part of it, whether an Internet addict who shuns his family to surf the World Wide Web or a computer-hater who enjoys the convenience of paying for groceries via electronic credit card processing.

Some have called this the Information Age, based largely on estimates that up to 50 percent of the work force will soon be involved in gathering,

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processing, retrieving, or analyzing information. However, as Richard Zare has pointed out, that label is too limited. He prefers, "an age of 'knowledge and distributed intelligence'," to encapsulate the power of electronic processing by which (in somewhat of a dramatic overstatement) "knowledge is available to everyone, located anywhere, at any time," with "power, information, and control . . . moving from centralized systems to individuals."[3]

Not only is this an age of electronic technology, but it is a time of unprecedented technological change. Change is so rapid that a person has to wonder whether data (for example, about computer usage) or information (for example, about computer applications) from an article one year old, much less five years old, is still valid. A sidebar in *Newsweek* made that point with data on the length of time from technology invention to use by one-fourth of the USA population. For electricity, there was a 46-year span, from 1873 to 1919; for the telephone, 35 years, from 1876–1911; for radio, 22 years, 1906–1928; for television, 26 years, 1926–1952; for the personal computer, 16 years, 1975–1991; and for the Web, 7 years, 1991–1998.[4] Those historical data, however, only provide a frame through which to view the pace of present and future implementations of innovative electronic technologies. They do not reflect the continual, daily barrage of information about new electronic consumer products and the scientific and commercial applications of electronic technologies, along with the accounts of calamities (such as the AOL overload and Galaxy satellite failure) and threats of disaster (e.g., air traffic computer overload and the Year 2000 Millennium Bug). As Fontana noted, with ongoing commercial and governmental efforts to "build a new global communications network . . . [that] will integrate technological breakthroughs in both wired and wireless technology . . . , the current Internet and global satellite systems give us only a glimpse at what is to come."[5]

At the same time, educators are cautioned "against embracing [information] technology with abandon."[6] They are warned about "technology as religion," that is, about an unexamined commitment to technological progress as commensurate with human progress.[7] And they are reminded that technologies have never been the educational panaceas the advocates have argued they would be.[8]

Within these seemingly paradoxical themes—that is, rapid and unforeseeable technological change and impact, on the one hand, and caution based on unfulfilled expectations in the past, on the other—what is the future of social studies education (in schools, not what social studies "experts" write and present papers about) in the electronic age of knowledge

and distributed intelligence? Will it differ markedly from the past record of general stability of instruction in social studies classrooms?[9] In particular, will electronic technology influence and be used as a vehicle for social studies reform?

The apparently contradictory titles of a book chapter, Marshall McLuhan's "The Medium is the Message,"[10] and an article, Richard Clark's "Media Will Never Influence Learning,"[11] set a context for the consideration of these questions.

Technology As Teacher

From one perspective, McLuhan argued that if a researcher studied the content of a medium, such as Schramm did in his research on the effects of television on children,[12] and not "the peculiar nature of the TV image,"[13] the research would yield nothing of consequence. However, in a series of chapters and articles, Clark has persuasively argued that those doing research on the effects of media on student achievement have confounded medium with content and instructional method, and it is the method and content, not the vehicle for delivery, that influence learning.[14] The medium is sufficient, but not necessary for learning; different media will accomplish the same learning objectives. So, "it cannot be argued that any given medium or attribute must be present for learning to occur, only that certain media and attributes are more efficient for certain learners, learning goals, and tasks."[15]

In short, according to Clark, there is "no compelling evidence in the past 70 years of published and unpublished research that media cause learning under any conditions."[16] Although certain attributes—such as animated motion or zooming—may facilitate the learning of some students, media are delivery vehicles and do not have a direct influence on learning, any more than the type of truck used to deliver groceries affects the consumer's nutrition (or sending a scholarly paper by snail mail or fax affects its content). Methods of delivery may, in Clark's view, influence the cost, the efficiency, or the extent of distribution of learning, but it is the content, including instructional method, that influences student achievement. Instructional method—like the medication that might be delivered by tablet, capsule, or liquid—is the active ingredient, not the medium. Media attributes are surface features; they may influence the economics of instruction, but not its effectiveness in influencing learning.

What about meta-analyses that indicate positive media effects on student achievement? Clark and Salomon found that a standardized mean

difference (SMD) of .5 for final examination mean scores in studies of computer-based college instruction shrank to .13 when the only studies included were those in which the same teacher planned and presented both the conventional and the computer-based course.[17] Eight years later, Clark revisited the issue of meta-analytic results for comparisons of traditional and media-based, particularly computer-based, instruction. An advantage of approximately 20 percent in mean test scores had been reported for computer-based instruction. Clark reanalyzed a subset of studies from a major meta-analysis, constituting the 30 percent of studies in which the same instructional design group produced the computer-based instruction and presented the live instruction. The reanalysis yielded no achievement difference; once content and teaching method were controlled, the apparent technology effect disappeared.[18]

Kerr; Krendl, Ware, Reid, and Warren; and Windschitl have concurred with Clark that the confounding of content and instructional method is a serious deficiency in research on the effects of media, including computers, on student achievement.[19] As Clark and Salomon pointed out, the new technology investigated in research projects is likely to be more effective than prior classroom teaching or technology because the materials are better prepared.[20] Aside from a novelty effect, the beneficial effects on student learning are due to instructional design, not the inherent qualities of the technology.

Clark's conclusion that it is content and teaching method, not media, that make the difference in student achievement on tests does not deny all positive effects of electronic technology in instruction. For example, Pahl noted different climates in history classrooms that were "computer-based," rather than "chalk-and-talk."[21] In such classrooms, Pahl observed, the teacher is no longer the focal point, but becomes an assistant; the noise level is high due to students assisting one another; the motivation to be involved is high and discipline problems rarely arise; and low achieving students show off their products to their parents at school-parent nights.

Pahl's conclusions about student attitudes and behavior are consistent with my own evaluations of computer writing labs. In an evaluation of seven projects, for example, we found that with computer labs, students wrote more, had better attitudes toward writing (when it was done on a computer), and were more likely to ask for and give writing assistance. However, consistent with Clark's conclusion, the impact on quality of writing, as assessed through holistic evaluations of student writing samples, was mixed and inconsistent.[22]

To sum up, some researchers have concluded that the confounding of medium and instructional design has led to erroneous conclusions about the instructional effectiveness of technology. Clark labeled instructional media research "a triumph of enthusiasm over substantive examination of structural processes in learning and instruction."[23] He noted that the fervent advocates of technology encourage educators "to begin with educational *solutions* and search for problems that can be solved by those solutions. . . . [They] begin with an enthusiasm . . . and search for a sufficient and visible context in which to establish evidence for [the] solution."[24] Could this be the story of electronic technology in social studies reform? Or is the current "technology boom" different? How about the Internet and its derivative, the World Wide Web?

The Internet/Web as Educator

The Internet and Web are the hot new topics of social studies technologists, and not surprisingly so, given the extent to which both have pervaded societal consciousness. True, the Internet and Web provide rapid local and worldwide communication and access to vast amounts of information. Also true, their use can be terribly time-consuming and frustrating, even if one has up-to-date computer capacity, often yielding an overabundance of information and information of doubtful validity. Anyone can put anything on a Web site, with none of the constraints of peer review or editorial oversight. As Risinger noted, "the real problem [in drawing on the rich resources of the Internet] is information evaluation and validation."[25] Although there are "incredible" resources on the Internet, and they are expanding rapidly, "there is probably more junk and stale sites . . . than good ones."[26] Even Web-based medical science reports are risky sources. A recent review of 60 Web pages sponsored by "major medical centers . . . , 'among our finest,'" found that four-fifths yielded inaccurate information, characterized as "garbage." The probable bases for the problem are that scientists did not create and manage the Web sites, and the pages are not peer reviewed.[27]

In his anecdotal report on the effects of the Web on college students' writing, Rothenberg highlighted the concern with instant, but dubious information.[28] Admittedly "as enchanted as anyone else by the potential of this new technology," he nevertheless lamented the Web's negative impacts on writing quality and originality. Research papers based on the Web are easy to spot, Rothenberg claimed: Books are not cited, just articles and Web sites. The material is often "curiously" out-of-date.[29] Beautiful pictures and graphs that are not directly related to the paper's content are

inserted neatly as if they actually represented the student's own work, and are often accompanied by unattributed quotes and detailed references to Web-type information—government reports, "corporate propaganda, or . . . commentary by people whose credibility is difficult to assess," but with few references to "careful, in-depth" sources. As Barrie and Presti suggested about the Web, along with the educational advantage of accessing large amounts of information in general or on specific topics "comes the inherent drawback [of] no reliable editor to raise the signal-to-noise ratio of information."[30]

The effectiveness of the available Web search engines is also open to question. Rothenberg claimed that the engines, "with their half-baked algorithms, are closer to slot machines than library catalogues."[31] Lawrence and Giles estimated that the "indexable Web," a subset of the total Web, currently contains at least 320 million pages.[32] (*Newsweek's* estimate was almost one-third less, at 220 million pages.[33]) It is estimated that in the short term, that is, the next two to three years, there will be a tenfold increase in the number of Web pages.[34] Hyman Hirsh, a computer scientist at Rutgers University—i.e., a university professor, not an elementary or secondary school teacher—has referred to the Web as "an unorganized, uncoordinated collection of information that is totally overwhelming."[35]

Lawrence and Giles checked out the assumption that six "major full-text search engines . . . index largely the same documents [which are] a relatively large proportion of the Web"[36] by analyzing searches conducted by scientists at the NEC Research Institute. They found that the individual engines captured 3 percent to 34 percent of the indexable Web, the engine that yielded the most up-to-date pages did not necessarily yield the most comprehensive set of documents, and from 1.6 percent to 5.0 percent of the documents were not valid because the page no longer existed or had been moved to another site. Combining the six search engines led to about 3.5 times as much Web coverage as from any one engine. The individual engines, graded on an A–F scale, were all given F grades.

Is the Web-search situation hopeless? Lawrence and Giles recommended the use of "meta search engines" that combine the results from several engines or the combination of search engines and automated online search. They also suggested "the creation of a search engine designed to keep up-to-date indexes important to scientists."[37] Indexes important to other sets of users will be needed as well. Sounds like librarians' work! Think of walking into a library with over 320 million documents and no card (on line) catalog.

Will these difficulties with the Internet as an information source be resolved? "Perhaps" is not an unreasonable response; however, "probably" is likely more valid. In any event, the problems of information overload and of location, retrieval, and evaluation of information sources are not new,[38] even though exacerbated by the Internet. They are, nevertheless, significant context for the consideration of the potential impacts of the Internet and Web on social studies education.

Internet/Web Research

What does educational research indicate about the potential of the Internet and Web as integral elements of the electronic technology available for instruction? According to Windschitl, not much. To date, the reported research has been primarily descriptions of the classroom implementation of technology or "intuitive analyses of what works and doesn't work with students."[39] The critical questions about impacts on students or on pedagogy have not been addressed.

As Windschitl pointed out, the computer brings to education a technological ability to store, sort, and analyze information that, as an ideal, can "help free learners from tedious, low level tasks" (and thus lead them to lose touch with the data, as often happens with researchers doing computer data analyses?), allowing them to "concentrate on higher-order tasks."[40] The Web, on the other hand, at least as currently constituted and used, "is less a transformer of data or processor of symbol systems . . . [than] a conduit to other people's information"[41] and, of course, misinformation. The Web's capabilities are extensions of computer capability, offering "advantages . . . of efficiency and scope rather than unique affordances" to the student, teacher, or curriculum. The Web can be used to support either traditional or innovative models of teaching. Despite the increased and quicker access to information and the imagery sometimes available that should be useful in promoting inquiry learning, "it is difficult to claim that there are any *truly novel* aspects of Web-based learning."[42] In fact, Windschitl noted, it will be crucial in research and teaching not to confuse accessing information with learning and not to confound the effects of using technology with the effects of using information. Not surprisingly, Windschitl opined that although we do not know yet what the classroom effects of the Web will be, Clark may be correct that the computer is no more than another medium, not to be confused with content, and that, by extension, the Web is simply another means of offering varied content.

The above is summed up well by Ruth's conclusion after designing and teaching an undergraduate business computer-applications course "using every possible new technology available" at George Mason University. Included were the "World Wide Web, Internet, CD-ROMs, audiocassettes and videocassettes, distance education, touch-screen multimedia training, autodidact teaching systems for learning spreadsheets and database programming, and many more." Lectures were for the most part on TV, audiocassettes, or in cyberspace; student classroom time was reduced to 12 hours; writing and practice using information technologies were extensive; and students could present their research projects using the campus TV studio. The course was more difficult, with a graduate-level textbook, but the model was different as well, including a focus on "students as discoverers, not receptacles." The result? "The students did a lot more than is usually required—and they loved it. . . . They worked better, learned more and we even reduced the unit cost of course delivery."[43] A major success for technology? Not true, according to Ruth:

> As one who threw everything but the technological equivalent of the kitchen sink at the problem I was surprised at how little was new. . . . [Technology was] definitely a player but a bit player, not a star. In other words, I have visited the promised land of technology and I have found it helps, but it is not the main answer. Good content and good teaching, along with a model of the students as discovers, not as receptacles—is what makes the difference.[44]

So, Where Are We?

The above call for caution is not meant to deny the potential for applications of electronic technology in social studies education, but to emphasize that the technology itself is not likely to be a fruitful basis for reform. The need for thoughtful curriculum development and careful instructional design, based on the thorough and on-going explication of assumptions about society, learners, and learning, are as critical to the productive use of electronic technology as to any other teaching mode.

Of course, the technology onslaught brings with it new dimensions of rationale and curriculum building. For example, the technological enthusiasm of some educators may need to be tempered with questions such as that posed by Neil Postman, as to whether "schooling, particularly for young children, is . . . about giving kids information [or about] teaching young children how to behave in groups . . . to turn narcissistic children

into a public?"[45] Or, such as, what are the curricular implications of virtual (i.e., online) versus real (i.e., in person) communities?[46] Here we begin to explore implications for modes of thought and interaction that go beyond issues of test achievement.

The keys to educational reform are many, including teacher education that is thought provoking, rather than geared primarily to the practical matters of lesson planning, classroom management, and textbook, or software, embellishment, and thereby a perpetuator of the status quo in schools; capable, reflective teachers; time for teachers to plan and develop curricula, and assistance in doing so; moral support from other teachers, school administrators, and the public, all of whom are more likely to be more attuned to school stability than to curricular change; and appropriate, usable curricular materials. In particular, financial resources—i.e., the fiscal and economic realities of public schools in the USA—are critical to a consideration of electronic technology and the future of social studies.

Technological Realities

As Diem noted, by spring 1995, there were an estimated 5.8 million personal computers available for instruction in USA schools. Diem also reported "literally thousands of [software] products . . . available for social studies and civics classrooms."[47] These figures might seem to suggest the potential for a heady role for technology in the future of social studies. Risinger's observations that how to use the Web was the most frequently requested workshop from Indiana University's Office of Professional Development and that "professional journals and conferences are filled with articles and presentations on the subject,"[48] along with Windschitl's observation that "educators . . . have developed wave after wave of special classroom activities and collaborative projects based on use of the Internet,"[49] might also be taken to suggest that the future of technology in social studies is here. The reality, however, is quite different.

Although examples of exemplary applications of electronic technology, including classroom computer use, in USA schools can be found,[50] they are not typical. The several reasons for that state of affairs are largely fiscally and economically based.

Computer Availability

The projection of 5.8 million instructionally available computers in USA schools by Spring 1995 translated into an average of about one computer

for every nine students.[51] The ratio of computers to students went from 1:125 in 1983–84 to 1:10.5 in 1994–95, still far short of the 1:4 or 1:5 ratio considered minimal.[52] That level of instructional computer availability has been achieved by only a small minority of public schools in this country. (Note, too, that with the current interest in advanced technology, the need for "small" technology—telephones, including voice mail and fax machines; calculators, television sets and VCRs; camcorders and editing tools—is often overlooked.[53])

The adequacy of one computer to ten students must be considered in light of the typical computer placement. In most schools, the majority of computers are located in computer labs. If there is a modem on a computer, it is usually in the principal's office. With careful scheduling, labs are a cost-effective way to make a limited number of computers available for instruction. It is, however, difficult to use the computers intermittently as an integral part of instruction. I found in my evaluations of computer writing labs that the computer lab was often not available when the class had reached a "writing moment," and difficult management problems faced teachers when there were not enough computers in the lab for an entire class of students.[54] Also, a modem in the principal's office is typically not accessible for instruction.

Scheduling is complicated by the fact that the computer labs tend to be used primarily for skill practice at the elementary level and for computer education (teaching word processing, spread sheet use, computer programming) at the secondary level, with only about 30 percent of the time available for use by subject-matter teachers. Only 9 percent of students in one survey reported using computers in English, 6 percent to 7 percent in mathematics, and 3 percent in social studies (where teachers also have reported difficulty in scheduling computer use.)[55]

Although about 50 percent of teachers have at least one computer in their classroom, very few have more than two, so use by individual students and by student groups is impractical. Not surprisingly, computer use in public schools has been reported by computer coordinators as only two hours per student per week, but as less by the students themselves.[56]

Computer Adequacy

Aside from a shortfall of computers, those that are available present a major usage problem. In 1995, about one-half of the computers in USA public schools were old 8-bit machines that could not handle CD-ROM sized databases, support network-integrated systems, or be used to run

complex software. In fact, most public school computer systems "would be considered obsolete by private sector standards."[57] A 1992 survey indicated that only 20 percent of school computers had hard disk drives and nearly 90 percent of printers were dot matrix, and so were limited in speed and quality. Surely this situation is changing, but how fast? In 1997, Robert Samuelson reported that his daughter attending school in Montgomery County, Maryland, which in 1993 was the tenth highest county in the country in household income, was still using Apple IIes, of mid-1980s vintage, in her computer class. The situation today? Thomas, Creel, and Day referred to "converting a massive field trip database from an old Apple IIe computer to one consistent with the newer computers *coming into* our [Montgomery County] schools."[58]

Why don't school districts across the country purchase and install adequate numbers of up-to-date computers? Samuelson estimated the cost of providing a computer for every four students in the USA, plus the provision of teacher training, at $10 to $15 billion annually.[59] The cost of one-time installation and the teacher training to have one personal computer per school, plus a modem connected to the Internet through a district-based file server, was estimated in 1995 to be $.08 billion; the cost to have a computer per student was estimated at $145 billion; annual operating costs, including teacher training and support, were estimated to be from $.16 to $11.28 billion, respectively.[60] The cost of electronic technology in "leader schools" has been reported as from $142 to $415 per student each year.[61]

It is estimated that the purchase price of a computer system is only 20 to 25 percent of its life cycle cost; installation, training, systems administration, user support, hardware and software maintenance constitute the other 75 percent to 80 percent of the cost. The cost of maintenance, of course, increases over time. That is a serious consideration in public education where five years is a short computer-replacement cycle compared to the three years or less in business and industry. Maintenance costs are also related to the numbers of components and connections between them, a problem with the older public-school hardware.[62]

The donation of used computers and other equipment by businesses at their replacement time, sometimes proposed as a form of volunteerism, is no solution for schools. The equipment would be at least one generation behind and the net effect would be increased costs, because different platforms would have to be integrated in most cases and because of the maintenance of aging equipment.

The costs associated with the provision of adequate numbers of computers for use as an integral part of the public school curriculum, including social studies, are not insignificant, especially in light of the public's general lack of willingness to support tax increases for public education

Internet Access

Access to the Internet and the Web is also in short supply. In 1997, it was reported that only about 50 percent of schools had at least one connection to the Internet, and it was used little by teachers (about 16 percent reported use of the Internet or other online services) and typically was unavailable to students.[63] This situation is not surprising, given the lack of telephone connections in classrooms—as noted above, available only in 1 in 8 classrooms. The absence of telephones is not only due to cost, but to the anticipation by many principals that telephone availability to teachers would be disruptive, giving teachers greater control of communications with parents, and to the fear of teacher misuse.[64] In general, too, the building infrastructure that university professors might take for granted is missing, not anticipated during construction and very expensive to install now.

Needed are not only telephone lines and jacks in classrooms, but fiber optic cable and the conduits and raceways for future technological advances (the installation of which would often involve the expensive removal of asbestos from ceilings and walls). Schools often lack air conditioning and, where it is in place, it is often inadequate to handle the cooling for additional computers. Moreover, the increased electrical power demands from computers and air conditioning units would often exceed the available wiring capacity (as I found out two years ago as dean of the School of Graduate Studies when my office was moved into an old building on campus during a renovation project).

Internet connections are more common in secondary than elementary schools, but typically through modems that are too slow for practical use, lacking the high-speed connections and network bandwidth necessary for Internet applications such as audio and/or graphics.[65] No wonder Giese concluded that although "there is much talk and promise about being connected to the Internet at the school district and building level, [it is] just that—talk and promises."[66]

Software

Despite Diem's enthusiasm about commercially developed educational software,[67] others take a less optimistic view. One problem is related to the age of public school computers; very little software, if any is being

developed that can be supported by the vintage Apple IIes in use in most schools.[68] But even with modern computers, there is a lack of software for the student-centered, constructivist approaches to education that are not only the current fad, but for which computer technology is supposed to be particularly functional.

In particular, there is often little fit between the software available and the curriculum, with development done by persons not conversant with the goals or classroom realities of social studies education. Although Baker, Hale, and Gifford were concerned primarily with the lack of use of computer instructional materials at the college level, they assessed elementary through college software involved in recent meta-analytic research reviews. They concluded that these materials are "narrowly conceptualized," "limited in scope," "theoretically chaotic," "non-transformative" (simply meant to be "bolted on to existent classroom teaching methods"), and "pedagogically confusing."[69] That could be a description of the bulk of supplementary materials for social studies instruction over the years, most of which have had little of the sustained classroom use that would displace the textbook from its fundamental position in the classroom.

The "relative dearth of high quality computer software and digital content designed specifically for [social studies] use," particularly at the secondary level, is a basic deficit. Moreover, there is little evidence of any large-scale software development efforts by either traditional educational software and multimedia vendors or textbook publishers.[70] There has been some National Science Foundation (NSF) funding for software development in science and mathematics, but at a too-low level and with little funding in other areas, including social studies.[71]

The primary problem is fiscally based economics—the lack of adequate public school software acquisition budgets to attract venture capital to elementary and secondary software development. (For example, Disney's "computer wizards" see exciting educational software possibilities, but outside of the school environment.[72]) Software acquisition budgets are about $10 to $16 per student each year, not enough to stimulate the development of new generations of software, especially with the existing market fragmentation that reflects a variety of academic subject areas, skill levels, and product specifications among school districts and states. The budget-fragmentation problem is compounded by procurement procedures, especially in the 22 "adoption" states, that are ill-suited to the software market, such as five-year approval cycles and pricing policies that prohibit volume-purchase discounts to large school districts. In addition,

the lack—in both quantity and age—of modern hardware is a serious market-size restriction that further discourages private sector investment in software development.[73]

An economics-based prediction must be that there will be comparatively little private software research and development aimed at public education in general, much less at social studies instruction in specific. As I noted in an earlier piece:

> The same factors that restricted [classroom] television use will limit the classroom impacts of computer technology: lack of hardware; inadequate quality and quantity of programming; the difficulty, without careful consideration by programmers of how and where their products might fit, in integrating programming into the curriculum. Perhaps most important, as was the case with the New Social Studies projects of the 1960s and 1970s and with educational television, the funding will not be available to develop products that can compete successfully for students' attention with those from the private entertainment enterprise. The brightest, most creative talent will continue to be drawn to business and entertainment by the personal financial opportunities and by the availability of capital for risky product development and for creatively satisfying products. Similarly, as with educational materials in the past, persons with innovative programming concepts to stir students' imaginations will find it difficult to locate producers.[74]

The novelty effect of new technology is of concern to educational researchers as a confounding variable. Over the long haul, however, what should be of greater concern to educators is the reverse-novelty effect, that is, the lack of novelty and stimulation of educational materials as compared to those available in the private marketplace. No one to my knowledge has ever taken a textbook home for an enjoyable evening of reading, and Stoll asked, "Can you recall [even] one educational filmstrip of decades past?" But, he went on, "I'll bet you remember the two or three great teachers who made a difference in your life."[75] Students' experiences with educational software are not likely to be different.

The Teacher

A fundamental ingredient in the electronic future of social studies is, of course, the teacher. According to the results from one recent survey, of the teachers who had one or more computers in their school, only 62 percent

used them regularly for instruction, and then mostly for teaching about computers or for drill and practice.[76] Diem reported that there was little or no use of computers for social studies instruction.[77]

Like others, teachers range widely in their familiarity and comfort with electronic technology, as well as in their acceptance and perception of its role in the curriculum. Many "find themselves bewildered by the changing landscape of computer, video, and telecommunication technologies."[78] Even for those teachers who are technophiles, the challenges—even assuming adequate hardware, building infrastructure, and software—in actually integrating technology into instruction are great.

Beyond the need to learn to "run the machines," teachers must identify and evaluate software and Web sites, decide which to use, how each fits into the curriculum, and how to organize classroom activities so that the technology is an integral part of instruction, not a sideshow. Even student assessment will likely need to be rethought, for example, to take into account individualized and group projects. These are not small tasks. In fact, it has been suggested that the optimal use of electronic technology will necessitate not only the restructuring of individual classes, but the restructuring of intra- and inter-curricular relationships as well.[79]

In light of the reconceptualization and other tasks to be done, it is no surprise that a major barrier to the use of technology in instruction is teacher time. There are good, even excellent, software and Web pages, but finding, sorting through, and evaluating software and Web hits are extremely time-consuming tasks to add to the teacher's already busy day.[80] Moreover, teachers need training in the location and evaluation of materials, as well as assistance in developing curricula to help their students be critical, reflective users of the Internet and Web. They also need assistance in the incorporation of technology resources that tend to be nonlinear and provide multiple student-learning routes, and thus are difficult to integrate into the standard curriculum. In addition to the time for inservice education, to become comfortable and fluid technology users teachers need time to observe and consult with technologically experienced and competent teachers and to engage in ongoing communication (perhaps via e-mail, which many users find to be time consuming) with teachers in similar circumstances.[81]

Teachers themselves often report time as the major obstacle to technology adoption and use. Teachers report they have, on average, 10 minutes of scheduled preparation time for each hour of teaching; with out-of-school preparation and grading of tests and papers, they report an

average 47-hour workweek.[82] It has been estimated that, typically, it would take teachers from three to five years to fully integrate electronic technology into their teaching.

The usual demands on teachers' time to perform routine tasks while staying current in their teaching and content expertise would certainly be exacerbated by any influx of technology into the curriculum. The time factor raises two interrelated and difficult issues that are not new, but are made more evident by the emergence of technology as a curricular ingredient. The first is logistic—that is how to restructure the school day to make time for teachers to do the material identification, evaluation, and selection, and the curricular and instructional planning that are necessary; the second is economic—how to pay for the restructuring and/or how to change teachers' incentives, such as "overtime" compensation, so that they will find the needed extra time.

Teacher Training and Assistance

As has been emphasized earlier in this article, even if adequate amounts of up-to-date technology were available in social studies classrooms, that in itself would not result in increased student achievement. Curricular organization, content, and teaching method precede technology in causal importance for learning. And the classroom teacher is, to use a time-worn but valid phrase, the key to all of that—i.e., to what happens in the classroom. However, a majority of teachers report that they feel inadequately prepared to be instructional technology users. Providing them with assistance is a crucial step if technology is to be used and used effectively in instruction. Finding the time to be engaged in inservice education is not the only problem, however; the needed training is often not available.

Typically, about 55 percent of school technology budgets is for hardware acquisition and maintenance, 30 percent for software acquisition, and 15 percent for teacher professional development. The consensus among those in the instructional technology field is that to be minimally adequate, the professional development portion of the budget should be at least 30 percent.[83] Again, good practice hinges on the availability of fiscal resources.

The adequacy, as well as the extent, of the professional development opportunities available to teachers is questionable. One survey indicated that 46 percent of the educational technology inservice courses were half-day workshops and that 79 percent were focused on operating hardware, navigating the Internet, or using specific pieces of software.[84] Little or no help was provided teachers in coping with the challenges of curricular integration and classroom organization, or with the critical tasks of software

and Web page evaluation.[85] Teachers, not surprisingly, reacted negatively to the narrow technological orientation of the workshops and reported finding themselves unprepared to handle the diverse logistic and curricular challenges they encountered, even in "technology rich" school environments.[86]

Neither school district inservice education nor college preservice or inservice education appears to be providing the necessary assistance to teachers. In one survey, less than 50 percent of USA schools had an introductory computer course available for teachers through the school district or a local college.[87] Colleges of education, despite the technological support often available from campus facilities, have not generally restructured courses (again, due to lack of instructor training and time, as well as inclination) to prepare prospective inservice teachers for technology use. Nor have technology-related school observation and practice teaching been generally provided for prospective teachers.[88] All is not necessarily well equipment-wise either. As White reported in his case study, lack of computer access can be a problem in preservice teacher education.[89]

Support Staff

Professional development through pre- and inservice education is necessary, but not sufficient for teachers' use of technology. Nor is informal consultation with other teachers, as time allows, sufficient. Teachers need ongoing, expert technical as well as pedagogic consultation and support, including on-call maintenance and troubleshooting assistance.[90] Yet, only about 5 percent of schools have a full-time computer support person, and nearly 60 percent of schools have no one with any percentage of time officially allocated to computer coordination and support. Even when schools have computer support personnel, they often spend over one-half of their time teaching computer-use courses to students and supporting administrative computer use, with only about 20 percent of their time spent helping teachers with technical and pedagogic problems.[91]

Summary and Qualification

The available reports on technology in USA public schools do not indicate a general situation conducive to technology-based or technology-driven instructional reform in general, or in social studies in particular. In light of the rapid changes in technology and its use in society, one might wonder if the OTA and Panel data are sufficiently current to be valid indicators of computer classroom availability and use. Given the general stability of American public education, due largely to budgetary constraints, my own

contacts with schools, and what I see on my relatively technology-rich university campus, the portrayal presented appears to be valid. Of course, there will be striking exceptions among school districts, schools, and teachers. Those at the university level who are computer users and who are often in contact with leading-edge schools and teachers must be cautious not to overgeneralize from their positive experiences.

Socioeconomic Status, Ethnicity, and Technology Availability

Although technology could be an instrument to empower historically disadvantaged groups, the influence of technology also could widen disparities and further disadvantage persons in those groups. Which it will be depends largely on how the technology is deployed and used in schools.[92]

To what extent is computer availability a function of socioeconomic status or ethnicity? The equity issues raised by that question are not trivial. Bracey summarized research that indicated that the "number of parents in the home, level of parental education, type of community, and state poverty rates for ages 5 to 6," all indicators of socioeconomic status, "account for fully 89 percent of the variance in NAEP [National Assessment of Educational Progress] scores."[93] That is an unusually high amount of variance to be explained in educational research.

School Availability

During the 1994–95 school year, the poorest USA schools (those with 80 percent of the students eligible for Title I [Elementary and Secondary Education Act] funding) had, on average, one computer for every 11 students. In the richest schools (less than 20 percent of the students Title I eligible), the computer/student ratio was 1:9.5.

The gap in computer availability may seem rather modest, but there were also significant differences in computer use. The low socioeconomic status (SES) students reported 14 percent less use of computers in school, and they were more likely to be taught about computer use than to use computers as learning tools in subject area classes. Higher SES 11th and 12th graders were 25 percent more likely than lower SES students to use computers for higher-order thinking and/or other subject-matter learning, rather than drill and practice.[94] The socioeconomic class-based curricular differences that Anyon reported—preparation for routine factory-type work versus preparation for professional, problem-encountering careers—apparently continue as an influence in the application of technology to education.[95]

It is no surprise that the computers in low SES schools are more likely to be out-dated, less well-maintained, not connected to the Internet, and not to have appropriate software available for student use. There are also disparities in teacher recruitment—higher SES schools are more likely to hire teachers trained in technology application—and in the inservice education provided for teachers.[96]

Ethnicity is also related to school technology availability. Schools with greater than 90 percent minority student enrollment were reported to have 16 percent fewer computers per student. Ethnicity is partly confounded with socioeconomic status, with all of the implications noted above.

Home Availability

A factor to be taken into account in contemplating the role of electronic technology in the future of social studies is the availability of the technology, especially computer technology, in students' homes. Home computer use may help to prepare students for computer use at school or offset the lack of adequate hands-on computer availability in schools.

Probably most persons who read this article will have a computer in their home, as well as at their office (if they have one). That circumstance does not validly reflect the situation in the general population, however. Samuelson reported that about 40 percent of USA households had a computer, up from 18 percent in 1987 and 31 percent in 1995, but well short of the 60 percent expected and with a slowing of demand that may be temporary but is not fully understood.[97] (The purchase slowdown may be short term, it may reflect economic market saturation, or it may be that Americans have decided that "the personal computer is not yet the indispensable tool that digital enthusiasts think it is.")[98]

A report from the National Telecommunications and Information Administration (NTIA) in July 1998 was less encouraging in regard to computer ownership. According to the NTIA data, from 48,100 Census Bureau door-to-door surveys in 1997, only 36.6 percent of USA homes have computers.[99] Samuelson indicated that Internet use by Americans 18 or older was at 28 percent in 1997, up from 8 percent in 1995, but not as high as Internet enthusiasts might expect. NTIA reported online access in homes to be 18.6 percent in 1997.[100]

The percentages of American homes with a computer and on-line access, and of Internet users, are, then, far from 100 percent, and the serious disparities in computer availability and use in schools are not likely to be ameliorated by home availability and use. About 50 percent of USA

households with one or more children were reported to have computers in 1995.[101] That figure went to 57.2 percent in the NTIA report. However, for single-parent households headed by females or males, the figures were only 25 percent and 30.5 percent, respectively. Overall, on-line access for married couples with children was 29.4 percent in 1997, but only 14 percent for male-headed, single-parent families and 9.2 percent for female headed, single-parent families.[102] Significantly, a large proportion of the children in homes with computers use them for school work, on average about one hour per week. That is roughly equal to a typical student's computer use in school.[103]

There is, however, even greater SES disparity in home computer availability than in school availability. In June of 1995, there were computers in only 14 percent of households in which the parent(s) had a high school education and an income less than $30,000 a year; with college education and an income greater than $50,000 per year, 73 percent had computers.[104] From a slightly different perspective, NTIA reported that in households with less than $35,000 annual income, computer ownership and online access were 36.6 percent and 26.3 percent, respectively. Similarly, 63 percent of persons with a college education owned computers, as contrasted with 6.8 percent for those without a high-school education. Online access was reported as 38.4 percent for those with college degrees, 9.6 percent for those with high-school diplomas, and only 1.8 percent for those without a high-school education.[105]

In 1993, African-American and Hispanic households were 57 percent and 59 percent, respectively, less likely than white households to have a computer. Of course, these data were reflected in use. In a 1995 survey, only 17 percent of African-American children reported using computers in their home, as compared to 38 percent of white children.[106] According to the NTIA report, despite a 52 percent increase in personal computer ownership since 1994, the disparities in computer ownership and home online access for whites, on the one hand, and blacks and Hispanics, on the other, have widened.

The discrepancies and their importance are underscored by spring 1997 data from Nielsen Media Research. In the total national sample (N = 5,399), 42.9 percent of the respondents reported owning a home computer, but only 29.0 percent of blacks in contrast to 44.3 percent of whites. At an income level below $40,000 per year, 26.0 percent of the respondents reported home-computer ownership, but only 13.3 percent of blacks reported ownership versus 27.5 percent of whites. However, of those

respondents with annual incomes at or over $40,000, 61.5 percent reported computer ownership, with blacks reporting slightly higher ownership (65.4 percent) than whites (61.2 percent).[107] In the NTIA data, 40.8 percent of white households had a computer, versus 19.3 percent of black and 19.4 percent of Hispanic homes. In contrast to the Nielsen Media Research data, even above the $75,000 annual income level, white households had higher percentages of computers than black households (76.3 percent vs. 64.1 percent), with online access at 21.2 percent for white households, but 7.7 percent and 8.7 percent respectively, for black and Hispanic households.

White students in the Nielsen Media Research national sample (all age 16 or older) were more likely than black students to have used the Web (65.8 percent vs. 48.6 percent), but the difference decreased (72.1 percent vs. 63.8 percent) when there was a computer in the home. White students without a computer at home were more than twice as likely to have used the Web within the past six months (37.8 percent vs. 15.9 percent).[108] Perhaps they had greater access to computers at friends' and relatives' homes or at libraries and community centers.[109]

Clearly, "access translates to usage."[110] For those interested in the technological future of social studies, the educational issues raised by SES and ethnic inequities in computer (and undoubtedly other technology) availability and use at school and at home must be a major concern. Can technology, even with properly designed content and appropriate pedagogy, be a positive force for or in instructional reform, given the present, unlikely-to-change, situation? The data present an important reality check for would-be reformers of social studies education. They also, of course, delineate important policy issues[111] that should be included with other technology public issues, such as listed by Diem,[112] for study and discussion in social studies classrooms.

What About McLuhan?

Despite the conclusion cited above—that McLuhan's declaration that "the medium is the message" does not apply to the effects of media on student achievement—the general thesis he proposed[113] cannot be ignored. There is no question but that, like the printing press, the telephone, and television, modern electronic technology will have tremendous impacts on the societies within which schools function. The already visible impact of e-mail on patterns of communication and the effects of being able to take on identity for Internet chat rooms are only clues to what lies ahead.

What are the implications for social studies? Will concepts of authority and cooperation change, with effects on classroom as well as societal interrelations?[114] Will immersion in electronic technology result in elementary and secondary school students who have been deprived of the opportunity to develop interpersonal, social skills? Probably not. In fact, some research indicates that the use of computers in classrooms leads to increased student interaction.[115] But there can be little doubt that the nature of the interaction will change.

Will there be electronic technology-induced changes in the teacher's role, reshaping the types and patterns of classroom interactions?[116] Perhaps, but with effects much less than technology enthusiasts envision, due in large part to the personnel, fiscal, and economic constraints noted above. As I have noted elsewhere, "Technological innovation . . . seems often to pass schools by or have little influence."[117] Television, for example, has had radical effects on society, but little impact on social studies instruction, except as context.[118]

The public will complain about schools, but, as in the past, will be unwilling to provide the resources to make technology a viable instructional element, with, of course, some striking exceptions in some school districts and schools. Generally, the public will continue to spend billions of dollars on their own hardware and software ($5.1 billion for software alone in 1997, according to USA Today, May 28, 1998, p. D1), but be unwilling to provide needed tax revenue for schools, even at a level that businesses would consider less than minimal for educational endeavors. Educational stability of the sort Cuban found for earlier decades will continue.[119]

The prediction that deeper, long-term societal change will occur, but only surface schooling changes, reflects past technology experience. As Noam has cautioned:

> It is characteristic of individuals, institutions, industries and entire societies to misjudge the future. . . . On the one hand, we tend to succumb to the various merchants of hype, overestimate short-term spread of technology as to its salutary impact—"a helicopter in every garage"; "atomic power too cheap to meter"; "the Internet in every classroom." On the other hand, we tend to underestimate the deeper long-term impact of fundamental technologies.[120]

Edison predicted, erroneously, in 1913 that films would replace books as instructional media. Similar prognostications of the effects of radio and TV have not come to pass. Nor have they, yet, for the computer.[121] Although

each of these technologies has fundamentally altered individual and societal perspectives and behavior, their effects on schooling in this country have been minimal.

Despite technology, schools and social studies instruction will continue much as they have for decades. The reasons are captured well by Giese's summation of Cuban's historical overview of teachers' adoption or, more frequently, rejection of new technologies, as applicable to current electronic technology:

> The Internet (and arguably other hypermedia) will enjoy widespread use if (a) the technology helps teachers accomplish their own instructional goals and objectives; (b) the benefits derived from the technology are proportionate to the costs and efforts necessary to use it; (c) as many extant or potential impediments as possible are removed from the equation; and (d) a fair amount of resources are allocated to support them, especially in training.[122]

Given the history of change in social studies instruction and the resources that the public is willing to provide schools, is there much question about the outcome?

> *The optimist believes this is the best of possible worlds; the pessimist fears that is true.*
>
> *A pessimist is a realistic optimist.*
>
> —(Sources unknown.)

Endnotes

1. This article was presented as a paper at the annual conference of the Social Science Education Consortium, "Reform and Change in Social Studies," Lillehammer, Norway, June 26, 1998. It appeared in the conference proceedings produced for SSEC by Lillehammer College (Research Report No. 47/1999) and is published here by permission of the author and SSEC. The editor wishes to note that while data in this article concerning technology use and distribution have changed somewhat since 1998, those changes do not diminish the fundamental points advanced by the author.
2. The author wishes to thank Dr. Andrew S. Gibbons, Associate Professor of Instructional Technology and Director of the Center for the School of the Future at Utah State University, who provided invaluable assistance in the preparation of the paper, with both materials and references to material.
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15. Clark, "Media Will Never Influence Learning," 2.
16. Ibid., 25.
17. Clark and Salomon, op. cit.
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23. Clark, "Media Will Never Influence Learning," 27.
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35. Ibid., 1.
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38. Neil Rudenstine, President of Harvard University, in a discussion of the information challenges of the Internet, drew an analogy with the information overload that accompanied the explosion of research publications in the last quarter of the 19th century. Harvard's library was cited by then president Charles Eliot as "completely inadequate to accommodate the sharp rise in acquisitions. Books. . . are piled upon the floors. . . . Alcoves are blocked up. . . . Thousands of (volumes) . . . have been placed in temporary positions, and large numbers of books were being stored haphazardly" (p. 3.) Rudenstine also recalled the fear of the printing press in the 18th century, when "Diderot remarked that 'a time will come when it will be almost as difficult to learn anything from books as from the direct study of the whole of the universe. . . the printing press, which never rests (will fill) huge buildings with books (in which readers) will not do much reading. . . . (Eventually) the world of learning—our world—will drown in books'" (p. 3). See Neil L. Rudenstine, *The Internet and Higher Education,* a paper presented at the Harvard Conference on the Internet and Society, Cambridge, MA (May 29, 1996).

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41. Ibid., 29.
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44. Ibid., 36.
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48. C. Frederick Risinger, "Instructional Strategies for the World Wide Web," *Social Education* 62 (1998): 110.
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51. OTA, op. cit., 1.
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53. For example, in 1995, almost every school had at least one TV and VCR, but only 41 percent of teachers had a TV in their classrooms; only one teacher in eight had a telephone in the classroom and less than 1 percent had access to voice mail (OTA, op. cit., 1, 39).
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55. James Giese, "Random Thoughts on Computers and Social Studies," *SSEC Bulletin* 5, no. 2 (1997): 2; Social Science Education Consortium, op. cit., 2.
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57. OTA, op. cit., 18.
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61. Panel, op. cit., 19.
62. Ibid., 9,11.
63. Ibid., 10–11.
64. OTA, op. cit., 39.

65. Ibid., 20; Panel, op. cit., 9–10.
66. SSEC, op. cit., 9; Giese, op. cit. Whether the national E-rate program, in which phone companies are to provide schools with digital wiring, telecommunications service, and Internet access at 20 percent to 90 percent discounts, will have a significant impact on Internet access for students remains to be seen. The Federal Communications Commission reduced the funding, which is based on phone company charges to customers, from $2.25 billion to less than $1.4 billion for 1998. The costs of internal wiring will pose difficulties for school districts not poor enough to receive the maximum discount [J. Couzin, (Ed.), "Netwatch," *Science* 281 (1998): 1247]. And the deficiencies in computer availability and teacher training remain largely unaddressed.
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78. Panel, op. cit., 6.
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81. Giese, op. cit.; SSEC, op. cit., 9.
82. Panel, op. cit., 17.
83. Ibid., 4; OTA, op. cit., 19, 25.
84. Panel, op. cit., 16.
85. Giese, op. cit.; SSEC, op. cit.
86. Panel, op. cit., 16.
87. OTA, op. cit., 25.
88. Panel, op. cit., 18.
89. Charles S. White, "Bringing Preservice Teachers Online," in P. H. Martorella (Ed.), *Interactive Technologies and the Social Studies: Emerging Issues and Applications* (pp. 27–56) (Albany, NY: State University of New York Press, 1997), 38–39.
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92. Ibid., 21.
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101. Panel, op. cit., 22.
102. NTIA, op. cit., 4.
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111. Ibid.; Panel, op. cit.
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Rewiring the History and Social Studies Classroom: Needs, Frameworks, Dangers, and Proposals[1]

Randy Bass and Roy Rosenzweig

Exaggerated predictions of boom and doom are giving way to the more sober process of assessing where computers, networks, digital media are and aren't useful. Selective appropriation of technology has already begun in the teaching of history (and social studies generally). Four questions should guide this process of selection and application: What we are trying to accomplish? What approaches will work best? Are there dangers that we

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