Steps Toward Increased Literacy with Technology (Guest Editorial).

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The Congress of the United States can, in a small and simple step, advance this country a considerable distance toward significant and beneficial computer literacy. Although the Technology Education Act of 1982 is no "cure-all," passing it this summer would provide good results within one year and considerable long-term benefit. This tax measure simply extends to elementary and secondary schools the benefits of tax incentives already allowed for donations to universities. Getting computers into all of our schools strongly supports other steps which are being taken to help the American people achieve adequate literacy regarding new technologies.

Assertions about Technology Education and Computers in Schools

In order to get right to the heart of my experience and expertise related to placing new equipment in schools, I'd like to begin with three assertions about computers and schools and technology education.

1) Technology education is especially important to the U.S. economically and socially right now. Leaders from industry, government, education, economics, and many other fields have argued for greater investment in education and training which would: a) develop a technically literate workforce; b) encourage more young people to enter scientific and technical fields; and c) provide the basic skills and understanding that every citizen needs to make good decisions in a technological world. Every day I see new examples of how technical knowledge and skills determine who gets jobs, which businesses survive, and how technology is used or misused in the workplace, in commerce, and in entertainment. Our present system for science and technical education needs help!

(I will not take time to describe the situation schools face: very little money to spend on technology; donations from industry are down due to the economy; schools are under considerable pressure from parents and community leaders to provide students experience with computers; only 10% of the elementary schools have even one computer for kids to use; less than half of our high schools, mostly the large ones in affluent areas accustomed to spending more on learning materials, report providing student access to computing; etc.)

2) Technology education has to start early, before one gets a job, before one enters college or technical school, and probably before one enters high school. Experts in engineering and technical education tell us that positive experiences with science and technology in junior high and elementary school make a significant difference in career choices, in how people use technology, and in lifelong attitudes toward science. I've seen the beneficial effect of these early experiences many times in the families and schools of my community. Often the starting point was access to a single computer in the classroom or library (or the home!) some time between sixth and ninth grade.

3) Today's small computers are effective tools for technology education in homes and schools. Because they are inexpensive, portable and convenient, personalized computers make a significant difference in kids' perceptions of technical equipment. Children quickly become comfortable with computers and want to understand the technical world. They begin to explore the roles computers might play in their lives and in society.

The fact that personal computers are widely used in the best engineering schools confirms that they are serious tools, not just toys. Indeed, they are more than just good tools; they open up new ways of thinking about information and procedures, systems and objects, decisions and values. Just as erector sets, bikes, cars and radios have been the "tinker toys" of our Yankee ingenuity, computers are the "thinker-toys" of the current generation. This country badly needs the skills and creativity which result from the challenge of working with computers from an early age.

Why a University Researcher with Many Computers Would Come to Testify

My interest in this bill stems from the many occasions I've seen one computer make a difference: students learn, they grow, and they come to contribute more to society—and the economy. Greater computer literacy will benefit our economy (through more skilled workers, less unemployment, better research and development, etc.), but anyone who appreciates what knowledge of computers does for individuals will be impressed by the positive effects and want to help get computers into schools.

Many computer manufacturers have donated machines to the University of Michigan for basic research under present tax law that allows generous deductions for the donor. My research on learning in lab situations has been helped, but I also care very much about how computers are used for learning and teaching in homes and schools now. On numerous occasions I have shifted some effort from research and development activities (my primary function at the Center for Research on Learning and Teaching) to service projects which provide more immediate advantage to teachers, students and parents. Indeed, I redirected some of my research program to examine support networks for computer use in schools and community centers. Since 1971 a series of projects (supported in part by Exxon Education Foundation and the National Science Foundation) has developed and confirmed the effectiveness of a variety of ways to support technical innovation in the schools as well as colleges and universities. However, most of the schools need financial help getting started.

I'm convinced by numerous studies and demonstrations that teachers and schools getting their first computers can help themselves through information, examples, advice and the support networks already in place. I've helped develop resource networks so that information and advice gets to the people who need it at the right time. I've studied those networks to be sure they are delivering the service as it is needed. And occasional direct involvement in providing that service

has been personally rewarding while at the same time confirming the results of the surveys and experiments. Just three weeks before I'd been in Washington to assist with a short course in computers for Congressmen. I was impressed again by how quickly and easily adults who are interested in exploring the technology will pick up the skills and see the relevance of computer use in education and decision making.

Benefits and Concerns Related to the Proposed Legislation

As soon as I heard of this bill I called a number of experts and assembled a list of benefits and concerns: impact of the proposed legislation on students and teachers, the costs and benefits for manufacturers, the impact on the publishing of computer-related materials, and the logistics of implementation. A packet of information was distributed to more than 200 people in the network of developers and support staff for computers in schools. Conversations with about 50 of these people to explore their opinions and advice provided a sound basis for my testimony today.

The resource people in the schools told me that if the Technology Education Act does get computers into the majority of schools that don't have them now, it will help interested teachers who have had no equipment to get something started, and it will provide an opportunity for many more teachers to become familiar with computers. A more important long-term result for the students who will eventually use computers is that getting equipment into the schools now provides teachers and administrators appropriate experience on which to base decisions about equipment selection, software (e.g., programming languages), applications and curriculum. These local resource people warn us not to expect too much from just one machine in a school. They advise their schools to begin modestly with an elective class, with a computer club, and with self-education for teachers. Make sure that the teachers and students who are most interested in computers have easy access to whatever machines are available. Look to computer education and teaching magazines for training and support materials, and for advice on the contributions computers can make to learning and teaching.

I also contacted representatives of publishers, manufacturers, professional associations and other organizations concerned with computers in education. All of them had heard of the bill and were making plans for appropriate responses to it. Each manufacturer will respond in ways consistent with its approach to the education market, and offer what can be done well and supported at each site with documentation, training and service.

The publishers tell me they have good literacy materials and will get the best books and programming languages to the schools. Getting computers into tens of thousands of additional schools will prompt publishers to produce more educational software. Having more applications available will result in more people buying computers. More computers further expands the market for the publishers, and so on!

A number of teachers in Michigan told me what they would do with a "free" computer. Those that already have machines described what would be done with a small number of additional machines in their schools. Those whose schools had no computers spelled out what it would take to get started with the first machine. They all like the fact that donations would help many more students get started now on computer literacy and skills essential to many careers. Just having ready access to a computer encourages all students to consider technical and scientific areas of study and employment. One teacher pointed out how having a computer that is used effectively for educational activities at school (with these activities made apparent at open

houses and the like) has helped families select a computer and better use it for home education. The major concern was to have enough time to plan for computer use, and to have full support from the administration and good technical help where it may be needed.

A Personal Statement in Support of the Technology Education Act

A new "Sputnik" is crossing over our country but hasn't yet made any dramatic appearances. Japan and other nations are in the process of taking over leadership in computers and information systems, the last area in which the U.S. has excelled in technology. Yet we still have the creative minds, the flexibility and the kind of educational system needed to retain leadership, if only we don't starve the curious and inventive minds of our current generation.

I wholeheartedly support this legislation because it is a simple "step forward, and an action which is sure to benefit many schools. The donors will do the best they can for the schools, since success in future sales depends on the successful use in schools of the equipment donated. Publishers will invest more in development and training since the market holds promise of copies sold to many more schools and individuals.

The Technology Education Act will do some "pump priming" in our educational and economic systems. The tax incentive will help place many more machines in schools at a fraction of the cost of usual funding mechanisms. The additional expense of demonstrations, training, technical support and diffusion of new ideas will be distributed throughout the system which supports educational use of computers. In addition to the manufacturers, schools will get help from publishers, professional associations, clearinghouses, state and regional service centers, science centers, universities and colleges, public libraries, computer clubs, local stores and so on. More machines in schools, and more attention to the needs and benefits, will result in larger investments by the private sector in materials needed by the schools.

In supporting this legislation, I do not mean to represent the Technology Education Act as the only measure that needs to be taken in this and related areas. Many other things merit Congressional action, and some may require appropriations. Long-term success depends on development centers, teacher training programs, more and better computer-related training materials, innovative technical developments, research on technologically-based learning, and research on the impact of computers on individuals, families and society.

Many factors will affect the use of computers in schools, But whatever else occurs, extending this tax incentive now to place computers in schools as well as universities will enhance the results. Teachers and administrators will have better experience on which to base decisions about equipment, programming languages, applications and curriculum. Efforts to disseminate new ideas and materials will build upon a base of experienced people in the schools. And the equipment in place will make it possible for teachers to test out new materials locally.

Some Points to Clarify and Emphasize within This Bill

- Equipment will be needed for teacher training programs at universities, colleges and the regional centers serving groups of school districts.
- Equipment will be used well by students of all ages at other public education sites such as science centers, community centers and libraries which may not be part of an elementary or secondary school.

- Essential instructional materials and sample applications should be part of the package for which the donor gets credit.
- The federal agencies concerned with science and technology education should assign appropriate resources to assist schools and teachers in ways that increase the effective use of the donated equipment.
- The schools should provide a short planning statement telling who will be responsible for the equipment and how it is to be used. This might be part of the written statement on use and disposition of property donated (presently "used in education of students ... not transferred in exchange for money, other property or services"). Of course these statements would be public information and helpful for professional associations who want to offer help to schools which may need it, as well as a basis for checking on the equitable distribution of machines.

Summary

The proposed legislation is straightforward in that it simply extends to schools for one year the benefits of a tax credit already allowed for donations to universities. This action to encourage distribution directly to schools bypasses the complexities and costs of proposal preparation, review, approval and administration, and it gets teachers and schools started right away on a self-help program to bring them into the computer age.

The computer education market and the support network for computers in schools will reward appropriate donations and discourage those that will not be productive. Each donor will put forward the best package possible to support technology education so that the recipients will come back to purchase present and future products. No donor wants its equipment to be criticized as obsolete and unreliable, or inconvenient and irrelevant for technology education. Publishers will put out the best text materials and computer programs they can afford to produce (and schools will buy) in order to capture their share of the new market for computer education materials. Others who have a stake in computer use in schools will do their best to see that recipients make good choices in selecting machines and learning materials, find appropriate help with teacher training and support, and put the equipment and materials to good use.

- The benefits of having computers in nearly all schools will show in the skills and interests of students in the computer clubs and classrooms that get machines in the first year this legislation takes effect.
- The benefits will expand dramatically for a long time to come as regular mechanisms of the education marketplace take over to provide an increasing amount of quality, computer-related instruction materials. More people will acquire technical skills that are important on the job, and all of us will find increased opportunities to become comfortable with the technology so pervasive in our society.
- Attracting national attention to information systems and technology will help keep our country among the leaders in this field which now dominates national economies and international trade.
- The small cost (in lost revenues for only one year) to "prime the pump" will be returned many times over in tax revenues on new markets for education in the home as well as in schools.

I hope the Congress will take this small, sure step at a time when leadership is so needed.

HR 5573 is now before the Committee on Ways and Means, having been modified by the Subcommittee in the following ways:

- The definition of equipment qualifying for favorable treatment under the bill is modified to provide a precise definition of computers, display screens and installation equipment.
- The requirement that the contribution be made no later than two years after the equipment is constructed is shortened to six months.
- Restrictions are added to assure that the donor does not limit its contributions solely to wealthy schools or a narrow geographical area.
- The amendment deletes the provision which would have raised the current 10 percent cap on deduction of corporate charitable contributions to 30 percent for qualified computer contributions.
- Language is added requiring that the contribution be made by a taxpayer who is in the business of making and selling the donated computer or computer equipment. Also, a donation of computer display screens or installation equipment may qualify only if given with the computer.

IMPACT ON STUDENTS AND TEACHERS

Benefits

- Helps interested teachers who have had no equipment to get something started.
- Provides an opportunity for many more teachers to become familiar with computers.
- Provides teachers more experience upon which to base decisions about equipment selection, software (e.g. languages), applications and curriculum.
- Gets students started now on computer literacy and skills essential to many careers.
- Encourages all students to consider technical and scientific areas of study and employment.
- Helps families select a computer and better use it for home education.

Concerns/Advice

- Don't expect too much from just one machine.
- Begin modestly with club activities, a small elective class and self-education for teachers.
- Look to computer education and teaching magazines for training and support materials and advice on the contribution of computers to learning and teaching.
- Make sure the teachers and students who are the most interested have easy access to the machine(s).
- Take time to plan for and make good use of full support (administrative, technical, inservice training, etc.)

COSTS AND BENEFITS FOR MANUFACTURERS

Benefits

- Three or more times as much equipment can be donated for the same cost to the company.
- Large user base will attract investment by publishers in new materials.

Concerns/Advice

- Donations should be consistent with sound practices in the education market.
- Manufacturers and schools choose what can be done well and supported at each site (documentation, training, service, etc.), keeping in mind distance from stores, service centers and consultants.

IMPACT ON PUBLISHERS

Benefits

- Provides a broader base for marketing computer related materials to education.

Concerns

- Emphasizes literacy (best books and programming languages for the purpose).

SUPPORT FOR THE LEGISLATION

Benefits

- The bill is consistent with present thinking about industry participation.
- It is only an extension of present tax credit to help a broader audience.
- It responds to need for greater technical literacy for employment, productivity, etc.

Concerns

- U.S. Treasury considers the bill to favor the computer industry inappropriately and allow too much credit to still be considered "charitable."
- The estimated revenue reduction is $27 million.
- The immediate need is for those presently employed (or not employable!).