

Equity in Computer Education

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Scholars have observed for years that we are moving toward an information-based society.¹ Less attention has been focused on the social consequences of this change. In a classic "industrial" society, wealth consists of material goods and the machines and skills which produce them.² In an information-based society wealth will consist of the ma-

* United States Senator (D-New Jersey). I wish to thank the members and editors of the *Yale Law & Policy Review* for their help in researching this commentary.

1. See, e.g., D. BELL, *THE COMING OF POST-INDUSTRIAL SOCIETY* (1973); H. Simon, *The Consequences of Computers for Centralization and Decentralization*, in *THE COMPUTER AGE: A TWENTY-YEAR VIEW* 212 (Dertouzos and Moses eds. 1979); A. TOFFLER, *PREVIEWS AND PREMISES* (1983).

Schools in the United States are also beginning to reflect this trend. Several studies have inquired into the availability of computer training in American schools. One study by the Johns Hopkins University Center for Social Organization of Schools found that a majority of schools now have at least one microcomputer for use in instructing students (53%). Furthermore, "[b]y January, 1983, 85% of all high schools, 77% of all junior-senior combinations and 68% of all middle and junior high schools had one or more microcomputers. The corresponding figure for elementary schools rose to 42%." The study also showed that the number of microcomputers in schools is growing at a faster rate than in previous years. JOHNS HOPKINS UNIVERSITY CENTER FOR THE SOCIAL ORGANIZATION OF SCHOOLS, *SCHOOL USES OF MICROCOMPUTERS: REPORTS FROM A NATIONAL SURVEY, ISSUE No. 1*, at 2 (April 1983) [hereinafter cited as HOPKINS ISSUE 1]. Further findings of the Hopkins study are set out in JOHNS HOPKINS UNIVERSITY CENTER FOR THE SOCIAL ORGANIZATION OF SCHOOLS, *SCHOOL USES OF MICROCOMPUTERS: REPORTS FROM A NATIONAL SURVEY, ISSUE No. 3* (October 1983) [hereinafter cited as HOPKINS ISSUE 3]. In a related study conducted by the University of Minnesota and funded by the National Science Foundation, students were asked if they had used a computer or computer terminal in school. Thirty-three percent of age 17 (senior high) and 23 percent of age 13 (middle school-junior high) responded that they had. The researchers also reported that "[e]ven percent of age 17 students said they had studied computer programming for one or more terms compared with only 7 percent in 1978." R. Kazarian, *Computer Learning Inequities are Found in Nation's Schools*, National Science Foundation Press Release No. NSF PR83-61, at 2 (on file with the *Yale Law & Policy Review*); [hereinafter cited as Minnesota Study]. A survey conducted by a private market research firm found impressive increases in the number of computers in American classrooms. The survey showed that 24,642 of 82,422 public schools used computers in instruction in 1983, up 56.2% from the fall of 1981. In addition, of 15,314 U.S. school districts, 8,947 (58%) used instructional computers, up 39% from 1981-82. The fastest growth was reported in the use of computers in elementary schools. A total of 10,499 of the nation's 52,000 elementary schools now use instructional computing, up 80% from the previous year. Update on the School Market for Microcomputers, Market Data Retrieval Press Release, (October 1982) (on file with the *Yale Law & Policy Review*) [hereinafter cited as Market Data Survey]. According to another market survey by the same firm, the average American grade school has 3.6 computers, while the average high school has ten. Elmer-DeWitt, *Slugging It Out in the Schoolyard*, TIME, March 12, 1984, at 62 (quoting from a survey by Market Data Retrieval).

2. See e.g., D. BELL, *supra* note 1.

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chines and skills which produce and manipulate knowledge.³ To avoid inequities in the information age, we must provide for wider distribution of these machines and skills. Without such wide distribution, many people will be unable to realize their potential. This loss of talent and enterprise betrays the American goal of equal and universal education. It is also a loss that this nation can ill afford in the face of an increasingly competitive international economy.

The competitive position of the United States in world commerce depends on the quality of education its children receive. In the information economy of the future, that education will be incomplete unless students receive analytic and other skills that stem from a modernized curriculum. Unfortunately, this country is in danger of falling behind other western nations in its ability to provide widespread computer education.⁴

In addition, a growing body of evidence indicates that within the United States, disadvantaged social groups receive less computer training than do other groups. Several studies have revealed alarming disparities between the level of computer training available to different income groups, races, and regions of the country.⁵ These studies suggest that new skills are being taught largely to the advantaged. If this tendency continues, the United States will pay a high price in both human and economic terms.

Recognizing computer literacy as a national priority would serve U.S. economic interests, while providing equal educational opportunities for both advantaged and disadvantaged Americans. Legislation tailored to these objectives is currently pending before Congress. The Computer Education Assistance Act would establish a federally-funded pilot program for computer education.⁶ The Act's goal is to ensure expanded

3. See Bell, *The Social Framework of the Information Society*, in *THE COMPUTER AGE: A TWENTY-YEAR VIEW* (Dertouzos and Moses eds. 1979) 163, 180-190.

4. See, e.g., NATIONAL COMMISSION ON EXCELLENCE IN EDUCATION, *A NATION AT RISK: THE IMPERATIVE FOR EDUCATIONAL REFORM* 5 (April 1984). The Commission states:

Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. . . . We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a People. . . .

. . . We have, in effect, been committing an act of unthinking, unilateral educational disarmament.

5. HOPKINS ISSUE 1, HOPKINS ISSUE 3, Minnesota Study, and Market Data Survey, *supra* note 1. For an excellent general discussion of these issues see *Theme Issue: Computer Equity*, 11 *COMPUTING TEACHER*, April 11, 1983 (includes related article by Senator Lautenberg).

6. S. 1849, 98th Cong., 1st Sess., 129 Cong. Rec. S12, 353-56 (daily ed. Sept. 15, 1983)

access to those skills necessary to succeed in the economy of the future. The Act also strives to remedy existing inequities in the distribution of computers, by earmarking a portion of the funds for disadvantaged schools.⁷ By remedying these inequities, the Act will ensure that America does not squander human resources vital to the maintenance of its international competitive position.

I. *The Problem*

Computer instruction is now recognized as an integral part of a modern education. The National Commission on Excellence in Education, for instance, advocates computer science as a basic subject in the high school curriculum, on par with the status of such traditional subject matter areas as English, math, science, and social studies.⁸ The idea of literacy itself has grown to include the ability to communicate with

[hereinafter cited as Computer Education Assistance Act]. This bill calls for relatively modest funding levels since it is meant to be a pilot program only. *Id.* at S12,353.

7. Computer Education Assistance Act, *supra* note 6, at §§ 5, 7, 8.

8. National Commission, *supra* note 4, at 24, 26. The Commission recommended that: state and local high school graduation requirements be strengthened and that, at a minimum, all students seeking a diploma be required to lay the foundations in the Five New Basics by taking the following curriculum during their 4 years of high school: (a) 4 years of English; (b) 3 years of mathematics; (c) 3 years of science; (d) 3 years of social studies; and (e) one-half year of computer science.

Id. at 24. The aim of the new requirement in computer science is to:

equip graduates to: (a) understand the computer as an information, computation, and communication device; (b) use the computer in the study of the other Basics for personal and work-related purposes; and (c) understand the world of computers, electronics, and related technologies.

Id. at 26. Other commentators are critical of this emphasis on computers in the classroom. *See, e.g., The Computer Fallacy*, 268 HARPER'S 22 (March, 1984) (interview of Joseph Weizenbaum by Franz-Olivier Giesbert, reprinted from *Le Nouvel Observateur*, Dec. 2, 1983.) Weizenbaum, of the Massachusetts Institute of Technology, contends that

[t]he temptation to send in computers wherever there is a problem is great. There's hunger in the Third World. So computerize. The schools are in trouble. So bring in computers. The introduction of the computer into any problem area, be it medicine, education, or whatever, usually creates the impression that grievous deficiencies are being corrected, that something is being done. But often its principal effect is to push problems even further into obscurity—to avoid confrontation with the need for fundamentally critical thinking.

Id. at 22, 24. *See also*, Euchner, *Equal Access to Computers in Education Could Become a Major Issue, Experts Warn*, EDUCATION WEEK, March 2, 1983, at 1, 15. (without proper teacher training, "computers will do little to prepare students for many of the jobs that will be available.")

It is important to note, however, that advocates of computer education do not see it as a substitute for traditional educational methods and subjects, but rather as an important supplement. *See, e.g.*, 98 CONG. REC. S12,352 (daily ed., Sept. 15, 1982) (statement of Sen. Lautenberg). ("Clearly computer education is not a substitute for the 3 R's. Putting computers in the classroom is not a panacea for the problems in American education which have been outlined by the Commission on Excellence in Education and others.") *See also* Asbell, *Writers' Workshop at Age 5*, N.Y. Times, Feb. 26, 1984, § 6 (Magazine), at 55, 64 (describing computer-assisted teaching system that "aims at allowing the child to write at the upper levels of his ability to think and talk," thereby using new technology to implement an "old idea").

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computers.⁹

But computer training requires computers, and today access to computers is often determined by wealth, race, sex, or region. A suburban high school student is much more likely than his or her counterpart in an inner city school to receive computer education.¹⁰ The findings of a major study by the Johns Hopkins Center for Social Organization of Schools further document that more affluent students enjoy greater access to computers. In January, 1983, nearly 70% of the schools in more affluent areas had at least one microcomputer, while only 40% of the schools in poorer areas were so equipped.¹¹ These findings are con-

9. Compaine, *The New Literacy*, 112 DAEDALUS 129 (Winter 1983). Compaine concludes that "in the near term, we might profitably think about computer skills as additional proficiencies in the bundle we call literacy." *Id.* at 139.

Mr. Compaine discusses a study in which a researcher with Harvard's Program on Information Resources Policy surveyed the help-wanted ads in the New York Times for the same June day in 1977 through 1982:

[The researcher] counted all jobs or skills in those ads that mentioned some "computer literacy" skill such as word processing, programming, data entry, and so on. In 1977, 5.8 percent of the want ads specified those skills. The percentage increased regularly to 1982, when 10.3 percent of the jobs listed required such skills.

Id. at 135-136. The study also notes an increase in the number of help-wanted ads for travel agents, bookkeeping jobs, and secretary-typists that called for computer skills. The ads which mentioned these skills in 1977 and 1982 increased from zero to 71 percent, 12 to 24 percent, and zero to 15 percent, respectively. *Id.* at 135-136. While the statistical rigor of such studies is limited, they reinforce impressionistic evidence and are therefore useful. Compaine states that "literacy is dynamic, a bundle of culturally relevant skills." *Id.* at 130. *See also* Vysotsky, *The Use of Computers for Business Functions*, in *THE COMPUTER AGE: A TWENTY-YEAR VIEW* 129 (Dertouzos and Moses eds. 1979).

10. HOPKINS ISSUE 1 and HOPKINS ISSUE 3, *supra* note 1. The Hopkins study is based on a probability sample of 2,209 public, private, and parochial elementary and secondary schools in the United States. The sample was constructed from a sampling frame of all public schools and over 90% of the private and parochial schools in the U.S. provided by Quality Education Data of Denver, Colorado. Information about whether a sampled school had a microcomputer, and how many it had was obtained for 96% of the national sample. This was accomplished between December, 1982 and February, 1983 by means of mailed questionnaires to the principal and a telephone conversation with school officials. The remaining information about microcomputer-using schools was provided by a teacher at the school identified as the "primary computer-using teacher." HOPKINS ISSUE 1, *supra* note 1, at 1. The return rate on an 18-page questionnaire sent to these teachers was 63% for the results in the first issue. *Id.*

There is some reason to believe that studies of this sort may reach incorrect results due to "reporting bias." *See, e.g.*, New York Post, Feb. 23, 1984 at 46, col. 2. (New York Board of Education official "says that the 6,075 computers reported [in response to an official survey] is probably 'closer to 10,000' and that administrators under-report because they think they won't get more.") However, since reporting bias is presumably the same for all categories of schools, it should not greatly diminish the significance of any of the studies discussed here.

11. HOPKINS ISSUE 3, *supra* note 1, at 7. The study confirmed that districts with a high percentage of poor families are much less likely to be microcomputer-owning schools. Whereas two-thirds of public schools in the better-off districts have microcomputers, only 41% of the schools in the least wealthy districts have any. Of the schools in the study's low socio-economic status (SES) category (the 26% of schools with the lowest family incomes in the survey), only 33% of low-SES elementary schools and 63% of low-SES secondary schools had one or more microcomputers. HOPKINS ISSUE 1, *supra* note 1, at 3.

firmed in a study commissioned by the National Science Foundation indicating that twice as many students in affluent areas had been exposed to computers as had students from disadvantaged urban areas.¹²

Race, as well as wealth, affects access. Schools with the most minority students are often those with the fewest computers.¹³ The Hopkins study found that 57% of high-income elementary schools had at least one computer, compared to 34% of minority-dominated schools.¹⁴ Although racial inequities are not as immediately apparent as those arising from disparities in income, they too must be redressed.¹⁵

12. Minnesota Study, *supra* note 1. The study, funded by the National Science Foundation's Office of Scientific and Engineering Personnel and Education, was conducted by the University of Minnesota, based on data from the National Assessment of Educational Progress, an evaluation of precollege science and mathematics education conducted every five years by the Department of Education. The basis of the study was "a national random sampling of 18,000 students. Three independent samples were taken from all U.S. students aged 9, 13 and 17. In addition, information was obtained from school principals on computer-related resources in their schools." This information led to the conclusion that students in affluent areas were exposed to computers at twice the rate of disadvantaged students. *Id.* at 2. Specifically, the study showed a level of computer exposure in disadvantaged urban areas of 16 percent compared with 31 percent in well-to-do urban areas. *Id.* See also Market Data Survey, *supra* note 1. Sharon Sanford, Director of Research for Market Data Retrieval, noted that "the same bias toward size and wealth that last year's survey identified was picked up again this year. Of the 2,000 largest, richest high schools, 80% have instructional computers. In the smaller, poorer high schools, the rate drops to 40%." Market Data phoned 15,314 U.S. school districts in 1981 and 1982 to get its figures. *Id.* at 2. See also Aplin-Brownlee, *For Poor Kids Computers are the Newest Disadvantage*, Washington Post, Sept. 12, 1983. In her article Aplin-Brownlee supports the general tenor of the various studies cited as well as suggesting the necessity of legislation such as the Computer Education Assistance Act. However, A. Daniel Peck of the University of San Francisco, founder of the Committee of Basic Skills Education, is quoted in the same article: "We're in a computer religion explosion to the detriment of basic skills education." *Id.* But see Savoye, *Have us. Have Nots in Classroom Computers*, Christian Science Monitor, Nov. 10, 1983 (comparing availability of computers in an affluent school in a Chicago suburb with a poorer school in Tuskegee, Alabama.)

13. See HOPKINS ISSUE 3, *supra* note 1, at 7. Figures for predominantly minority schools show that these schools are among the least likely schools to have microcomputers. The percentages for elementary and secondary schools which serve a predominantly minority student population are only 33% and 64%, respectively. See also Minnesota Study, *supra* note 1. The Minnesota researchers reported that "it is noteworthy that racial differences are no longer large, though gender differences are." They do report however that "the probability of enrollment for at least a year in a computer programming course is much lower for . . . pupils going to Title-I eligible schools, those with large numbers of economically disadvantaged pupils." See also Winerip, *Rich Schools Getting Richer in Computers*, New York Times, June 24, 1983, at B1 col. 2., quoted in 129 CONG. REC. S10,899 (daily ed., July 26, 1983). The article reports that "at Westfield High [a predominantly white suburban school], a student can take up to three years of programming; in Newark if he (or she) is lucky enough to be at a school with computers, he can take one year." In addition, students at Westfield work on terminals that connect to a large, central computer memory while students in Newark use computers that are simple self-contained units that cannot handle the more sophisticated programming done in Westfield. Five of Newark's 17 high schools have no computer courses at all and only three of the system's 50 elementary schools can accommodate computers. A school official estimates that 1000 terminals are needed to make computer literacy possible in the first eight grades, but he has only 25 terminals.

14. HOPKINS ISSUE 3, *supra* note 1, at 2.

15. The University of Minnesota study concluded that the true dichotomy was between

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Still other inequities exist. The geographic region where a student attends school may also affect his or her access to computers. Urban and suburban students are more likely to acquire computer skills than their rural counterparts.¹⁶ Students in the West benefit from a superior ratio of computers to students, although schools in other regions appear to use their computers more.¹⁷ Sex-based disparities are especially alarming: the average female student receives far less exposure to computers in school than does the average male.¹⁸

Left alone, these inequities—based on wealth, race, region and sex—will only worsen. In time, they will exacerbate existing divisions among Americans and ultimately jeopardize the competitive position of the nation as a whole. These realities constitute a persuasive case for a federal program to assist in stimulating widespread computer education. The Computer Education Assistance Act is one form such a program may take.

II. *The Computer Education Assistance Act*

Equity in educational opportunities for American children has long been a national goal. Beginning with racial segregation, obstacles to equity have been identified and addressed by the courts¹⁹ and by Congress.²⁰ Adequate computer training is a logical and compelling extension of this policy. Equity in computer training is one component of equal educational opportunity that has been recognized in at least one school desegregation case, in which the consent decree specifically provided for such training.²¹ The Computer Education Assistance Act is,

rich and poor schools. Because income is highly correlated with race, however, such findings are not fundamentally at odds with the Hopkins study. Minnesota Study, *supra* note 1, at 2.

16. Minnesota Study, *supra* note 1, at 2. The study revealed low levels of computer exposure in rural areas (12 percent), larger numbers in medium-sized cities (22 percent), and the highest percentages in well-to-do urban areas (31 percent).

17. HOPKINS ISSUE 3, *supra* note 1, at 4-6. The Hopkins study reported large regional differences. For example, whereas 48% of elementary schools outside the South had a microcomputer, only 29% of those in the South had any. The Minnesota study also showed large disparities between the West and the South. Among 13-year old students, "those in the West were twice as likely to have computer school experiences as were those in the Southeast, 25 percent and 12 percent, respectively." Minnesota Study, *supra* note 1, at 2.

18. Minnesota Study, *supra* note 1, at 2.

19. *See, e.g.*, Clark v. Board of Educ. of the Little Rock School District, 705 F.2d 265 (8th Cir. 1983) (recommendations on the quality of education included a plan for the inclusion of computer literacy); United States v. Texas Education Agency, 679 F.2d 1104 (5th Cir. 1982) (stipulation included a statement that a magnet school program include a computer science track).

20. *See, e.g.*, The Elementary and Secondary Education Act of 1965, Pub. L. No. 89-10, 79 Stat. 27 (1965); The Education for All Handicapped Children Act of 1975, Pub. L. No. 94-142, 89 Stat. 773 (1975).

21. The consent decree in San Francisco NAACP v. San Francisco Unified School District, 576 F. Supp. 34 (N.D. Cal., 1983) included computer education in two ways. The de-

therefore, an extension of a fundamental goal of contemporary educational policy: equalizing access to the means of becoming a productive citizen.

The Act is a pilot program that provides federal matching funds for the purchase of computers by state and local school authorities. The funds are distributed according to a two-tiered plan. One-half of the Act's annual appropriations to the states are allocated based on the number of students between the ages of 5 and 17 in each state.²² The other half of the appropriations are allocated to states according to a formula that takes into account the following factors: (1) the number of students in each state from families below the poverty line, and (2) the amount of money paid by each state through other educational programs, within certain limits.²³ The more low-income students a state has, the bigger its share of appropriations.

It is important to note that the Act provides *matching* funds for computer education. Federal funds may be matched with either state or private funds; the federal contribution would be \$75 out of every \$100.²⁴ This provides an incentive for both states and private organizations to continue contributing funds for computer education.²⁵

cree specified that one school would be converted "from a basic K-5 [kindergarten through fifth grade] elementary school to a computer-assisted instruction and computer science and awareness elementary school." *Id.* at 43. Another would be established as "a laboratory school with strong academic emphasis," including a computer science program. *Id.*

22. Computer Education Assistance Act, *supra* note 6, at § 5(A).

23. Computer Education Assistance Act, *supra* note 6, at §§ 5(B) and 8(2)(A). Section 5(B) reads:

[States are to receive] an amount which bears the same ratio to one-half of such remainder as the amount the State is eligible to receive under subpart I of part A of Title I of the Elementary and Secondary Education Act of 1965 [*supra* note 20] . . . in the fiscal year for which the determination is made bears to the amount available to all states under such subpart 1.

Section 8(2)(A) requires, as a condition for funding, that local education agencies file an application which

provides assurances that of the payments made to the local education agency in each fiscal year at least half of such funds shall be used to serve children who are counted under section 111(c) of the Elementary and Secondary Education Act of 1965 [*supra* note 20].

24. Computer Education Assistance Act, *supra* note 6, at § 11(b)(1). ("The Federal share for each fiscal year shall be 75 percent.")

25. Private corporations already have an incentive to contribute computers and other equipment to schools, in the form of tax rules involving charitable contributions. I.R.C. § 170 (taxpayer allowed deduction equal to fair market value of property contributed, with ceiling on percentage of gross income that can be offset by such a deduction). As companies replace outmoded computer systems, cash contributions will become increasingly attractive, since "a taxpayer is well advised to sell depreciated property in order to realize the loss and then to donate the proceeds," thus avoiding tax on the proceeds. BITTKER, 2 FEDERAL TAXATION OF INCOME, ESTATES, AND GIFTS, ¶ 35.2.1 (1981). For certain limited contributions of scientific and technical equipment to colleges and universities, corporations may deduct as much as twice the cost of the property they contribute. I.R.C. § 170(e)(4). Special legislation

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The Act also requires that states allocate computer education funds within the state so that at least half of the funds will serve educationally disadvantaged students.²⁶ This ensures that equity considerations do not end at the state level. To receive funds, local school boards would have to submit detailed plans describing how the funds would be spent and the role of computers in their schools' curricula.²⁷ The planning requirements in the Act, and funding for teacher training, are meant to ensure that computers are not just purchased, but that they are used as an integral part of the curriculum to achieve specific academic goals. This provision will engender a large library of practical computer education proposals, which will be available to all schools.

III. Conclusion

The Computer Education Assistance Act is designed to provide computer education for all American students, the economically disadvantaged as well as the more fortunate. The Act furthers the traditional goal of equity in education by extending its reach to an area of increasing importance to the nation as a whole. A program of national computer education, in which American students are equal participants, can help the United States remain an equal competitor in the world economy. This is so because a nation draws strength not only from its machines, but also from the skill and energy of its citizens.

aimed at extending these provisions to include donations of computers to elementary and secondary schools was introduced in 1982. Apcar and Chase, *Apple Wants a Big Tax Break So It Can Give One of Its Computers to Every School*, Wall St. J., Mar. 19, 1982, at 29 col. 4; *Apple Clears Hurdle On Its Plan to Send Computers to Class*, Wall St. J., Sept. 23, 1982, at 20 col. 2. The so-called "Apple bill" was never passed, but the state of California did adopt a 25% state income tax credit for gifts of computers and scientific equipment to California secondary and elementary schools, if made before June 30, 1984. *Hard-Core Support*, Wall St. J., Jan. 19, 1983, at 1 col. 5. Computer manufacturers have other incentives besides the tax system to place their computers in classrooms. It is widely believed that once students leave school, they are more likely to buy the same model computer they used while in school. See, e.g., Elmer-DeWitt, *supra* note 1.

26. Computer Education Assistance Act, *supra* note 6, at §§ 7(3)(A), 7(3)(B), and 8(2)(A). Sections 7(3)(A) and 7(3)(B) require each state to file an application with the Secretary of Education which

provides assurances that the State—

(A) will use grants under this Act (i) so as to supplement the level of funds that would, in the absence of such funds, be made available from non-Federal sources for the purpose of the program for which assistance is sought; and (ii) in no case to supplant such funds from such non-Federal sources; and

(B) will not commingle funds made available under this Act with State funds.

Section 8(2)(A) is reproduced *supra* at note 23.

27. Computer Education Assistance Act, *supra* note 6, at § 7.