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The Politics of Technology

In our society, technology is seen as an autonomous process. It is set apart and viewed as if it had a life of its own, independent of social intentions, power, and privilege. We examine technology as if it were something constantly changing and as something that is constantly changing our lives in schools and elsewhere. This is partly true, of course, and is fine as far as it goes. However, by focusing on what is changing and being changed, we may neglect to ask what relationships are remaining the same. Among the most important of these relationships are the sets of cultural and economic inequalities that dominate even societies like our own.[1]

By thinking of technology in this way, by closely examining whether the changes associated with "technological progress" are really changes in certain relationships after all, we can begin to ask political questions about their causes and, especially, their multitudinous effects: Whose idea of progress? Progress for what? And fundamentally, who benefits?[2] These questions may seem rather weighty ones to be asking about schools and about current or proposed curricular and teaching practices. Yet, we are in the midst of one of those many educational bandwagons that governments, industry, and others so like to ride. This wagon is pulled in the direction of a technological workplace and carries a heavy load of computers as its cargo.

The growth of the new technology in schools is definitely not what one would call a slow movement. In one recent year, there was a 56% reported increase in the use of computers in schools in the United States, and even this may be a conservative estimate. Of the 25,642 schools surveyed, over 15,000 schools reported some computer usage.[3] In the United States alone, it is estimated that over 350,000 microcomputers have been introduced into the public schools in the past four years.[4] This is a trend that shows no sign of abating. Nor is this phenomenon only limited to the United States. France, Canada, England, Australia, and many other countries have "recognized the future." At its center seems to sit a machine with a keyboard and a screen.

I say "at its center," since in both governmental agencies and in schools themselves the computer and the new technology have been seen as something of a savior economically and pedagogically. "High tech" will save declining economies and will save our students and teachers in schools. In the latter, it is truly remarkable how wide a path the computer is now cutting.

The expansion of its use, as well as the tendency to see all areas of education as a unified terrain for the growth in use of new technologies, can be seen in a two-day

workshop on integrating the microcomputer into the classroom held at the University of Wisconsin, Madison. Among the topics covered were computer applications in writing instruction, in music education, in secondary science and mathematics, in primary language arts, in business education, in health occupation training programs, in art, in social studies. To this are added applications for the handicapped and for teacher record keeping and management as well as a series of sessions on the "electronic office," how technology and automation are helping industry, and how we all can "transcend the terror" of technology.[5]

Two things are evident from this list. First, vast areas of school life are now seen to be within the legitimate purview of technological restructuring. Second, there is a partly hidden but exceptionally close linkage between computers in schools and the needs of management for automated industries, electronic offices, and "skilled" personnel. Thus, recognizing both what is happening inside and outside of schools and the connections between these areas is critical to any understanding of what is likely to happen with the new technologies, especially the computer, in education.

As I have argued elsewhere, all too often educational debates are increasingly limited to technical issues. Questions of "how to" have replaced questions of "why."[6] This paper reverses this tendency. I want us to consider a number of rather difficult political, economic, and ethical issues about some of the tendencies in schools and the larger society that may make us want to be very cautious about the current technological bandwagon in education. In so doing, a range of areas will need to be examined: Behind the slogans of technological progress and high tech industry, what are some of real effects of the new technology on the future labor market? What may happen to teaching and curriculum if we do not think carefully about the new technology's place in the classroom? Will the growing focus on technological expertise, particularly computer literacy, equalize or further exacerbate the lack of social opportunities for our most disadvantaged students?

At root, my claim will be that the debate about the role of the new technology in society and in schools is not and must not be just about the technical correctness of what computers can and cannot do. These may, in fact, be the least important kinds of questions. At the very core of the debate instead are the ideological and ethical issues concerning what schools should be about and whose interests they should serve.[7] The question of interests is currently very important since, as a result of the severe problems currently besetting economies like our own, a restructuring of what schools are *for* has reached a rather advanced stage.

Thus, while there has always been a relatively close connection between the two, there is now an even closer relationship between the curriculum in our schools and corporate needs.[8] In a number of countries, educational officials and policy makers, legislators, curriculum workers, and others have been subject to immense pressure to make the "needs" of business and industry the primary goals of the school system. Economic and ideological pressures have become rather intense and often very overt. 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[9]—has begun to push aside concerns for a democratic curriculum, teacher autonomy, and class, gender, and

race inequality. Yet, we cannot fully understand the implications of the new technology in this restructuring unless we gain a more complete idea of what industry is now doing not only in the schools but in the economy as well.

Technological Myths and Economic Realities

Let us look at the larger society first. It is claimed that the technological needs of the economy are such that unless we have a technologically literate labor force we will ultimately become outmoded economically. But what will this labor force actually look like?

A helpful way of thinking about this is to use the concepts of increasing *proletarianization* and *deskilling* of jobs. These concepts signify a complex historical process in which the control of labor has altered, one in which the skills that workers have developed over many years are broken down and reduced to their atomistic units, automated, and redefined by management to enhance profit levels, efficiency and control. In the process, the employee's control of timing, over defining the most appropriate way to do a task, and over criteria that establish acceptable performance are slowly taken over as the prerogatives of management personnel who are usually divorced from the place where the actual labor is carried out. Loss of control by the worker is almost always the result. Pay is often lowered. And the job itself becomes routinized, boring, and alienating as conception is separated from execution and more and more aspects of jobs are rationalized to bring them into line with management's need for a tighter economic and ideological ship.[10] Finally, and very importantly, many of these jobs may simply disappear.

There is no doubt that the rapid developments in such high-tech areas as microelectronics, genetic engineering, and associated "biological technologies" are partly transforming work in a large number of sectors in the economy. This may lead to economic prosperity in certain sections of our population, but its other effects may be devastating. Thus, as R.W. Rumberger and H.M. Levin demonstrate in a study that examined the impact of new technologies on the future labor market:

> This transformation . . . may stimulate economic growth and competition in the world marketplace, but it will displace thousands of workers and could sustain high unemployment for many years. It may provide increased job opportunities for engineers, computer operators, and robot technicians, but it also promises to generate an even greater number of low level, service jobs such as those of janitors, cashiers, clericals, and food service workers. And while many more workers will be using computers, automated office equipment, and other sophisticated technical devices in their jobs, the increased use of technology may actually reduce the skills and discretion required to perform many jobs. [11]

Let us examine this scenario in greater detail.

Rumberger and Levin make a distinction that is very useful to this discussion. They differentiate between high-tech industries and high-tech occupations, in essence

between what is made and the kinds of jobs these goods require. High-tech industries that manufacture technical devices such as computers, electronic components and the like currently employ less than 15% of the paid work force in the United States and other industrialized nations. Just as importantly, a substantial knowledge of technology is required by *less than one fourth* of all occupations within these industries. On the contrary, the largest share of jobs created by high-tech industries are in areas such as clerical and office work or in production and assembly. These actually pay below average wages.[12] Yet this is not all. High-tech occupations that do require considerable skill—such as computer specialists and engineers—may indeed expand. However, most of these occupations actually "employ relatively few workers compared to many traditional clerical and service fields."[13] Rumberger and Levin summarize a number of these points by stating that "although the percentage growth rate of occupational employment in such high technology fields as engineering and computer programming was higher than the overall growth rate of jobs, far more jobs would be created in low-skilled clerical and service occupations than in high technology ones."[14]

Some of these claims are supported by the following data. It is estimated that even being generous in one's projections, only 17% of new jobs that will be created between now and 1995 will be in high-tech industries. (Less generous and more restrictive projections argue that only 3 to 8% of future jobs will be in such industries.) [15] Such jobs, though, will not be all equal; clerical positions, secretaries, assemblers, and warehouse personnel will be the largest occupations within the industry. If we take the electronic components industry in the late 1970s as an example, this is made much clearer. Engineering, science, and computing occupations constituted approximately 15% of all workers in this industry. The majority of the rest of the workers were engaged in low wage assembly work. Thus, in the late 1970s, nearly two thirds of all workers in the electronic components industry took home hourly wages "that placed them in the bottom third of the national distribution."[16] If we take the archetypical high-tech industry—computer and data processing—and decompose its labor market, we get similar results. In 1980, technologically oriented and skilled jobs accounted for only 26% of the total.[17]

These figures have considerable weight, but they are made even more significant by the fact that many of that 26% may themselves experience a deskilling process in the near future. Deskilling is the reduction of jobs down into simpler and atomistic components and the separation of conception from execution, this trend that has had such a major impact on the labor process of blue, pink, and white collar workers in so many other areas is now advancing into high technology jobs as well. Computer programming provides an excellent example. New developments in software packages and machine language and design have meant that a considerable portion of the job of programming now requires little more than performing "standard, routine, machine-like tasks that require little in-depth knowledge."[18]

What does this mean for the schooling process and the seemingly widespread belief that the future world of work will require increasing technical competence on the part of all students? Consider the occupations that will contribute the largest number of jobs not just in high-tech industries but throughout the society by 1995. Economic

forecasts indicate that these will include building custodians, cashiers, secretaries, office clerks, nurses, waiters and waitresses, elementary school teachers, truck drivers, and other health workers such as nurses aides and orderlies.[19] None of these are directly related to high technology. Excluding teachers and nurses, none of them requires any post secondary education. (Their earnings will be approximately 30% below the current average earnings of workers, as well.)[20] If we go further than this and examine an even larger segment of expected new jobs by including the forty job categories that will probably account for about one half of all the jobs that will be created, it is estimated that only about 25% will require people with a college degree.[21]

In many ways, this is strongly related to the effects of the new technology on the job market and the labor process in general. Skill levels will be raised in some areas, but will decline in many others, as will jobs themselves decline. For instance, "a recent study of robotics in the United States suggests that robots will eliminate 100,000 to 200,000 jobs by 1990, while creating 32,000 to 64,000 jobs."[22] My point about declining skill requirements is made nicely by Rumberger and Levin. As they suggest, while it is usually assumed that workers will need computer programming and other sophisticated skills because of the greater use of technology such as computers in their jobs, the ultimate effect of such technology may be somewhat different: "A variety of evidence suggests just the opposite: as machines become more sophisticated, with expanded memories, more computational ability, and sensory capabilities, the knowledge required to use the devices declines."[23] The effect of these trends on the division of labor will be felt for decades. But it will be in the sexual division of labor where it will be even more extreme. Since historically *women's work* has been subject to these processes in very powerful ways, we shall see increased proletarianization and deskilling of women's labor and, undoubtedly, a further increase in the feminization of poverty.[24]

These points clearly have implications for our educational programs. We need to think much more rigorously about what they mean for our transition from school to work programs, especially since many of the "skills" that schools are currently teaching are transitory because the jobs themselves are being transformed (or lost) by new technological developments and new management offensives.

Take office work, for example. In offices, the bulk of the new technology has not been designed to enhance the quality of the job for the largest portion of the employees (usually women clerical workers). Rather it has usually been designed and implemented in such a way that exactly the opposite will result. Instead of accommodating stimulating and satisfying work, the technology is there to make managers' jobs "easier," to eliminate jobs and cut costs, to divide work into routine and atomized tasks, and to make administrative control more easily accomplished.[25] The vision of the future society seen in the microcosm of the office is inherently undemocratic and perhaps increasingly authoritarian. Is this what we wish to prepare our students for? Surely, our task as educators is neither to accept such a future labor market and labor process uncritically nor to have our students accept such practices uncritically as well. To do so is simply to allow the values of a limited but powerful segment of the population to work through us. It may be good business, but I have my doubts about whether it is ethically correct educational policy.

In summary, then, what we will witness is the creation of enhanced jobs for a relative few and deskilled and boring work for the majority. Furthermore, even those boring and deskilled jobs will be increasingly hard to find. Take office work, again, an area that is rapidly being transformed by the new technology. It is estimated that between one and five jobs will be lost for every new computer terminal that is introduced.[26] Yet this situation will not be limited to office work. Even those low paying assembly positions noted earlier will not necessarily be found in the industrialized nations with their increasingly service oriented economies. Given the international division of labor, and what is called "capital flight," a large portion of these jobs will be moved to countries such as the Philippines and Indonesia.[27]

This is exacerbated considerably by the fact that many governments now find "acceptable" those levels of unemployment that would have been considered a crisis a decade ago. "Full employment" in the United States is now often seen as between 7-8% *measured* unemployment. (The actual figures are much higher, of course, especially among minority groups and workers who can only get part-time jobs.) This is a figure that is *double* that of previous economic periods. Even higher rates are now seen as "normal" in other countries. The trend is clear. The future will see fewer jobs. Most of those that are created will not necessarily be fulfilling, nor will they pay well. Finally, the level of technical skill will continue to be lowered for a large portion of them.[28]

Because of this, we need convincing answers to some very important questions about our future society and the economy before we turn our schools into the "production plants" for creating new workers. *Where* will these new jobs be? *How many* will be created. Will they *equal* the number of positions lost in offices, factories, and service jobs in retailing, banks, telecommunications, and elsewhere? Are the bulk of the jobs that will be created relatively unskilled, less than meaningful, and themselves subject to the inexorable logics of management so that they too will be likely to be automated out of existence?[29]

These are not inconsequential questions. Before we give the schools over to the requirements of the new technology and the corporation, we must be very certain that it will benefit all of us, not mostly those who already possess economic and cultural power. This requires continued democratic discussion, not a quick decision based on the economic and political pressure now being placed on schools.

Much more could be said about the future labor market. I urge the interested reader to pursue it in greater depth since it will have a profound impact on our school policies and programs, especially in vocational areas, in working class schools, and among programs for young women. The difficulties with the high-tech vision that permeates the beliefs of the proponents of a technological solution will not remain outside the school door, however. Similar disproportionate benefits and dangers await us inside our educational institutions as well, and it is to this that we shall now turn.

Inequality and the Technological Classroom

Once we go inside the school, a set of questions concerning "who benefits?" also arises. We shall need to ask about what may be happening to teachers and students

given the emphasis now being placed on computers in schools. I shall not talk about the individual teacher or student here. Obviously, some teachers will find their jobs enriched by the new technology and some students will find hidden talents and will excel in a computer-oriented classroom. What we need to ask instead (or at least before we deal with the individual) is what may happen to classrooms, teachers, and students differentially. Once again, I shall seek to raise a set of issues that may not be easy to solve, but cannot be ignored if we are to have a truly democratic educational system in more than name only.

While I have dealt with this in greater detail in *Ideology and Curriculum* and *Education and Power*,[30] let me briefly situate the growth of the technologized classroom into what seems to be occurring to teaching and curriculum in general. Currently, considerable pressure is building to have teaching and school curricula be totally prespecified and tightly controlled for the purposes of "efficiency," "cost effectiveness," and "accountability." In many ways, the deskilling that is affecting jobs in general is now having an impact on teachers as more and more decisions are moving out of their hands and as their jobs become even more difficult to do. This is more advanced in some countries than others, but it is clear that the movement to rationalize and control the act of teaching and the content and evaluation of the curriculum is very real.[31] Even in those countries that have made strides away from centralized examination systems, powerful inspectorates and supervisors, and tightly controlled curricula, there is an identifiable tendency to move back toward state control. Many reforms have only a very tenuous hold currently. This is in part due to economic difficulties and partly due as well to the importing of American styles and techniques of educational management, styles, and techniques that have their roots in industrial bureaucracies and have almost never had democratic aims.[32] Even though a number of teachers may support computer oriented curricula, an emphasis on the new technology needs to be seen in this context of the rationalization of teaching and curricula in general.

Given these pressures, what will happen to teachers if the new technology is accepted uncritically? One of the major effects of the current (over) emphasis on computers in the classroom may be the deskilling and depowering of a considerable number of teachers. Given the already heavy work load of planning, teaching, meetings, and paperwork for most teachers, and given the expense, it is probably wise to assume that the largest portion of teachers will not be given more than a very small amount of training in computers, their social effects, programming, and so on. This will be especially the case at the primary and elementary school level where most teachers are already teaching a wide array of subject areas. Research indicates, in fact, that few teachers in any district are actually given substantial information before computer curricula are implemented. Often only one or two teachers are the "resident experts."[33] Because of this, most teachers have to rely on prepackaged sets of material, existing software, and especially purchased material from any of the scores of software manufacturing firms that are springing up in a largely unregulated way.

The impact of this can be striking. What is happening is the exacerbation of trends we have begun to see in a number of nations. Rather than having the time and the

skill to do their own curriculum planning and deliberation, teachers become isolated executors of someone else's plans, procedures, and evaluative mechanisms. In industrial terms, this is very close to what I noted in my previous discussion of the labor process, the separation of conception from execution.[34]

The reliance on prepackaged software can have a number of long-term effects. First, it can cause a decided loss of important skills and dispositions on the part of teachers. When the skills of local curriculum planning, individual evaluation, and so on are not used, they atrophy. The tendency to look at one's own or one's colleagues' historical experience about curriculum and teaching is lessened as considerably more of the curriculum, and the teaching and evaluative practices that surround it, are viewed as something one purchases. In the process—and this is very important—the school itself is transformed into a lucrative market. The industrialization of the school is complemented, then, by further opening up the classroom to the mass produced commodities of industry. In many ways, it will be a publisher's and saleperson's delight. Whether students' educational experiences will markedly improve is open to question.

The issue of the relationship of purchased software and hardware to the possible deskilling and depowering of teachers does not end here though. The problem is made even more difficult by the rapidity with which software developers have constructed and marketed their products. There is no guarantee that the mass of such material has any major educational value. Exactly the opposite is often the case. One of the most knowledgeable government officials has put it this way: "High quality educational software is almost non-existent in our elementary and secondary schools."[35] While perhaps overstating his case to emphasize his points, the director of software evaluation for one of the largest school systems in the United States has concluded that of the more than 10,000 programs currently available, approximately 200 are educationally significant.[36]

To their credit, this serious problem is recognized by most computer enthusiasts, and reviews and journals have attempted to deal with it. However, the sheer volume of material, the massive amounts of money spent on advertising software in professional publications, at teachers' and administrators' meetings, and so on; the utter "puffery" of the claims made about much of this material, and the constant pressure by industry, government, parents, some school personnel, and others to institute computer programs in schools *immediately*, all of this makes it nearly impossible to do more than make a small dent in the problem. As one educator put it, "There's a lot of junk out there."[37] The situation is not made any easier by the fact that teachers simply do not now have the time thoroughly to evaluate the educational strengths and weaknesses of a considerable portion of the *existing* curricular material and texts before they are used. Adding one more element, and a sizable one at that, to be evaluated only increases the load. Teachers' work is increasingly becoming what students of the labor process call *intensified*. More and more needs to be done; less and less time is available to do it.[38] Thus, one has little choice but to simply buy ready-made material, in this way continuing a trend in which all of the important curricular elements are not locally produced but purchased from commercial sources whose major aim may be profit, not necessarily educational merit.[39]

A significant consideration here, besides the loss of skill and control, is expense. This is at least a three-pronged issue. First, we must recognize that we may be dealing with something of a "zero-sum game." While dropping, the cost of computers is still comparatively high, though some manufacturers may keep purchase costs relatively low, knowing that a good deal of their profits may come from the purchase of software later on or through a home/school connection. This money for the new technology *must come from somewhere*. This is an obvious point but one that is very consequential. In a time of fiscal crisis, where funds are already spread too thinly and necessary programs are being starved in many areas, the addition of computer curricula most often means that money must be drained from one area and given to another. What will be sacrificed? If history is any indication, it may be programs that have benefited the least advantaged. Little serious attention has been paid to this, but it will become an increasingly serious dilemma.

A second issue of expense concerns staffing patterns, for it is not just the content of teachers' work and the growth of purchased materials that are at stake. Teachers' jobs themselves are on the line. At a secondary school level in many nations, for example, lay-offs of teachers have not been unusual as funding for education is cut. Declining enrollment in some regions has meant a loss of positions as well. This has caused intense competition over students within the school itself. Social studies, art, music, and other subjects must fight it out with newer, more "glamorous" subject areas. To lose the student numbers game for too long is to lose a job. The effect of the computer in this situation has been to increase competitiveness among staff, often to replace substance with both gloss and attractive packaging of courses, and to threaten many teachers with the loss of their livelihood.[40] Is it really an educationally or socially wise decision tacitly to eliminate a good deal of the choices in these other fields so that we can support the "glamour" of a computer future? These are not only financial decisions, but also ethical decisions about teachers' lives and about subjects in which our students are to be educated. Given the future labor market, do we really want to claim that computers will be more important than further work in humanities and social sciences or, perhaps even more significantly for working class and ethnically diverse areas, in the students' own cultural, historical, and political heritage and struggles? Such decisions must not be made by only looking at the accountant's bottom line. These, too, need to be arrived at by the lengthy democratic deliberation of all parties, including the teachers who will be most affected.

Third, given the expense of microcomputers and software in schools, the pressure to introduce such technology may increase the already wide social imbalances that now exist. Private schools to which the affluent send their children and publicly funded schools in more affluent areas will have more ready access to the technology itself.[41] Schools in inner city, rural, and poor areas will be largely priced out of the market, even if the cost of "hardware" continues to decline. After all, in these poorer areas and in many public school systems, it is already difficult to generate enough money to purchase new textbooks and to cover the costs of teachers' salaries. Thus, the computer and computer literacy will "naturally" generate further inequalities. The impact will be enormous. The top 20 percent of the population will have

computers in their homes[42] and in their offices. The institutions of higher education to which their children will be applying will either ask for or assume "computer skills" as keys of entry or advancement.

The role of the relatively affluent parent in this situation does not go unrecognized by computer manufacturers.

> Computer companies . . . gear much of their advertising to the educational possibilities of computers. The drive to link particular computers to schools is a frantic competition. Apple, for example, in a highly touted scheme proposed to "donate" an Apple to every school in America. Issues of philanthropy and intent aside, the clear market strategy is to couple particular computer usages to schools where parents—especially middle class parents with the economic wherewithal and keen motivation [to insure mobility]—purchase machines compatible with those in schools. The potentially most lucrative part of such a scheme, however, is not in the purchase of hardware (although this is also substantial) but in the sale of proprietary software.[43]

This very coupling of school and home markets, then, cannot fail further to disadvantage large groups of students. Those students who already have computer backgrounds—be it because of their schools or their homes or both—will proceed more rapidly. The social stratification of life chances will increase. These students' original advantage—one not due to "natural ability," but to *wealth*—will be heightened.[44]

We should not be surprised by this, nor should we think it odd that many parents, especially middle class parents, will pursue a computer future. Computer skills and "literacy" are partly a strategy for the maintenance of middle class mobility patterns.[45] Having such expertise, in a time of fiscal and economic crisis, is like having an insurance policy. It partly guarantees that certain doors remain open in a rapidly changing labor market. In a time of credential inflation, more credentials mean fewer closed doors.[46]

The credential factor here is of considerable moment. In the past, as gains were made by different ethnic groups, working class groups, women, and others in schooling, one of the latent effects was to raise the credentials required by entire sectors of jobs. Thus, class, race, and gender barriers were partly maintained by an ever increasing credential inflation. Though this was more of a structural than a conscious process, the effect over time has often been again to disqualify entire segments of a population from jobs, resources, and power. This, too, may be a latent outcome of the computerization of the school curriculum. Even though the bulk of new jobs will not require "computer literacy," the establishment of computer requirements and mandated programs in schools will condemn many people to even greater economic disenfranchisement. Since the requirements are in many ways artificial—computer knowledge will not be so very necessary and the number of jobs requiring high levels of expertise will be relatively small—we will simply be affixing one more label to these students. "Functional illiteracy" will simply be broadened to include computers.[47]

Thus, rather than blaming an unequal economy and a situation in which meaningful and fulfilling work is not made available, rather than seeing how the new

technology for all its benefits is "creating a growing underclass of displaced and marginal workers," the lack is personalized. It becomes the students' or workers' fault for not being computer literate. One significant social and ideological outcome of computer requirements in schools, then, is that they can serve as a means "to justify those lost lives by a process of mass disqualification, which throws the blame for disenfranchisement in education and employment back on the victims themselves."[48]

Of course, this process may not be visible to many parents of individual children. However, the point does not revolve around the question of individual mobility, but large scale effects. Parents may see such programs as offering important paths to advancement, and some will be correct. However, in a time of severe economic problems, parents tend to overestimate what schools can do for their children.[49] As I documented earlier, there simply will not be sufficient jobs and competition will be intense. The uncritical introduction of and investment in hardware and software will by and large hide the reality of the transformation of the labor market, and it will support those who are already advantaged unless thought is given to these implications now.

Let us suppose, however, that it was important that everyone become computer literate and that these large investments in time, money, and personnel were indeed so necessary for our economic and educational future. Given all this, what is currently happening in schools? Is inequality in access and outcome now being produced? While many educators are continually struggling against these effects, we are already seeing signs that inequality is being produced.

There is evidence of class, race, and gender based disadvantage in computer use. In middle class schools, for example, the number of computers is considerably more than in working class or inner city schools populated by children of color. The ratio of computers to children is also much higher. This in itself is an unfortunate finding. However, something else must be added here. These more economically advantaged schools not only have more contact hours and more technical and teacher support, but the very manner in which the computer is used is often different than what would be generally found in schools in less advantaged areas. Programming skills, generalizability, a sense of the multitudinous things one can do with computers both within and across academic areas, tend to be stressed more (though drill and practice uses are still widespread even here).[50] Compare this to the rote, mechanistic, and relatively low level uses that tend to dominate the working class school.[51] These differences are not unimportant, for they signify a ratification of class divisions.

Further evidence to support these claims is now becoming more readily available as researchers dig beneath the glowing claims of a computer future for all children. The differential impact is made clearer in the following figures. In the United States, while over two thirds of the schools in affluent areas have computers, only approximately 41% of the poorer public schools have them. What one does with the machine is just as important as having one, of course, and here the differences are again very real. One study of poorer elementary schools found that white children were four times more likely than black children to use computers for programming. Another found that the children of professionals employed computers for program-

ming and for other "creative" uses. Non-professional children were more apt to use them for drill and practice in mathematics and reading, and for "vocational" work. In general, in fact, "programming has been seen as the purview of the gifted and talented" and of those students who are more affluent. Less affluent students seem to find that the computer is only a tool for drill and practice sessions.[52]

Gender differences are also very visible. Two out of every three students currently learning about computers are boys. Even here these data are deceptive since girls "tend to be clustered in the general introductory courses," not the more advanced levels.[53] One current analyst summarizes the situation in a very clear manner.

> While stories abound about students who will do just about anything to increase their access to computers, most youngsters working with school computers are [economically advantaged] white and male. The ever-growing number of private computer camps, after-school and weekend programs serve middle class white boys. Most minority [and poor] parents just can't afford to send their children to participate in these programs.[54]

This class, race, and gender impact will also occur because of traditional school practices such as tracking or streaming. Thus, vocational and business tracks will learn operating skills for word processing and will be primarily filled with (working class) young women.[55] Academic tracks will stress more general programming abilities and uses and will be disproportionately male.[56] Since computer programs usually have their home bases in mathematics and science in most schools, gender differences can be heightened even more given the often differential treatment of girls in these classes and the ways in which mathematics and science curricula already fulfill "the selective function of the school and contribute to the reproduction of gender differences."[57] While many teachers and curriculum workers have devoted considerable time and effort to equalize both the opportunities and outcomes of female students in mathematics and science (and such efforts are important), the problem still remains a substantive one. It can be worsened by the computerization of these subjects.

Towards Social Literacy

We have seen some of the possible negative consequences of the new technology in education, including the deskilling and depowering of teachers and the creation of inequalities through expense, credential inflation, and limitations on access. Yet it is important to realize that the issues surrounding the deskilling process are not limited to teachers. They include the very ways students themselves are taught to think about their education, their future roles in society, and the place of technology in that society.

The new technology is not just an assemblage of machines and their accompanying software. It embodies a *form of thinking* that orients a person to approach the world in a particular way. Computers involve ways of thinking that are primarily *technical*.[58] The more the new technology transforms the classroom into its own image, the more a technical logic will replace critical political and ethical understanding. The discourse of the classroom will center on technique, and less on substance. Once

again "how to" will replace "why," but this time at the level of the student. This situation requires a response in the form of social, not technical, literacy for all students.

Even if computers make sense technically in all curricular areas and even if all students, not mainly affluent white males, become technically proficient in their use, critical questions of politics and ethics remain to be dealt with in the curriculum. Thus, it is crucial that whenever the new technology is introduced into schools students have a serious understanding of the issues surrounding their larger social effects.

Unfortunately, this is not often the case. When the social and ethical impacts of computers are dealt with, they are usually addressed in a manner that is less than powerful. One example is provided by a recent proposal for a statewide computer curriculum in one of the larger states in the United States. The objectives that dealt with social questions in the curriculum centered around one particular set of issues. The curriculum states that "the student will be aware of some of the major uses of computers in modern society...and the student will be aware of career opportunities related to computers."[59] In most curricula the technical components of the new technology are stressed. Brief glances are given to the history of computers (occasionally mentioning the role of women in their development, which is at least one positive sign). Yet in this history, the close relationship between military use and computer development is largely absent. "Benign" uses are pointed to, coupled with a less than realistic description of the content and possibility of computer careers and what Douglas Noble has called "a gee-whiz glance at the marvels of the future." What is nearly never mentioned is job loss or social disenfranchisement. The very real destruction of the lives of unemployed autoworkers, assemblers, or clerical workers is marginalized.[60] The ethical dilemmas involved when we choose between, say, "efficiency" and the quality of the work people experience, between profit and someone's job, these too are made invisible.

How would we counterbalance this? By making it clear from the outset that knowledge about the new technology that is necessary for students to know goes well beyond what we now too easily take for granted. A considerable portion of the curriculum would be organized around questions concerned with social literacy. "Where are computers used? What are they used to do? What do people actually need to know in order to use them? Does the computer enhance anyone's life? Whose? Does it hurt anyone's life? Whose? Who decides when and where computers will be used?[61] Unless these are fully integrated in a school program at all levels, I would hesitate advocating the use of the new technology in the curriculum. To do less makes it much more difficult for students to think critically and independently about the place the new technology does and should have in the lives of the majority of people in our society. Our job as educators involves skilling, not deskilling. Unless students are able to deal honestly and critically with these complex ethical and social issues, only those now with the power to control technology's uses will have the capacity to act. We cannot afford to let this happen.

Conclusion

I realize that a number of my points in this essay may prove to be rather contentious. But stressing the negative side can serve to highlight many of the critical issues that are too easy to put off given the immense amount of work for which school personnel are already responsible. Decisions often get made too quickly, only later to be regretted when forces are set in motion that could have been avoided if the implications of one's actions had been thought through more fully.

There is now something of a mad scramble to employ the computer in every content area. In fact, it is nearly impossible to find a subject that is not being "computerized." Though mathematics and science (and some parts of vocational education) remain the home base for a large portion of proposed computer curricula, other areas are not far behind. If it can be packaged to fit computerized instruction, it will be, even if it is inappropriate, less effective than the methods that teachers have developed after years of hard practical work, or less than sound educationally or economically. Rather than the machine fitting the educational needs and visions of the teacher, students, and community, all too often these needs and visions are made to fit the technology itself.

Yet, the new technology does not stand alone. It is linked to transformations in people's lives, jobs, hopes, and dreams. For some of these people, those lives will be enhanced. For others, the dreams will be shattered. Wise choices about the appropriate place of the new technology in education, then, are not only educational decisions. They are fundamentally choices about the kind of society we shall have, about the social and ethical responsiveness of our institutions to the majority of our future citizens.

My discussion here has not been aimed at making us all neo-Luddites, people who go out and smash the machines that threaten our jobs or our children. The new technology is here. It will not go away. Our task as educators is to make sure that when it enters the classroom it is there for politically, economically, and educationally wise reasons, not because powerful groups may be redefining our major educational goals in their own image. We should be very clear about whether or not the future it promises to our students is real, not ficticious. We need to be certain that it is a future all of our students can share in, not just a select few. After all, the new technology is expensive and will take up a good deal of our time and that of our teachers, administrators, and students. It is more than a little important that we question whether the wagon we have been asked to ride on is going in the right direction. It's a long walk back.

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NOTES

[1] David Noble, *Forces of Production: A Social History of Industrial Automation* (New York: Alfred A. Knopf, 1984), pp. xi-xii. For a more general argument about the relationship between technology and human progress, see Nicholas Rescher, *Unpopular Essays on Technological Progress* (Pittsburgh: University of Pittsburgh Press, 1980).

[2] Noble, p. xv.

[3] Paul Olson, "Who Computes? The Politics of Literacy," unpublished paper, Ontario Institute for Studies in Education, Toronto, 1985, p. 6.

[4] Patricia B. Campbell, "The Computer Revolution: Guess Who's Left Out? *Interracial Books for Children Bulletin* 15 (no. 3 1984), p. 3.

[5] "Instructional Strategies for Integrating the Microcomputer Into the Classroom," The Vocational Studies Center, University of Wisconsin, Madison, 1985.

[6] Michael W. Apple, *Ideology and Curriculum* (Boston: Routledge and Kegan Paul, 1979).

[7] Olson, p. 5.

[8] See Michael W. Apple, *Education and Power* (Boston: Routledge and Kegan Paul, 1982).

[9] For further discussion of this, see Apple, *Ideology and Curriculum*, Apple, *Education and Power*, and Ira Shor, *Culture Wars* (Boston: Routledge and Kegan Paul, 1986).

[10] This is treated in greater detail in Richard Edwards, *Contested Terrain* (New York: Basic Books, 1979). See also the more extensive discussion of the effect these tendencies are having in education in Apple, *Education and Power.*

[11] Russell W. Rumberger and Henry M. Levin, "Forecasting the Impact of New Technologies on the Future Job Market," Project Report No. 84-A4, Institute for Research on Educational Finance and Government, School of Education, Stanford University, February, 1984, p. 1.

[12] Rumberger and Levin, p. 2.

[13] Rumberger and Levin, p. 3.

[14] Rumberger and Levin, p. 4.

[15] Rumberger and Levin, p. 18.

[16] Rumberger and Levin, p. 18.

[17] Rumberger and Levin, p. 19.

[18] Rumberger and Levin, p. 19-20.

[19] Rumberger and Levin, p. 31.

[20] Rumberger and Levin, p. 21.

[21] Rumberger and Levin, p. 21.

[22] Rumberger and Levin, p. 25.

[23] Rumberger and Levin, p. 25.

[24] The effects of proletarianization and deskilling on women's labor is analyzed in more detail in Michael W. Apple, "Work, Gender and Teaching," *Teachers College Record* 84 (Spring 1984), pp. 611-628 and Michael W. Apple "Teaching and 'Women's Work': A Comparative Historical and Ideological Analysis," *Teachers College Record* 86 (Spring 1985). On the history of women's struggles against proletarianization, see Alice Kessler-Harris, *Out of Work* (New York: Oxford University Press, 1982).

[25] Ian Reinecke, *Electronic Illusions* (New York: Penquin Books, 1984), p. 156.

[26] See the further discussion of the loss of office jobs and the deskilling of many of those that remain in Reinecke, pp. 136-158. The very same process could be a threat to middle and low level management positions as well. After all, if control is further automated, why does one need as many supervisory positions? The implications of this latter point need to be given much more consideration by many middle-class proponents of technology since their jobs may soon be at risk too.

[27] Peter Dwyer, Bruce Wilson, and Roger Woock, *Confronting School and Work* (Boston: George Allen and Unwin, 1983), pp. 105-106.

[28] The paradigm case is given by the fact that three times as many people now work in low paying positions for McDonalds as for U.S. Steel. See Martin Carnoy, Derek Shearer, and Russell Rumberger, *A New Social Contract* (New York: Harper and Row, 1983), p. 71. As I have argued at greater length elsewhere, however, it may not be important to our economy if all students and workers are made technically knowledgeable by schools. What is just as important is the production of economically useful knowledge (technical/administrative knowledge) that can be used by corporations to enhance profits, control labor, and increase efficiency. See Apple, *Education and Power*, especially Chapter 2.

[29] Reinecke, p. 234. For further analysis of the economic data and the effects on education, see W. Norton Grubb "The Bandwagon Once More: Vocational Preparation for High-Tech Occupations," *Harvard Educational Review*, 54 (November 1984), pp. 429-451.

[30] Apple, *Ideology and Curriculum* and Apple, *Education and Power*. See also Michael W. Apple and Lois Weis, eds. *Ideology and Practice in Schooling* (Philadelphia: Temple University Press, 1983).

[31] See also Arthur Wise, *Legislated Learning: The Bureaucratization of the American Class room* (Berkeley: University of California Press, 1979).

[32] Apple, *Ideology and Curriculum* and Apple, *Education and Power*. On the general history of the growth of management techniques, see Richard Edwards, *Contested Terrain*.

[33] Douglas Noble, "The Underside of Computer Literacy," *Raritan*, No. 3 (Spring 1984), p. 45.

[34] See the discussion of this in Apple, *Education and Power*, especially Chapter 5.

[35] Douglas Noble, "Jumping Off the Computer Bandwagon," *Education Week*, 3 Oct., 1984, p. 24.

[36] Noble, "Jumping Off," p. 24.

[37] Noble, "Jumping Off," p. 24. See also, Noble, "The Underside of Computer Literacy," p. 45.

[38] For further discussion of the intensification of teachers' work, see Apple, "Work, Gender and Teaching."

[39] Apple, *Education and Power*. For further analysis of the textbook publishing industry, see Michael W. Apple, "The Culture and Commerce of the Textbook," *Journal of Curriculum Studies* 17 (1985).

[40] I am endebted to Susan Jungck for this point. See her excellent dissertation, "Doing Computer Literacy," unpublished Ph.D. dissertation, University of Wisconsin, Madison, 1985.

[41] Reinecke, p. 176.

[42] Reinecke, p. 169.

[43] Olson, p. 23.

[44] Olson, p. 31. Thus, students' familiarity and comfort with computers becomes a form of what has been called the "cultural capital" of advantaged groups. For further analysis of the dynamics of cultural capital, see Apple, *Education and Power* and Pierre Bourdieu and Jean-Claude Passeron, *Reproduction in Education, Society and Culture* (Beverly Hills: Sage, 1977).

[45] Olson, p. 23.

[46] Once again, I am endebted to Susan Jungck for this argument.

[47] Noble, "The Underside of Computer Literacy," p. 54.

[48] Douglas Noble, "Computer Literacy and Ideology," *Teachers College Record*, 85 (Summer 1984), p. 611. This process of "blaming the victim" has a long history in education. See Apple, *Ideology and Curriculum*, especially Chapter 7.

[49] R. W. Connell, *Teachers' Work* (Boston: George Allen and Unwin, 1985), p. 142.

[50] Olson, p. 22; for an analysis of the emphasis on and pedagogic problems with such limited uses of computers, see Michael Streibel, "A Critical Analysis of the Use of Computers in Education," unpublished paper, University of Wisconsin, Madison, 1984.

[51] Olson, p. 22.

[52] Campbell, "The Computer Revolution: Guess Who's Left Out?" p. 3. Many computer experts, however, are highly critical of the fact that students are primarily taught to program in BASIC, a less than appropriate language for later advanced computer work. Michael Streibel, personal communication.

[53] Campbell, p. 3.

[54] Campbell, p. 3.

[55] An interesting analysis of what happens to young women in such business programs and how they respond to both the curricula and their later work experiences can be found in Linda Valli, "Becoming Clerical Workers: Business Education and the Culture of Femininity," in Apple and Weis, ed. *Ideology and Practice in Schooling*, pp. 213-234. See also her more extensive treatment in Linda Valli, *Becoming Clerical Workers* (Boston: Routledge and Kegan Paul, 1985).

[56] Jane Gaskell in Olson, p. 33.

[57] Feodora Fomin, "The Best and the Brightest: The Selective Function of Mathematics in the School Curriculum," in Lesley Johnson and Deborah Tyler, eds. *Cultural Politics: Papers in Contemporary Australian Education, Culture and Politics* (Melbourne: University of Melbourne, Sociology Research Group in Cultural and Educational Studies, 1984), p. 220.

[58] Michael Streibel's work on the models of thinking usually incorporated within computers in education is helpful in this regard. See Striebel, "A Critical Analysis of the Use of Computers in Education." The more general issue of the relationship between technology and the control of culture is important here. A useful overview of this can be found in Kathleen Woodward, ed. *The Myths of Information: Technology and Postindustrial Cultural* (Madison: Coda Press, 1980).

[59] Quoted in Noble, "The Underside of Computer Literacy," 56.

[60] Noble, "The Underside of Computer Literacy," p. 56.

[61] Noble, "The Underside of Computer Literacy," p. 56.