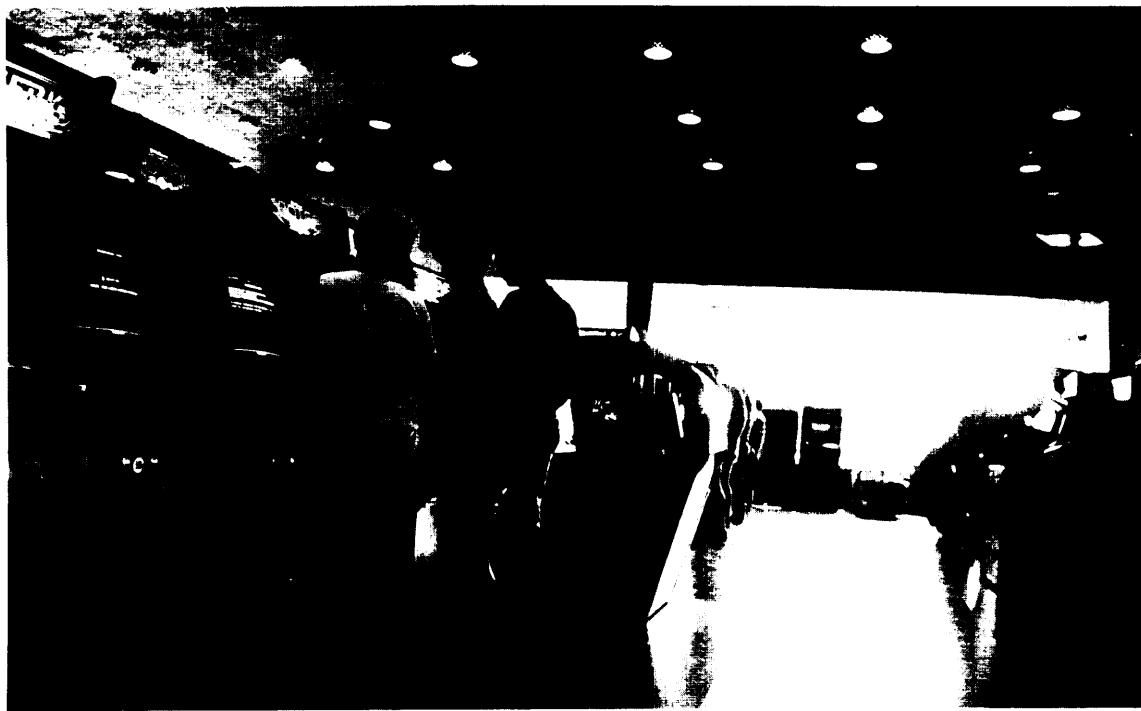

Chapter 10

Implications for Policy



The new information technologies offer a promising mechanism for responding to the many challenges facing American education. **How** they will be applied will be determined, in part, by governmental policies

Implications for Policy

Whether or not the new information technologies fulfill their educational potential will depend, in part, on the kinds of actions that the Federal Government takes to assure that these technologies are used effectively and are made accessible to all. OTA has identified several areas where it may be appropriate for the Federal Government to play an active role in its development. Anticipating structural changes in the economy and the growing need for a highly literate and technically trained work force, Congress might wish to encourage the greater use of educational technologies for manpower training and retraining. Recognizing the educational benefits that can be derived from the use of information technologies, Congress might take steps to assure that the public has equitable access to them. Aware of the powerful nature of the technology, Congress might take some actions to encourage their effective development and use.

Directly or indirectly, Federal policy to encourage the use of educational technology would influence a number of stakeholders, among them:

- institutions that provide education and training,
- clients for educational services,
- producers of hardware and providers of information services,

- producers of curriculum, and
- employers.

Legislation could be addressed specifically at any of these groups-direct funding for schools to purchase technology, support for students taking technology-based education, tax writeoffs or subsidies for donations of technology and services, support for the development of curricula, or incentives for employers to provide job training.

In turn, all of these groups, and their potential use of technology, will be influenced by the shape of education policy. Decisions made by Congress will determine the roles various institutions will play in the education system of the future. They will determine which options for education and training are available to citizens, as well as which citizens will have access to them. The information industry may also be affected. Policy will influence industry decisions about what technology and services to develop and market to schools. It will affect whether curriculum producers will develop high-quality, technology-based material. Finally, policy may influence the nature and level of skills that employees bring to their jobs and the choices employers will make about in-house training and retraining.

Arguments for Federal Action

Arguments in favor of adopting a policy in support of educational technology are based on the premise that the changes in American society are creating new requirements for education and training. They are based, in particular, on the view that computer-based automation in the manufacturing and service sectors will require workers who have new skills and who can be continually retrained as changes occur and new technologies are adopted. To

be retrainable, the entering work force must first be educated to a high level of basic and technological literacy. There will also be a high and growing demand for scientific and technical experts.

It appears that the educational system as it is currently structured and operating will be unable to fill these needs. Many public schools face problems such as decreasing tax-

payer support and a decline in the quality of entrants into the teaching profession. While new commercial educational institutions may emerge to provide necessary educational services, their existence may present a serious challenge to nonprofit and publicly funded schools. In making decisions about educational technologies, Congress may want to take into account how their application and widespread use may affect the roles of present educational institutions.

Information technology could be a major tool for responding to these challenges. It could enhance the productivity of existing institutions and serve as the incentive for the growth of new educational and training services and of new institutions to provide them. If these technologies fulfill their educational potential, the Nation as a whole would benefit from the widespread adoption of educational technology by both schools and other education providers. The Federal Government might decide to take an active part in the adoption of these technologies in order to assure their equitable distribution, to overcome barriers to their use, and to support the national dissemination of information.

OTA found that, while many schools are adopting the use of desktop computers, there is concern among educators that many schools may be left behind. For a variety of reasons—lack of funds, lack of information, unmotivated faculty, or parents—these schools may not elect to use the technology. Such a choice could consign their students to poor employ-

ment opportunities and could lead to greater disillusionment with, and thus loss of support for, the public schools. Most importantly, it could result in substantial inequities in the way that educational services are distributed.

Some experts think that the development of good, innovative curriculum materials may be too expensive for the currently limited and fragmented market to bear. Not enough schools use computers, video disks, and other technology to provide a large enough sales base. Under these circumstances curriculum producers will be either inhibited altogether from producing material, or they will concentrate on those few applications—such as professional retraining—that have a high income potential at the expense of more basic education. Furthermore, significant developmental work remains to be done before the technology can reach its full potential. The Federal Government might provide the high-risk, critical-mass funding needed at this time to stimulate the development of a technology-based curriculum market.

Finally, mechanisms for combining and sharing experience gained from the existing activities are needed. Some experts have pointed out a need for one or more national clearinghouses to review and evaluate educational software, as well as for research centers where new techniques and materials can be developed. Again, Federal leadership is a means for creating or aiding the development of such nationwide activities.

Arguments Against Federal Action

Some experts have also raised a number of concerns about Federal involvement in stimulating the educational use of the technology. Basically they argue that the private sector can and will respond to the needs for improved education, and that education policy is the proper domain of local and State governments alone.

Federalism has been a major element of educational policy debates for many years. If the Federal Government were to undertake action to encourage the development or use of educational technology, it is likely that concerns will be expressed about undue Federal interferences in choices considered to be most appropriately made at the local level to suit local

needs. These concerns would be particularly strong if Government funds were used to develop curricula.

Any new program initiatives will be carefully scrutinized for their budgetary impacts. Although few policy options appear to be extraordinarily expensive when compared to other education and research and development budgets, the Federal education budget is shrinking rapidly. Any increase of funding for technology, no matter how modest, will appear to be at the expense of other educational priorities that are already being tightly pressed.

Another important concern is that a Federal education policy that focuses on technology might create the impression that technology is a panacea. Such an impression could divert attention as well as funds from other signifi-

cant problems that may not be solvable by the technology. It could also create overexpectation followed by unwarranted disillusionment about the potential contributions technology could make to education.

Finally, some concern has been expressed about the potential long-term effect on learning that may be caused by an extensive use of technology for education. Society would be augmenting or even replacing an old and well-known process—the classroom and teacher—by new technology-based methods. Some people anticipate a number of possible side effects that might have significant negative consequences for students. These effects might include shortened attention span, loss of effective learning, or decreased opportunities for social interaction.

Congressional Options

OTA found that a broad range of Federal policy options relating to educational technology have been suggested. They range in scope from policies that call for no Federal action to those that call for a marshaling of Federal resources. All of these policies would, however, be inextricably linked to the broader education policy, which has recently been the focus of significant restructuring. Since OTA has not attempted to perform an overall assessment of Federal education policy, only a broad overview of the structure of some of the more feasible options available has been taken.

Option 1: Subsidize Hardware

Legislation has already been introduced to help schools obtain information technology. For example, H.R. 5573 is intended to increase the amount of tax deduction allowed to manufacturers for donations of computer hardware. Such a policy would likely increase the number of donations of technology to schools, although the quantity would depend on the growth of the market. Firms with a large backlog of purchase orders might be less inclined

to see an advantage in donations, even if accompanied by tax writeoffs. On the other hand, incentives such as advertising, long-term market development, or a sense of public responsibility might encourage contributions.

On the negative side, some have suggested that schools might be the recipients of obsolescent machines as manufacturers clear out their inventories prior to the introduction of the next generation of systems. Moreover, schools might tend to accept inappropriate hardware that is free rather than purchase equipment that best fits their needs.

One congressional option would be to increase direct funding to the schools to allow them to purchase hardware. Such a policy would have the advantage of allowing the institutions to select the equipment they prefer. The OTA case studies indicated that many of the most successful schools that now employ computers used Federal funds as seed money for their programs. Desktop computers can be used to teach introductory computer programming and computer literacy without extensive

software. Such a course characterized the initial use of computers in many of the schools that OTA examined. In addition, a substantial increase in the base of hardware available in educational institutions would provide a more attractive market for curriculum producers. It could both encourage the development of material and decrease the price of software since development costs would be written off over a larger sales base.

Option 2: Subsidize Software

Many producers of educational curricula are interested in the growing market for technology-based materials, but they are uncertain about entry. In the early, formative stage of the market development, expensive development projects are risky, at best. In addition, much still needs to be learned about the best educational use of the new media. These problems have served to slow the pace of development.

In response to these problems, some have suggested that the Federal Government provide assistance with developmental costs of some major curriculum packages. Either direct funding, full or partial, could be provided to the producers, or educational institutions could be given funds for the purchase of educational software.

Direct support of the producers would allow the Federal Government to set priorities in two ways. Curriculum packages could be designed around those subjects for which a clear national need exists—e.g., mathematics and science, foreign language, or adult literacy. And research and development concerns could be taken into account when setting priorities for projects to be funded. Support could be given to those that showed the most promise of advancing the state of the art in the uses of education technology. Opponents of such an approach suggest that priorities for these two concerns are best set at the local level and in the marketplace.

An alternative method of support that takes these objections into account would be to pro-

vide educational institutions funds to purchase educational software. Such a policy would increase the size and likelihood of a potential market for software and encourage producers to compete for a share of that market. Priorities for subject matter would then be set in the market by the users and producers, and competition would result in increased quality and decreased costs. Opponents argue that many potential educational users are not yet sophisticated enough to exercise their best judgment. Their naivete, coupled with the expenditure of Federal rather than local funds, could encourage wasteful expenditures on well-marketed but educationally unsound curriculum packages.

Option 3: Assume a Leadership Role

The lack of information by the potential users of educational technology is the basis for suggestions that the Federal Government play a leadership role, particularly with respect to the elementary and secondary schools. Few teachers or school administrators are trained in the instructional use of computers or other electronic media. Unsound decisions in implementing technology and selecting curriculum packages could be extremely costly to schools. Money would be wasted, and potential benefits could be lost. Furthermore, exaggerated expectations or a bad initial experience with technology resulting from a poor implementation strategy could lead to disillusionment with educational technology and to significant delays in its appropriate implementation.

At the same time, OTA case studies suggest that, at least in a number of schools, there is a great deal of interest and motivation by faculty and administrators, students and parents, and local industries to promote the use of computer technology. This motivation, if properly informed and guided, could be an important driving force for the implementation of educational technology.

The Federal support might take the form of funding for teacher training, either inservice

or preservice in the teacher colleges, for demonstration and development centers, or for information clearinghouses. Such activities might be undertaken directly by the Government, or through the encouragement of a variety of institutional partnerships involving education, industry, and nonprofit foundations interested in education. S. 2738, for example, would provide tax credits to firms that hire public school math and science teachers during the summer.

OTA has found general agreement that there is a significant lack, particularly in the area of precollege science and mathematics, of qualified teachers. The concern has been expressed both about the numbers of teachers being trained and their quality. The Federal Government has funded teacher training programs in the past, particularly in areas where there was a vital national need. For example, inservice programs in science and mathematics education were funded by the National Science Foundation.

A major problem noted by some experts and administrators in the area of computer training is the natural competition of the private sector for people with abilities in this area. One effect of the growth of the knowledge industry has been to increase the earning power of individuals with expertise in science, mathematics, and engineering disciplines. This trend is particularly apparent in the computer-related fields.

This problem creates a need for more teacher education. However, it also suggests that, while salaries remain significantly lower in education than in other sectors, teachers who receive such training would need to take this possibility into account, through mechanisms such as:

- making commitments to the teaching profession part of the selection criteria,
- making contractual agreements with teachers attending the programs that they will return to teaching,
- making agreements with local industry not to lure teachers newly trained in computer technology,

- setting up cooperative programs with local industry to provide summer jobs to teachers that have been trained in computing, and
- using differentials to encourage teachers with more marketable skills to stay in the education profession.

The clearinghouse and demonstration center suggestions respond to the other major non-monetary barrier: lack of information and guidance on how to institute and use educational technology. For many years, suggestions for various forms of such centers have been put forth. They could perform a wide variety of functions, including the following:

- evaluate educational software and disseminate their findings. The extreme case of this review process would be for the center to certify software as educationally valid;
- provide a location and experienced staff for teachers and administrator training programs;
- provide expert consulting and guidance, since salaries at such a center might be more competitive;
- serve as an instructional test bed for both new technology and new teaching techniques that integrate instruction and technology; and
- identify and examine in detail those institutions that have already successfully adopted technology in order to share their experiences more broadly.

Option 4: Incorporate Technology Initiatives in General Education Policy

Congress makes policy that broadly addresses the general problems and needs of education. This broad legislation could be tailored where appropriate, either to encourage technological use or to remove unintended barriers to such usage.

To the extent that education legislation is created based on a view of the educational system—needs, providers, and mechanisms—pol-

icy should also take into account the possibility of change from the information revolution. For example:

- Vocational education must take into account the problems of experienced workers displaced by automation and the new skill requirements of high-technology industry.
- Veteran's education must consider whether continuing adult education will shift focus from schools to industry or even to the home.
- Special education will need to consider the enormous potential of information technology to improve the access of handicapped to the information stream of U.S. society and, hence, to educational services specifically tailored to their needs.

Impacts

Any policy relating to educational technology will need to be evaluated, not only for its direct effect, but also for the potential it holds for longer term impacts. OTA has identified three general areas of potential impact that seem particularly significant for Federal policy.

Implicit Choices

Congress could influence the long-term development of the educational system through policies that deliberately or unintentionally favored particular institutions, clients, or technological mechanisms. As a result, there could be significant long-term effects on who is educated in our society, for what purpose, who provides it, and what mechanisms are used to provide it.

OTA found that a variety of new providers of education and educational material are appearing and that the roles of traditional institutions are shifting. It is possible that information technology will be a powerful tool for decreasing costs of instruction or for increasing the quality, distribution, or variety of educational offerings. If so, those institutions that are able to adapt to its use most quickly will have a significant competitive advantage over

those that cannot. By focusing on the needs of one or more of these institutions—e.g., the public schools, libraries, or industrial training facilities—at the exclusion of others, Congress could influence that competitive balance.

Certain objectives may overtly dictate such policies. For example, if it were determined that public school's lack of access to educational technology put their students in a severely disadvantaged position, Congress could, for public policy reasons, focus policy on public schools in order to strengthen them institutionally. If it were determined that the proper Federal interest was to see that information literacy increased among the population in more general terms, policy might address the needs of libraries or museums. Policy that addresses the need for job training might concentrate on industrial education.

Certain clients for educational services may also be favored over others. To the extent that different institutions serve different sets of needs, the policy impacts on institutional roles discussed above will also affect the clients. In addition, a number of Federal education policies—those concerned with special education, foreign language instruction, etc.—are specifically tailored to the needs of particular learners.

Finally, policy may be directed at specific technologies. OTA found that a wide variety of computer, telecommunication, and video technologies have potential educational application. Furthermore, they can be combined in new and unexpected ways to form instruction systems. Policies narrowly focused on one technology—microcomputers, two-way cable, etc.—could inhibit the full exploration of the potential of the much wider collection of information technologies.

Potential Equity Impacts

OTA found concern among some experts that the widespread implementation of educational technology could create issues of equity. Information technology could accelerate the existing trend of educational services moving into the private marketplace. To the ex-

tent that such a trend affects both the cost and accessibility of instruction, it may have a differential impact on the ability of groups within the society to become educated. The cost of education may increase beyond the economic means of some. Providers may not have an incentive to meet certain needs if they see less potential for profit in them. Regions may be geographically isolated, without access to vital telecommunication technologies that could provide needed educational services.

On the other hand, information technology could also substantially improve access to high-quality educational services. Communication services such as direct broadcast satellite can bring instruction to remote areas. In-home information technology such as two-way cable and personal computers can improve the homebound' access to education. Technology could provide effective education in areas such as bilingual education, supplementary tutoring for children with learning disabilities, or assistance in classroom communication for the physically handicapped.

To the extent that Federal policy influences the impact of educational technology on access to education, it will also likely influence both the access of affected groups to jobs and their ability to participate in an increasingly complex society.

Long-Term Educational Impacts

Finally, over the long term, a major societal dependence on information technology could have significant educational and psychological effects on the U.S. population. We have little information about what those effects might be. While the educational effectiveness of information technology seems generally to be accepted, not much has been learned about the more subtle effects on learning or the possible impacts of more extensive, longer term use. Most likely, some skills will be enhanced by use of technology while others may be lost or lessened.

To the extent that changes do occur, there may be concomitant changes in the skills de-

manded by society. For example, some experts argue that simple arithmetic skills may be less important in a world of pocket calculators and automated cash registers, and that spelling may be less important in light of modern word processing systems that correct errors. Even more importantly, if more and more jobs may require the use of computers and automated data bases to solve problems, then the skills that are particularly enhanced through interaction with a computer-based education system may be very important in the future.

The analysis of potential policies and their impacts suggest that, while any particular action will affect the future use and development of educational technologies, none of them can, by themselves, meet the total challenge facing American education today. As this OTA report demonstrates, to meet the educational needs of an information society will involve all individuals, groups, and institutions. It will require the use of a full range of educational approaches and technologies. It will, moreover, entail overcoming a wide variety of complex institutional and social barriers. And it will necessitate a thorough understanding and the continued monitoring of these rapidly unfolding technologies.

The information age is having a profound effect on American education, increasing the need and the demand for a broad variety of educational services. The Nation's educational needs are not now being met, creating a situation that could impede the Nation's economic growth, undermine its international competitive position, and increase and exacerbate the socioeconomic divisions within society. The new information technologies offer a promising mechanism, and in some cases the only mechanism, for responding to these educational needs. Their widespread application will significantly affect how and to whom educational services are provided. Such changes will present both challenges to and opportunities for American education. Congress could take a number of specific actions to affect the development, educational application, and distribution of information technologies. But such an

approach would address only a single aspect of the problem and may generate undesirable and unexpected side effects. If this is to be avoided, a broad approach, which takes into

account the changing needs for education and training, considerations of equity, and changing institutional roles, will be required.