Are Educational Technology and School Restructuring Appropriate Partners?

By Michael J. Carbone

Introduction

Through my years of involvement with education, both as a public school teacher and now as a teacher educator, school restructuring seems to be the reform movement which holds the most promise for significant and fundamental educational change.[1] Its strength is not in the originality of the ideas, but rather in the particular constellation of ideas that characterize it and, most importantly, the educational questions and critiques restructuring is forcing. There have been no more thoughtful critics of the "industrial school" than John Dewey, Paul Goodman, John Holt, Charles Silberman, Jonathan Kozol, Ted Sizer, Maxine Greene, and most recently, John Gatto (1992), whose insightful little text *Dumbing Us Down: The Hidden Curriculum of Compulsory Schooling* has renewed this line of critique. However, these critiques have never seemed to penetrate what Harry Broudy called the "real world of the public schools."

Now many of these trenchant critiques—once considered the province of only the most radical educational critics of a rigid, mechanistic, and rationalistic public education system—have found their way into the current debate. "Schools were designed by Horace Mann and by Sears and Harper of the

Michael J. Carbone is a professor in the Department of Education at Muhlenberg College, Allentown, Pennsylvania.

University of Chicago and by Thorndyke of Columbia Teachers College and by some other men to be instruments of scientific management of a mass population. Schools are intended to produce, through the application of formulas, formulaic human beings whose behavior can be predicted and controlled" (Gatto, p. 26). As Michael Katz has noted, by the end of the 19th century, most urban schools were "cold, rigid, and somewhat sterile bureaucracies." He openly wondered how the humane impulse of the early school movement turned so quickly into the dispassionate ethos of "red tape and drill" (in Spring, 1990, p.78).

The confluence of events—usually thought to have begun with *A Nation at Risk* in 1983—has led conventional educational thinkers, foundations, and public debate to embrace the ideas behind, if not the rhetoric of, serious and substantive criticisms of a school system established in the early industrial period. For instance, an article in *U.S. News and World Report* noted that "the reform movement of the 1980s elevated the mission of public education [but] in practice it has mostly meant tinkering with a fundamentally flawed machine." Among other typically conservative school reforms, the article also recommended cutting school bureaucracy. "Public schooling's vast infrastructure...has grown so unwieldy and idiosyncratic that it is more often a hindrance than a support to education" (Toch, 1993, p. 46, 50).

Restructuring is the one reform movement which is at long last embracing ideas of school structure and organization, and how these in turn structure particular ideas about students, intelligence, learning, and teaching. There is also a recognition that teaching and learning are not just classroom-bound activities. Rather, they are situated within a specific institutional context, highly subject to institutional and organizational decisions which have often been well beyond the decision making power of teachers and, for that matter, students. The arena of educational reform has now expanded to what some describe as the bureaucratic sediment covering our schools—stifling creativity, initiative, and professional judgement. This is a direct challenge to the "fundamental ideological issues pertaining to bureaucracy's meaning in a democratic society" (Murphy, 1991 p. 10).

School Restructuring and Democratic Possibilities

An underlying ideology and key element within the restructuring movement is a democratic and humane notion of education guiding the creation of appropriate structures. As Michel Foucault reminds us, power resides in many things, including architecture and modes of organization. It is the particular strength of the restructuring movement to recognize this central idea and to suggest that, despite the previous best intentions of educators, schools did not flow in shape and form from democratic principles nor embody these ideas in physical and organizational ways. Clearly, restructuring—as it is currently talked about—is characterized by an emphasis on decentralization, community, participation (meaning both students and teachers), teacher/student empowerment, and definitions of teaching and learning which stress critical understanding (Murphy, 1991, pp. 15-16). These

ideas are, above all else, democratic principles derived from non-mechanistic and non-standardized notions about students and about schools as social institutions. In other words, these are direct democratic challenges to the industrial model of schooling. As noted, they represent the basic ideas of a long established critical and dissenting voice in educational theory and scholarship.

The call for more democratic forms of education found its strongest voice in Dewey, who was convinced that the civic, political, and work culture of the corporate industrial revolution was in many cases antithetical to, or at the very least destructive of, those places in American life where democracy could be learned, practiced, and valued. For Dewey, schools should become public spaces committed to participatory democratic values reflected in practice as well as epistimology (see Wingo, 1974). Recently, Benjaman Barber (1992) among others (see especially Bellah, *et. al.*, 1991) reminds us again of the urgency of these ideas in one of the most recent works about the demise of public and community in American life. Barber writes:

> What is the mission of education in a democracy? In the first instance, democracy itself, just as a primary mission of democracy is public education. The spirit of inquiry (asking tough questions) coupled with the capacity to judge (offering provisional answers) defines both liberal education and education for liberty, both critical learning and deliberate democracy. (p. 262)

The meanings of democratic schooling are best expressed in a series of questions which frame the central role of public education in a democratic society and represent what can be achieved through the restructuring movement. In response to the conservative and mechanistic educational reforms of the late 1970s and 1980s, I posed these issues for teacher education:

> Can and should teachers begin to think more expansively and relationally about education? Can they learn to conceive of classrooms and schools as something more than places to get job skills or knowledge for success in college? Can they, as Henry Giroux and others have suggested, be made to see schools as potent public spaces dedicated to empowering people to live humane lives in the face of an increasingly rationalized social order? Can they, as Maxine Greene suggests, be made to think of education as a means to restore notions of human freedom and choice, to recreate ideas of possibility and foster a critical intelligence of what controls us and why? And lastly, might [teachers] be able to see [all] students as future citizens capable of participating in the life of our democracy? (1990a, p. 82)

Joseph Murphy (1991) has captured these basic ideas and translated them to a democratic ethos by characterizing restructuring as follows:

> a) A basic change in views about the relationship between the school and the social environment.
> b) A focus on the basic organization and management of schools and the social relationships within schools.

c) A radically different way of thinking about the educability of children and
adolescents.
d) A fundamental shift in our assumption about knowledge existing outside and
objective to human experience to something that is internal, subjective, and
contextually dependent.
e) An elevated concept of teaching as a complex activity— demanding autonomy,
cooperation, and flexibility. (pp. 15-21)

No one is entirely certain what all of this will look like, or how it will "be" once
it is enacted within our schools, and perhaps as a result, there seems to be a fair
amount of agreement that no one model will come to dominate the definition of a
restructured school. The lack of a standardized model, which can be reproduced and
made to fit all situations, is both a strength and a potential problem. Its strength lies
in that a non-standardized or a non-formulaic model of restructuring continues to
open up and suggest educational possibilities: the replication of the model does not
itself become the end. Indeed, at its best, the democratic philosophy inherent within
the restructuring movement suggests an eclectic learning model sensitive to the
dialectics of subject matter, pedagogy, locality, students, and the contexts within
which all of this occurs.

However, there are also dangers in this flexibility. When a fundamental
guiding principle is not able to be succinctly or simply articulated and defined, it
becomes susceptible to interpretations which may be inimical to its values. For
example, the efforts to restructure schools and education in America operate within
a fundamentally positivistic, rationalized, corporatized social, political, and eco-
nomic order, and restructuring could be co-opted as a movement to produce more
"flexible" or "imaginative" workers. We must always be mindful that the nature of
the goals for restructuring schools are quite dissonant, despite their current
pervasiveness within educational communities. The faddish character of past
educational reform movements suggests restructuring's vulnerability to distortion
and co-optation by corporate and technological agends (see Spring, 1990). The term
"restructured" can too easily be used to describe practices which may not even be
remotely related to the complex, democratic goals of school restructuring. As
Murphy notes, "There is a great deal of tension in much of the activity unfolding
in the ares of educational reform...a schizophrenic quality to much of it" (p. 82).

I would argue that the clearest way to prevent faddish or corporate-driven drift
is to **fix** the critical ideas which stress basic democratic and decentralized goals and
ideals, and place these at the **center** of our thinking about school restructuring. I
have strongly argued that any lasting and meaningful educational reform must be
organized around teacher empowerment and critical forms of knowledge, and those
structures of education which enable both. These concepts frame teaching

as something dynamic, immediate, complex, and autonomous. Such work flows
from a body of knowledge and practice which can not be reduced to rules or
procedures and prescriptions. [L]earning situations would grow out of the needs

of particular communities, learners, towns and cities. If schooling is to educate students for a democratic society, then teachers need to work in a democratically empowered workplace. (Carbone, 1990b p. 101)

I would argue that it is these concepts which should provide the touchstones for developing and creating those reforms which truly contribute to "restructured" schools and educational practices, and it is against these concepts that I will review the proposals to inject educational technologies into the restructuring movement.

Technology Enters the Restructuring Debate

There is increasing attention within restructuring literature focused on the issue of technology[2] and its role within schools. The technology of computers became integral to the debate about American education in the early 1980s. The widespread introduction of these machines prompted such headlines as "Here Come the Micro Kids," "Schools Are in the Grip of a Computer Mania," and *Time* celebrating the computer as "Man of the Year" in 1982 (Cuban, 1986, p. 72). Michael Apple (1986) has noted that the growth of the new technology was definitely not a slow movement. In 1985 alone, there was a 56 percent reported increase in the use of computers in United States schools and of 25,642 schools surveyed, over 15,000 reported some computer use.

The promise of the computer to revolutionize American education came through high tech decrees about academic excellence, readiness for an information society, and a future demarcated by the need for "computer literate workers" in preparation for the world competitive high-tech job market. So deeply convincing were these mantras that in 1983 the National Commission on Excellence in Education recommended computer training as one of the five New Basics, along with English and Science. (Kahane & Oram, 1989, p. 69) This original push for computers in classrooms is generally accepted to have failed. The reasons for this, both stated and implied, have been attributed to high early costs, poor software design, and the lack of professional training for teachers to use the equipment (see Cuban 1986; Hurly and Hlynka, 1982; Kell, et.al., 1990).

More recently, "Performance and Educational Technologists" (as they like to refer to themselves) clearly see school restructuring as a new opening for the reasseration of a technology-based vision of education. This revived discussion of educational technology reflects our continuing fascination with technology in education. For example, the following quote from a recent article in *Electronic Learning* illustrates this nicely:

Technology is one way to get students interested in learning, Ketchem says. With things like CD-ROM, video discs, fiber optics, telecommunications-regardless of whether the technology is new or not, it gets them excited to learn. I've seen kids get 300,000 points on Nintendo, so I know they have eye/hand coordination. They can reason and make quick decisions. They can develop problem solving skills. What a lot of people tend not to realize is that Nintendo calls on all these skills, and

if they can do it there, they can learn in school. (Bruder, 1992 p. 25)

While technology's failure to become an integral part of an earlier educational reform movement of the 1980s was humbling, it also provides for the new urgency and appeal. Educational technologists attribute the failure of the earlier introduction of computers to the fact that you "couldn't teach an old dog new tricks," *i.e.,* technology-based changes to schools did not go far enough. They now assert that it is only in the **reshaping** of our schools from the bottom up that we can meaningfully introduce educational technology and exploit it to its fullest advantage. The current restructuring movement is providing the "framework for changing the system as a whole, thus creating an environment within which particular [technological] reforms can be carried out successfully" (Sheingold, 1991, p. 18). For example, Sharon Shrock (1990) writes about the "extent to which the most likely [restructuring] reforms will create schools more conducive to performance technology" (p. 13). She defines performance technology as media (hardware, etc.) and as design. This idea of schools restructured around technological needs is something for which she argues forcefully. Doris Ray (1991a), another advocate for this idea, writes that "there are no limits to educational technology, there are only limits to school organization that limits its uses.... Educators would do well to remember a hard-learned business lesson: To apply technology effectively, you must first organize to use it." She exploits the critiques of the industrial school to argue that "technology can play a significant role in almost all of the educational directions emerging from the school restructuring movement" (p 10, see also Ray 1991b). Most proponents of a technology-compatible restructuring movement use this same basic argument.

Phrases such as "increasingly automated and complex society" have given these arguments an aura of certainty, inevitability and legitimacy: "Today's computer and video technologies are more powerful and versatile [and] their pervasiveness in the world of adult work has given them a new legitimacy in school..." (Sheingold p. 18). They link education and technology to larger arguments about the nature of a post-industrial society and characterize the urgency with which the school restructuring movement should embrace educational technology. Perhaps more importantly, there is the powerful assumption that technology is the key to, or as Ray notes, the "platform" for restructuring. Performance and Educational Technologists argue that decentralization, teacher autonomy, student motivation, individual student attention, critical thinking, and creative teaching are but a system away. Somewhere within the complex of video disks, computer networks, satellites, interactive video, telecommunications, hypermedia, and multi-media technologies lies the realization of these in restructured schools. The Director of the Division of Applied Measurement Research at Educational Testing Service states that "future technologies offer almost unimaginable possibilities to education" but they must be "deeply integrated into the purposes and activities of the classroom"

(Sheingold, p. 20). She goes on to note that this refers to priorities, structures, and physical spaces. Such future integration should include things like electronic displays of student work, special studios where students can work on technology intensive projects, and teacher technology rooms (Sheingold, p. 23).

We are asked to believe that information technologies will usher in, facilitate, and even demand a more constructivist view of teaching and learning and that their penetration into society can no longer be ignored. Jane David (1991), director of the Bay Area Research Group, asserts that "technology has the potential to transform the relationships between teachers and students and even change what schools look like." She forcefully writes of our need to prepare students for the Twenty-First Century and further notes "that together technology and restructuring are a far more powerful force for change than either would be alone" (p.38). The educational future is breathtaking as we read about video discs which give learners access to libraries of images that can be searched and scanned instantly, students using camcorders to develop communication skills, problem solving skills, and the skills of analysis and synthesis. Imagine, we are told, of students using MIDI (Musical Instrument Digital Interfaces) and synthesizers for music composition, and graphic tablets and digital scanners to produce visual art, and finally video animation software to actually become movie directors and producers (Ray, 1991a). This is not even an exhaustive list. There is a litany of promises about computers and other educational technologies being able to facilitate communication, metacognition, reflective practice, transdisciplinary education, active learning, and even human values. In linking educational technology with educational reform, Performance and Educational Technologists' visions of progress are without limit.

If we are not yet appropriately dazzled and convinced, they turn to the idea of educational technology as "design." In applying design ideology to the issue of decentralizing school structures, Shrock expresses serious concerns about teacher competence in effectively using these technologies:

> If our goal as technologists is to see children benefit from the application of the technologies we practice, we have to be doubly concerned about teachers' ignorance of these technologies if schools are decentralized... Schools devoid of external regulation may well be harder for technologists to influence, because instruction benefits from economics of scale and system wide coordination—two factors that may be diminished if schools are decentralized. (p. 24)

Ironically, this statement appeared in an article exploring the role of educational technology in the restructuring movement!

Perhaps the most novel and extreme argument for information technologies' role comes from the work of Lewis Perelman. In a recent article (1993) which presents an overview of his new book (1992), *School's Out: Public Education Obstructs the Future*, he reflects a faith in technology's ability to usher in a completely new system of education. Economic trends, according to Perelman,

point toward "a second industrial revolution" and the development of knowledge-based businesses which are "scrambling to capture the high ground of the new multimedia, telecomputing mega-industry that is springing up from the digital integration of many diverse enterprises" (1993, p. 71). In the face of this future/ emerging present, the outmoded idea of public education becomes, for Perelman, a "redundant term." Recognizing the market for information technology that education represents, he introduces education's new future as "hyperlearning"—or HL. It will be characterized by its ability to exploit "smart environments," the "telecosm," and "hypermedia." The upshot of HL is that it will render public schools obsolete. "The hyperlearning revolution is inevitable. It is being driven by the unstoppable onrushing advance of knowledge-age technology. The businesses that sieze the HL initiative today are the ones most likely to attain leadership in the new economy" (1993, p. 104). In reading Perelman one is almost convinced that restructuring schools around technologies is somewhat quaint and, at the very least, one would be foolish to resist technology-based restructuring now.

To sum up, my reading of the emerging literature dealing with the issue of technology, education, and school restructuring reveals the social and educational meanings of technology. While some educational technologists would have us believe that they work backward from the goals of school restructuring to appropriate uses of technology, I believe the reverse to be true. This is betrayed by a continuing tendency to argue for the widescale introduction of technology into our schools in response to changing social and economic agendas. In the early 1980s an unquestioned push for computer literacy and more "productive" American workers was the driving force for the introduction of information technologies in schools. This essential economic argument failed for numerous reasons, but now the issue of restructuring has provided a new opportunity for a technological agenda for our schools. When reading the uncritical advocacy and celebratory nature of the literature concerning technology and education, one feels as if one has certainly fallen through the looking glass where almost everything gets distorted. The power of technology to lead us into a brave new educational future (if we but clear its path) is argued to be limitless. This discourse reveals a less than thoughtful or carefully examined response to technology's role within our social institutions. Serious discussions of the limits of technology and a healthy engagement of the issues raised by the likes of Neil Postman, Theodore Roszak, C. A. Bowers, David Noble, Douglas Sloan, or Apple are absent.

Before we again wholesale purchase more machinery (and their agendas) for our schools and give technologies priority in school restructuring reform, we must engage in thoughtful and critical analysis of information technology and technological thinking, and their relationship to the democratic and humane values possible within the restructuring movement. Control of educational technology should be our starting point, and not its appeal to be all things to all people. There is a tension between what I have identified as the touchstones of restructuring and

this reintroduction of a technological agenda. It must not go unexplored.

The Need for Critical Questions
About Educational Technology

Framing—as I have—the restructuring movement as essentially democratic and empowering in character, one must immediately ask how compatible are the newest forms of educational information technologies with these goals? The appearance of these technologies as a major factor in this reform movement deserves careful analysis for several reasons quite apart from any specific analysis of their relationship to restructuring. The first of these reasons is because we live in a society generally infatuated with technology— what Noble calls our "gee whiz" notion of the future. President Clinton (1993), in his inaugural address, invoked technology: "the sights and sounds of this ceremony are broadcast instantaneously to billions around the world. Communications and commerence are global, invest-ment is mobile, technology is almost magical..." (p. A15). Technology represents a modern form of faith or religion with the power of social redemption and eternal progress. We tend to invest it with power unto itself which manifests our belief in technology's essential neutrality as something beyond human control, and charac-terized by an inherent (and almost fatalistic) inevitability (see especially Cordes).

A second and ironic contradiction to the first reason for careful analysis of technology's role in school restructuring is that technology is not neutral. There are agendas and curricula embedded in technologies influencing social relationships, and what constitutes knowledge, literacy, work, and their related cultures. Third, and most specific to this paper, the literature critical of educational technologies suggests the possibility that they may well be problematic to the key democratic ideas behind the restructuring movement. For these reasons, I would suggest that a technological agenda within the restructuring movement is in tension with its democratic and empowering ethos, and I will explore these tensions in the remainder of this paper. The earlier minority critiques of educational technologies, which surfaced during the first wave of introducing them into school in the early to mid 1980s, present us with a powerful critical paradigm for interpreting how and if technology should become an integral part of education and the school restruc-turing movement. They represent an analysis of technology which presents a parallel to the argument for the democratic nature of school restructuring. With the new life educational technology has found in the restructuring movement, the early critical writings about computers in education beg to be reviewed within this context. Issues of teacher work and autonomy, critical forms of knowledge, and the structures which enable both should not be dismissed to the "inevitability" of our movement from the early "industrial school" to the post-modern "technology school."

It would be extremely narrow to argue that certain forms of technology have no place in our schools and in children's education. However, the claims made on

behalf of technologies tend to make any arguments against them seem reductive and too easily dismissed as the rantings of technophobes. Michael Young (1984) saw the need to conceptualize an overarching view of technology—not just as information technology—if educational sociology is to make a critical contribution to educational practices and policy. He went on to note the necessity of "a sociology or politics of technology" and warned critical educational sociologists against "ending up with...an anti-technology argument, which would offer nothing to teachers or anyone else. [What] we need to develop [is] a view (or more ambitiously, a theory) of people's relation to technology as the products of other people's work embodied in artifacts or commodities" (p. 207). Sloan (1984) has asserted that professional responsibility demands much more than the mindless sloganeering of educators "urging to outdo one another in thinking of new ways to use the computer in all manners and at every level of education possible" (p. 1). Roszak warns decisively:

> The loose but exuberant talk we hear on all sides these days about "the information economy," "the information society," is coming to have exactly [the] function [of] ambitious global definitions that make it all good things to all people. [T]heir very emptiness may allow them to be filled with a mezmerizing glamor. These often-repeated catchphrases and cliches are the mumbo jumbo of a widespread public cult. Like all cults, this one also has the intention of enlisting mindless allegiance and acquiescence. People who have no clear idea what they mean by information or why they should want so much of it are nonetheless prepared to believe that we live in an Information Age, which makes every computer around us what the relics of the True Cross were in the Age of Faith: emblems of salvation." (p. x)

We may take for granted that the degree to which schools have become markets means that the merchants of technology, along with their apologists, will work feverishly to exploit any reforms as a way to market and sell educational technology. As Roszak (1986) notes, "For the most part, the schools (or mainly trend-conscious administrators and anxious parents, less so teachers) respond with the promptness and the gullibility of well-trained consumers to the commercial pressure of the computer industry" (p. 48). This propensity is very evident today. A short article illustrates this. Gaylord Information Systems has announced that GALAXY, an integrated library system, has been selected for the James Garfield Magnet "School of the Future" in Revere, Massachusetts. The heavy hitters with power in the school district, the Massachusetts Department of Education, and United States Department of Education supported this investment ("School," p. 29). Clearly, the public relations benefits to companies and schools from such an investment can be staggering, but so can the costs, which in this particular case were never mentioned. Another article suggested as much when the author stated that "it seems sensible to use textbook dollars to invest in technology for curriculum delivery and as a tool for student expression" (Madian, 1990 p. 8). In the grip of a technology consumer frenzy, school administrations often overlook these issues.

Roszak writes:

> it is also the case that these educational millions [were] being budgeted for machinery at a time when the average teacher in America [had] a starting salary of $13,000 [in 1985/6]—barely above the official poverty level. Against that background, what all the proposals highlight, with their belated call for rational planning, is that the computer has made a wastefully jagged and disruptive entry into the school systems of the nation. (p. 48)

As educators, we owe it to ourselves and our children to assess the earlier critical literature which offers powerful critical and skeptical insight into the issue of technology and school restructuring. We must think about ways in which technology may or may not contribute to those key features which make restructuring a democratic and humane movement in American education reform. It is worth noting that this critical inquiry has current parallels in other worlds of work. For instance, John Buschman (1993) writes on the issue of information technologies and librarianship:

> If the profession as a whole (and not just our administrative, library school, and technical elite) is to make responsible decisions about libraries, if we seek to fill a central role in debate about information policy in our institutions and our nation, if we are to aid and further public and scholarly inquiry, and if we are to control (or regain control of) the agendas of our institutions, then we must account for and join that established body of theoretical and critical scholarship which has seriously questioned the role that technology has come to play in Western society.... (pp. 5-6)

These critiques of educational technologies have come to represent for the most part, an unpacking, a probing and thoughtful look into what Bowers calls the "cultural dimensions of educational computing." The parameters of inquiry have been broadly drawn from a larger body of literature and which asks questions about the relationship of the sociopolitical nature of technology to: teacher work, classroom culture, cognitive processes, hidden biases, school/corporate relationships, forms of literacy, and the ways in which schools embody and reproduce all of these. This scholarship interprets technology in relation to democratic educational practices and principles. This inquiry has taken scholars into not only the processes of technology, but into the deep cultural and structural foundations of schooling and the institutional nature and relations of classrooms, machines, learners, teachers, and curriculum. It is the relevant aspects of the earlier critical literature on computers and education which I will now review.

Deskilling, Teachers' Work, and Empowerment Issues

The first question to be raised concerns the relationship of teacher empowerment to educational technologies. As technology enters the work place, work is altered, and teaching is no different. Apple (1986) has argued that because teaching

has developed as feminized, "women's paid work," it is particularly vulnerable to issues of hierarchy, authority, and control inherent in the technologization of curricula and teacher practice. "[I]t has been exceptionally difficult for women to establish [social] recognition of the skills required in their paid and unpaid work. They must fight not only against the ideological construction of women's work, but against the tendencies for the job to become something different and for its patterns of autonomy and control to change as well" (pp. 57-58). Computers are having just such an effect on the psychology of teacher's work. Their influences are felt in the domains of teachers' use of professional knowledge, communications among themselves regarding the aims and purposes of education, student/teacher relationships, and professional autonomy (Carbone, 1985). Hurley and Hlynka (1982) note that

> The drive toward greater productivity in education—the modernization of education—requires the transformation from a labour-intensive to a capital-intensive operation. Teachers' unions have long suspected that labour reduction was the main objective behind the introduction of industrial strategies in the classroom. If the promise of greater efficiency and control have been the government's prime objectives to justify expenditures in new instructional technologies, are these the sole criteria for gauging educational improvement?...Is the push to "teach with computers" motivated by a similar cost-conscious concern...? (pp. 3-4)

It would be unfair and one-dimensional to say that the deskilling of teachers' work is solely the product of technological forces alone. Educational policy shows a long history of the attempts of "educational managers" to control the shop floor, so to speak. To the extent that control is now facilitated, enhanced, and aided by technological means—primarily computers—teachers' work may be transformed. The design technologies of the assembly line, bureaucracies, and the power of each based on technical and technological solutions to problems is characterized by rule-using or adherence to patterns. In other words,the brains get built into the system, rendering it worker proof. (Zuboff, 1983) This brings to mind the argument for educational information technology design as the "platform" for school restructuring, as presented by Performance and Educational Technologists. There is indication of how they analytically employ the idea of "technology as design," and there may well be some cause for serious concern. It would suggest that the primacy and centrality of technology is the appropriate starting place for restructuring schools—or at the very least they should lie at the center of the debate. It also suggests that decentralized schools—a hallmark of restructuring—may not be completely compatable with educational technologies.

For example, when an entire curriculum was embedded within a computer system either in an individual classroom or within an entire school, as in the GEMS- or Goal-based Educational Management Systems, the ability of authority to be built into the machine, so as to appear seemingly invisible to the implementor/user comes to characterize a very sophisticated form of teacher control (Carbone, 1985). The

GEMS system as studied by Bullough, Goldstein, and Holt (1984) offers some particular insight. The GEMS program as developed for the Jordan School District represents the ability of educational computer technology to easily exploit public notions of accountability in education in pursuit of cost effectiveness. Bullough and his co-authors, in studying teachers' interactions with what they called the "rational curriculum," found deskilling as well as an uneasy acquiescence on the part of teachers as they responded to such technological curricular systems. Teachers seemed to vacillate somewhere between sensing the control of the system and liking the fact that it took the guesswork out of teaching, thus providing an odd sense of potency derived from a clear, rationalized statement of educational purposes and outcomes. Bullough, Goldstein, and Holt write:

> Since the curriculum is presented in the form of an organized, complete, and obviously powerful system, it is as though it was created by nonhumans or superhumans rather than by humans who might have their own particular and peculiar axes to grind. Teachers have reified the system and its objectives into something that transcends human beings and their abilities to make good judgements. (p. 32)

The intended or unintended reduction of teachers to clerks is one possible outcome of the computerized school and the rationalized curriculum. In another study of a technologized curriculum and teacher work, Apple and Jungck (1990) find:

> when individuals cease to plan and control a large portion of their own work, the skills essential to doing these tasks which have built up over decades of hard work—setting relevant curricular goals, establishing content, designing lessons and instructional strategies, "community-building" in the classroom, individualizing instruction based on an intimate knowledge of students' desires and needs, and so on—are lost. (p. 232)

There is little evidence in the literature that suggests teachers have harnessed technology for their own instructional purposes. Most teachers simply do not have the time, facilities, training, or knowledge to create their own software. As a result, they tend to rely on commercially produced material. This lack of time and the consequent pressure in teachers' work is not likely to recede in the near future. Again Apple and Jungck observe that intensification of the work day is one of the most concrete ways in which the working conditions for teachers have eroded. The upshot is that intensification increasingly forces teachers to rely on "experts" (*i.e.*: technological solutions) to tell them what to do (p. 234). The irony might just be that in relieving one problem—work intensification—teachers end up with another greater one, deskilling and increased work alienation. This correlates what Bullough, Goldstein, and Holt found in their studies. Teachers who work with "technological curricula," for any number of reasons, tended not to raise questions about the values or the goals/aims toward which they were working, in short the normative questions

of educational policy. Any definition of teaching which precludes reflective and flexible practice seriously deskills teachers and undermines professional autonomy.

There are those who believe that work degradation resulting from the introduction of educational technologies will not necessarily be the case. Tom Snyder argues that the technological revolution will only be educationally meaningful when programs are created that put computers in teachers' hands, and serves as a tool for their own purposes. He envisions computers as storehouses of information that teachers can draw on to inform their opinion and give substance to their views—in other words his vision is one of teacher empowerment (West, 1992, p. 21). Indeed, recent summaries of the deskilling/reskilling debate have come to mixed conclusions. While information technologies have been shown to deskill and proletarianize work—including intellectual labor—other signs point to an expansion and deeping of skills through information technologies (see Harris & Hannah, 1993, pp. 113-16; Winter, 1993, pp. 186-89). My argument is that the historically marginal and feminized profession of teaching and American education's strong links to dominant social and economic agendas (mentioned throughout this paper) would point toward teaching becoming one of the deskilled professions.[3] Harry Bravermen (1974) reminded us that "machinery comes into the world not as the servant of 'humanity,' but as the instrument of those who own or control it....It is ironic that this feat is accomplished by taking advantage of that great human advance represented by the technical and scientific developments that increase human control over the labor process" (p. 193).

Instrumental Forms of Reason, Literacy, and Cultural Reproduction

Critical inquiries into the broad areas of literacy, technology, and social reproduction contextualize technology within social and political frameworks. Viewed in this way, technology becomes something more than just an assemblage of parts, circuits, and plugs promising wonderful things; its essence, its human associative meanings are revealed in ways which challenge the basic cultural myth of the "neutrality of technology." The relationship of instrumental and technical forms of literacy to issues such as the environment, democracy and equity, human subjectivity, and quality of life, are important in thinking about the technological agenda. The particular forms of literacy which our schools embody are of no small consequence (see Bowers, 1988a). Key to the earlier critiques of computers in education is an investigation into what Broughton (1984) calls the "invisible pedagogy" of technological systems (Postman, 1979), or what Noble (1984) has called the "imperatives of high technology."

Several very important conceptual domains constitute the core of this literature. Instrumental reason is one such domain, since the computer embodies a particular form of rationality which is "the condition of the possibility of computer

technology, its fundamental presupposition" (Broughton, 1984, p. 103). This form of rationality represents a closed system of thought, dealing primarily in the realms of what can be quantified, measured, and observed, recognizing explicit forms of knowledge and priviliging the production of measurable data. In turn, the characteristics of both efficiency and effectiveness are redefined. Bowers (1988) notes that technology's underlying metaphor involves viewing the world as a machine, and the task of the mind is rational and calculatory: simply to re-engineer the various systems in order to improve prediction, control, and efficiency. Other forms of knowing, which enable us to be effective cultural beings, are discounted or devalued in a technological curriculum. As he puts it:

> the technicist mind-set (as formed by instrumental reason) privileges experimental innovation over substantive tradition, abstract and theoretical ways of thinking over implicit forms of understanding, the autonomous individual over the collective memory and interdependence of the cultural group, and a reductionist, materialistic view of reality that denigrates the forms of spiritual discipline necessary for living harmoniously. (1988, p. 9)

There is an ideology in the invisible pedagogical dimensions of the electronic learning environment. Again, Bowers characterizes the nature of the literacy that instrumental reason priviliges through information technologies:

> The sender-receiver model of thought and communication (or input-output, to stay with the jargon associated with computers) reinforces the view that the ideas, information, and data that are transmitted through the language are objective. That is, the human authorship of the knowledge is obscured....The interactive language of the microcomputer is represented as the conduit through which the objective information...flows. (1988, pp. 42-43)

It should be noted that implicit within this critique is the rejection of computers as mere tools. Their value in teaching and learning is not simply a matter of adequately supporting the needs of the user to acquire the necessary skills, attitudes, objectives, and behaviors to use new instructional technology or methods effectively.

Another important issue is the power that schools have (although not exclusively) to influence "patterns of social interaction, the legitimation of what constitutes knowledge, the political ideology reinforced by the content of educational experience, and how educational computing in the classroom mediates and transforms the cultural transmission process" (Bowers, 1988a, p. 41). Sloan (1984) has argued persuasively for what he calls the role of "image" in thinking. He suggests that new insights present themselves in new images. They form and underlie thought, even though they must then be developed through more formal logical and calculatory forms of thinking. A rich vital imagery and imagery-making capacity of the mind are essential for new insight. Images, he argues, will shape the kind of world we come to know, the kind of world we give ourselves. "It is particularly in relation to the centrality of the image in all thinking that much serious thought must

be given to the appropriate educational use of the computer with its powerful but highly specific, and exceeding limited, form of imagery" (p. 6). The computer and its function—both symbolic and actual—represent and reproduce a mechanistic imagery, basically reproductive of the instrumental reason which has come to dominate our age. Normative questions about educational meaning and purposes come dangerously close to becoming issues of technical or systems adjustments. This critical literature naturally forces us to reconsider basic normative questions.

Closely linked with Sloan's concept of images is the danger of confusing information with ideas. Rozak (1986) argues that information does not create ideas; they are generated, revised, or unseated by other ideas. He concludes that the principal task of education should be to teach young minds how to deal with ideas, evaluatively and adaptively—not coincidentally an educational value stressed in both a post-industrial economy and a critical public democracy. Images and ideas imply a domain of knowledge which is outside of but not exclusive of the technical, measurable, and observable. John Davy (1984) writes, "Computers, by their very nature, and whether operated with LOGO or otherwise, are potent training grounds for thinking about thinking in purely functional, operational, and instrumental terms" (p. 19). Using the metaphor of light for the computer, he too warns us that the "light is flat, and there is little room to move around. Compared to the mysteries of hide-and-seek among moving shadows, it is a limited world...it is sited on the slopes of the mountain of instrumental reason" (pp. 19-20).

Dewey (1936) wrote about collateral learning, a phenomenon which he referred to as what is learned in addition to the obvious lesson at hand. To ignore this domain is, he thought, a great pedagogical fallacy, an educational blind spot. This idea provides a focus point and summary of the problems of educational information technologies and literacy, instrumental reason, and cultural reproduction. As Harriet Cuffaro (1984) writes:

> It is the presence of these collateral learnings—the distance and narrowing of the physical reality, the magical quality of pressing keys, the "invisible" sharing of control, the oversimplification of process, the need for precision and timing—that merit great attention when thinking about young children's learning and the use of microcomputers. (p. 23)

Education, Economic Agendas, Technology, and Corporate Control

All forms of educational technology have generated a good deal of critical inquiry into the relationship between schools and economic agendas. Areas of major concern are: the empowerment of a technological imperative and elite; schools as market outlets for technology; a critique of the mantra of the social and economic need for "computer literacy"; and lastly, the potential demise of schools as public spaces devoted to critical forms of literacy for democratic ends. At the core of this area of inquiry is the commitment to be absolutely clear about issues of power

and control in any shift to an educational environment saturated with technologies. Again, Buschman (1993) has summarized some of the important issues like: technological forms of censorship, privatization, and market control of information and their formats. He and Jansen (1993) both recognize the tendency for corporate centralization and control of distribution and production of networks, databases, and the soft and hardware to run them. As these become more important and profitable, the control of these systems may well come to resemble cable and network television: an influential and closely guarded source of cultural power.

As schools become more reliant upon technologies and more characterized by them, they also become more reliant on those who provide the databases, software, hardware, etc. Issues of the source and control of data and access must therefore become important to educators. Hurly and Hlynka (1982) have already noted how this scenario would serve to empower a technological elite. If it does not, then the ability of private industry to shape and guide curricula will be greatly enhanced. A low-tech example of corporate-produced educational videotapes illustrates this well. In the absence of adequate budgets to purchase good quality supplementary video materials, private corporations have stepped in with free, but highly biased, educative materials of relevance to their industries (Ryan, 1994). Schools could become unquestioning outlets for more sophisticated—and biased—"teaching" products.

Apple (1986) questions the ideological and ethical issues concerning what schools should be about and whose interests they should serve:

> The language of efficiency, production, standards, cost-effectiveness, job skills, work, discipline, and so on—all defined by powerful groups and always threatening to become the dominant way we think about schooling—has begun to push aside concerns for a democratic curriculum, teacher autonomy, and class, gender, and race equality. (p. 153)

The early critics of computers in education also questioned whether a high tech revolution in our schools would usher in a new era of productivity and economic power for the United States. The huge influx of information technologies into business in the last decade or so has not resulted in the expected productivity gains. Harvard economist Gary Lugman states that "at a time when the economy has increased its spending on computers quite dramatically, and...the number of people employed either producing or using information technology has grown enormously..., real wages have failed to grow and the economy has generally deteriorated" (National Public Radio, 1992). When examined closely, educational technology and economic productivity have little relation to one another. The occupations that have grown the most include mostly service jobs—building custodians, cashiers, secretaries, office workers, waiters, truck drivers, and health workers. This is certainly not a prescription for high tech literacy. In fact it is estimated by economic forecasters that only about 25 percent of jobs will require people with a

college degree (Apple, 1986). It could be argued that the widespread automation of manufacturing and business actually created a net loss in jobs, especially among women.

What then might be the reason for the technological push in education? Is it to produce more critical thinkers? Even if educational technologies did foster critical thought—which many believe they do not—there is little objective data confirming the assertion that computer programming enhances intellectual functioning or problem-solving and what students do learn by programming computers has little carry over into non-computer situations (see Sloan, p. 66; Cuban, p. 94). Indeed, when the National Academy of Sciences put together a conference on promoting advanced technology as a means to "reinvent schools," no sessions were scheduled to present research to support this vision (Cordes, 1994). Apple (1986) and Noble (1984) believe that computer literacy (and by extension educational technology) does not prepare people for potent, intellectual work, and even if it did, such work will be a rare commodity in tomorrow's labor market.

The ideology of computer literacy, fueled by visions of economic recovery, serves as a form of educational practice which does not seem to include critical social or political analysis or a vision other than a high-tech future. It exploits the corporate assertion that the information age is already here and that if we don't hurry we'll be left behind. The debate about technology and computer literacy in our schools has become seriously depoliticized and irrational. We are left to believe that all other forms of education are valueless in that they have no economic clout and are not translatable into spendable and powerful social currency. Creating spaces for critique and possibilities for alternative technological scenarios could become quite difficult in this environment.

We may (or may not) have moved beyond a simplistic economic mantra for the widescale introduction of educational technologies in our schools, but the under-lying economic imperatives for such a move remain the same in the technology-based restructuring literature. The basic issue of economic imperatives for public instituions has been nicely explicated by Henry Giroux (1984). He describes a *de facto* change in public policy regarding educational issues. The danger, as he sees it, is that as an ideal, a model of economic rationality, is becoming the basis for new relationships between schools as public institutions and the private economic sector. This model represents an ideology that undermines the importance of critical public spheres, where the capacity for learning is not defined by economic or technical considerations. Giroux suggests that this poses a direct threat to the public good, because such a view of public policy provides the philosophical basis for launching an assault on the relevance of any public sphere dedicated to goals other than those which can directly benefit the economic needs of corporate America or its inherent technical logic (see also Giroux, 1981). We must ask what is being lost educationally in terms of democratic issues, human development for all of our citizens, and spaces for critical inquiry which are not beholden to such economically

reductive ideologies and pressures. He ends by stressing the need to construct a public philosophy that is committed to "developing forms of knowledge, pedagogy, evaluation, and research that promote critical literacy and civic courage" (Giroux, 1984, p. 194). I would argue that this is fundamental to the potential of the restructuring movement. The emphasis on democratic educational practices and ends, which I have argued should be central to restructuring, comes finally to rest upon such key ideas of the public good, and against which Giroux forcefully defines technical and economic agendas.

Conclusion

In this paper I have suggested that the democratic facets of the current school restructuring movement should be assessed by how they contribute to empowered teachers and students, critical forms of knowledge, and those school structures which enable both. It is in these broad areas that I find tensions with the reintroduction of information and educational technologies. In reviewing the arguments for technology's role in restructuring, I would characterize that literature as less than critical. To paraphrase Roszak, while these technologies may well become decent public servants, the "overdressed" claims made on their behalf are overwhelming. Despite conscious attempts to distance the new push for information technologies within the restructuring movement from the earlier —failed—push for computers in classrooms, I have found remarkable consistency in the inherent assumptions of both technological movements. The critical-theoretical literature of a decade ago raised serious questions about the role of technology in schools. Given the current, similar push for educational technologies in restructuring, that literature still holds insight for us.

Questions about the effect of the new technology on teacher work remain central. If restructuring is to be democratic in nature, reforms must empower—and not deskill—teachers. The concept of who controls the "shop floor" is at the center of this issue. Insofar as the Performance and Educational Technologists have suggested that schools be redesigned first for the effective use of technology, then teachers' control over classrooms, curricula, and materials may be severely limited. The idea of technology itself serving as a platform for school restructuring suggests that restructuring practices and goals be subservient to the nature of the machinery.

To what degree will the investment in new technologies require their use? Will these information technologies preclude other non-technological teaching practices? I recognize that most schools are not yet ready to be technologically saturated, but schemes are on the immediate horizon. For example, there is Chris Whittle's Project Edison and Perelman's call for the actual elimination of public schools, both of which feature technology at the center of their curricular proposals. As schools become more connected to, and dependent upon, technological resources, the results may empower an elite outside of teachers and other professionals' control. Schools could become nothing more than marketplaces for these privately con-

trolled resources.

Questions regarding knowledge and its meanings are critical areas of tension as well. I stated that the related issues of empowered students and critical forms of knowledge should be central to democratic restructuring. Again, the early critiques of computers in the classroom suggested that information technologies have an epistemological influence in the classroom which has been characterized as overly instrumental, decontextualized, and limited to the characteristics of the machine. Obviously, this is not the formula envisioned for the education of a critical and empowered citizenry. How will students come to view information in relation to knowledge? Will these become synonymous terms? What happens to critical ways of viewing the world which are outside of the domain of technical and empirical rationality? I question the fate of the organic and complex activities of teaching informed by notions of knowledge as internal, subjective, and contextual within a restructuring movement that defines teaching and learning by its machinery. The current Performance and Educational Technology literature has yet to address the epistemological limits or biases of the technologies. The implications are that students can learn vastly more, and at higher cognitive levels. The question still remains—what will they be learning? Hubert Dreyfus (1992) suggests that, even at the highest levels of power, machines can not grasp or replicate the human capacity to learn from metaphors, the environment, our physical experience, and language (p. ix-xii).

A final area of concern is the relationship of technology to school structures and economic agendas. I suggested that the last touchstone of democratically restructured schools was the creation of structures which enabled and sustained teacher/student empowerment and critical forms of knowledge. Giroux's commentary on the nature of our new public philosophy and its power to frame the aims of public education summarizes the tensions between democratic and capitalist economic values. A whole host of issues fall under this area. Most important is the school's ability to sustain itself as a public institution not solely harnessed to notions of economic expansion and productivity. If this is the purpose of public education, then one must question whether there are real possibilities for structures which enable teacher/student empowerment and critical forms of knowledge to develop. Early critiques of computers in classrooms clearly suggested the presence and the reproduction of an economic and technical agenda in this movement, and this still seems to permeate the assumptions guiding the push for educational technologies in the restructuring reforms. Restructuring is hinged upon the decentralized autonomy of schools and teachers to shape educuational aims, structures, and practices. The technology-based restructuring literature still contains an emphasis on preparing students for a high-tech employment future, and the proposals for restructured schools reflect those concerns.

Let me return to the original question which began this inquiry: are educational technolgies and school restructuring appropriate partners? I have no definitive

answer, but a review of the literature dealing with the role of technology in re-structuring reveals some older, unanswered questions. This literature has effectively exploited the democratic rhetoric of restructuring, and, in fact, has even suggested that technology will enhance the realization of those goals. However, the essential problems raised by the earlier critical-theoretical literature on computers in classrooms remain unresolved. It is these tensions which suggest that a more careful and skeptical view must be taken of technology in restructuring. The technology industries and their enthusiasts must not be allowed to define their role in our schools or the restructuring movement. It may be a risk, but I would suggest that educators have not had the best track record in resisting such hype and giving thoughtful reflection to educational reforms or technologies. Somewhere, there is a graveyard littered with silly and useless educational fads—and the budgets that supported them.

It is the particular genius of the current reform movement that it allows for and requires such reflection. We should not squander this opportunity on the search for yet another "magic bullet" for our problems. The unfixing of the factory-like routinized education system opening out to a more fluid and participatory community must be a reform nurtured by and strongly committed to democratic goals. Murphy notes that restructured schools "reveal a reorientation from control to empowerment" (p. 18). Empowerment must not come to mean the ability to follow rule A rather than rule B. It must mean thoughtful analysis of the rules themselves and the ability and confidence to re/create practices and contexts. In answering the question I posed, I would say that yes, technologies have a role to play in restructuring, but not as an equal partner, and certainly not in the way that role is being currently formulated. The democratic ends of restructuring must come first, and only later can we envision the technological tools which may further those ends. We must never forget that, although we are a society in love with our machines and what we believe they can do for us, the machines embody social, human, and value choices. Apple (1986) best summarized this when he wrote that the choices we face "are fundamentally choices about the kind of society we shall have and about the social and ethical responsiveness of our institutions to the majority of our future citizens" (p. 174).

Notes

1. Portions of this paper are based on my chapter entitled "Critical Scholarship on Computers in Education: A Summary Review" in the book *Critical Approaches to Information Technology in Librarianship: Foundations and Applications* edited by John Buschman, Westport, CT: Greenwood Press, 1993.
2. Perhaps the most succinct and thorough description of what I mean by technology can be found in Balabanian. (1993) He notes that

contemporary technology can not be understood without considering at least the following dimensions or elements: 1. Physical Objects [i.e.] hardware.., structures.., materials... 2. Knowledge [i.e.] procedures, methods, processes

and technique. Accumulated knowledge is as much a part of technology as a machine... 3. Personnel [i.e.] standardized people, largely interchangeable with one another... 4. Organization and System [i.e.] organized structure, the mechanisms of management and control, the integrated systems...that tie together hardware, technique, and personnel with the social institutions... 5. Political and Economic Power. (pp. 17-18)

Elsewhere, Slaby (1993) echoes these same points when he argues that the definition of technology "must encompass global concepts rather than those limited in scope and vision to purely mechanical items" (pp. 105-110). It is this conception of technology embedded in classrooms, schools, and systems of schooling that I will be addressing.

3. Indeed, highly skilled and abstract forms of work are by no means immune to deskilling. Dennett (1986) notes the gradual encroachment of diagnostic systems on physician's work. His point was made crystal clear by the Vice President of a prestigious medical school who stated flatly, "The physician no longer has the kind of academic freedom to say 'I'm going to do it my way....' There's a body of knowledge showing that there's a preferred way and he better damn well do it the preferred way" (Drake, 1988).

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