HB

106

HFIN

FILE

HOUSE COMMITTEE REPORT

(11)
Date Referred: April 19, 1993

FURTHER REFERRALS:

Date of Committee Action: 2/17/94

The FINANCE Committee considered: HB 106

HOUSE BILL NO. 106 — EDUCATION TECHNOLOGY PROGRAM

"An Act establishing the Alaska education technology program; and providing for an effective date."

RECOMMENDATIONS:
be replaced with CSHB106 (Fin) [✓] the same title [ ] a new title
[ ] have attached amendments(s)
[ ] do pass
[ ] do not pass
[ ] no recommendations
[X] individual recommendations
[ ] additional referral to the ______ Committee

ADOPTS: ______ letter of Intent

ATTACHES NEW FISCAL NOTE(s): (Dept)
3[X] fiscal impact 2 - DOE 1 - Rev
[ ] zero fiscal note ______

APPROVES PREVIOUS: (Dept/Date)
[ ] fiscal note(s) ______
[ ] zero fiscal note(s) ______

SIGNING DO PASS	DP	OTHER RECOMMENDATIONS	DNP	NR	AM
Kay Brown	✓	E P Maclean		✓	
Mike Navarre	✓	Ronald L. Larson		Old Rcs	
Richard Foster	X	Sean Parnell		X	
[illegible]		Terry Martin		[illegible]	
[illegible]					

Ronald L. Larson E P Maclean
CHAIRMAN'S SIGNATURE

FISCAL NOTE

STATE OF ALASKA
1994 LEGISLATIVE SESSION

BILL NO. H.B 106

Revision Date:
Title: An act establishing the Alaska Education Technology Program
Sponsor: Rep. Kay Brown
Requestor: Rep. Kay Brown

Dept. Affected: Education
BRU: Libraries, Archives & Museums
Component: Library operations
COMPONENT SERIAL NO. 208

Expenditures/Revenues (Thousands of Dollars)

OPERATING EXPENDITURES	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00
PERSONAL SERVICES	34.7	34.7	34.7	34.7	34.7	34.7
TRAVEL	5.0	5.0	5.0	5.0	5.0	5.0
CONTRACTUAL	25.0	3.0	3.0	3.0	3.0	3.0
SUPPLIES	.3	.3	.3	.3	.3	.3
EQUIPMENT	9.0	1.0	1.0	0	0	0
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	74.0	44.0	44.0	43.0	43.0	43.0

CAPITAL EXPENDITURES						

CHANGE IN REVENUES ( )						

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF	74.0	44.0	44.0	43.0	43.0	43.0
1005 GF/Program Receipts						
1006 GF/MHTIA						
Other						
TOTAL	74.0	44.0	44.0	43.0	43.0	43.0

Estimate of any current year (FY94) cost: $

POSITIONS

FULL-TIME	1.0	1.0	1.0	1.0	1.0	1.0
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

This fiscal note does not assume the administrative cost necessary to administer the Education Technology Fund. Should the fund be created, additional costs would occur.

Prepared by: Karen R. Crane
Division: Libraries, Archives & Museums
Phone: 465-2910
Date: 12/6/93

Approved by Commissioner: Jerry Covey
Agency: Education
Date:

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FISCAL NOTE

STATE OF ALASKA
1994 LEGISLATIVE SESSION

BILL NO. CSHB 106 (HES)

Revision Date:		Dept. Affected:	Revenue
Title:	An Act establishing the Alaska education technology program	BRU:	Revenue Operations
		Component:	Treasury
Sponsor:	Representatives Brown, Ulmer, Davidson		
Requestor:	House Finance	COMPONENT SERIAL NO.	121

Expenditures/Revenues: (Thousands of Dollars)

OPERATING	FY95	FY96	FY97	FY98	FY99	FY00
PERSONAL SERVICES	5.0	5.0	5.0	5.0	5.0	5.0
TRAVEL						
CONTRACTUAL	20.0	20.0	20.0	20.0	20.0	20.0
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	25.0	25.0	25.0	25.0	25.0	25.0
CAPITAL						
REVENUE FUND SOURCE:						

FUNDING: (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF						
1005 GF/Program Receipts						
1006 GF/MHTIA						
Other	25.0	25.0	25.0	25.0	25.0	25.0
TOTAL	25.0	25.0	25.0	25.0	25.0	25.0

POSITIONS:

FULL-TIME						
PART-TIME						
TEMPORARY						

Estimate of current year (FY94) impact: $

ANALYSIS: (Attach a separate page if necessary.)

The $25.0 expenditure in total operating costs is the basic fixed personal service and contractual cost for an investment portfolio managed by the Treasury Division. Contractual costs would consist of external investment management, accounting and custodial services. Future cost increases are dependent on the asset growth of the portfolio from contributions and market gains. Variable expenses of 0.2% of the assets under management in excess of $12.5 million can be estimated.

Prepared by:	Laraine L. Derr *(signature)*	Phone:	465-4880
Division:	Treasury	Date:	January 14, 1994
Approved by Commissioner:	Darrel J. Rexwinkel *(signature)*	Date:	January 14, 1994
Agency:	Revenue		

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FISCAL NOTE

STATE OF ALASKA
1994 LEGISLATIVE SESSION

BILL NO. H.B. 106

Revision Date:

Title: An act establishing the Alaska Education Technology program

Sponsor: Representative Kay Brown

Requestor: Representative Kay Brown

Department Affected: Education

BRU: Educational Program Support

Component: Basic Education

COMPONENT SERIAL NO. 171

Expenditures/Revenues: (Thousands of Dollars)

OPERATING	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00
PERSONAL SERVICES	86.5	86.5	86.5	86.5	86.5	86.5
TRAVEL	6.3	10.0	10.0	10.0	10.0	10.0
CONTRACTUAL	21.5	14.3	14.3	14.3	14.3	14.3
SUPPLIES	.5	.5	.5	.5	.5	.5
EQUIPMENT	18.0	0	0	0	0	0
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	132.8	111.3	111.3	111.3	111.3	111.3
CAPITAL						
REVENUE FUND SOURCE:						

FUNDING: (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF	132.8	111.3	111.3	111.3	111.3	111.3
1005 GF/Program Receipts						
1006 GF/MHTIA						
Other						
TOTAL	132.8	111.3	111.3	111.3	111.3	111.3

POSITIONS:

FULL-TIME	1.5	1.5	1.5	1.5	1.5	1.5
PART-TIME						
TEMPORARY						

Estimate of current year (FY94) impact: $ None

ANALYSIS: (Attach a separate page if necessary.)
This fiscal note does not assume the administrative costs necessary to administer the Education Technology Fund. Should the fund be created, additional costs would occur.

Prepared by: Cathy Carney
Phone: 465-8718
Division: Educational Program Support
Date: February 15, 1994

Approved by Commissioner: [signature] Jerry Covey
Agency: Education
Date: February 15, 1994

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Rev 11/93

FY95

Personal Services

1 full-time Education Specialist II, Range 21: $70.1

Primary Responsibilities:

- Promote the development of district/site plans for appropriate use of technology-assisted learning, and provide assistance in securing the necessary training and other resources to carry out these plans.
- Coordinate the use of educational technology within the Department's existing curriculum, vocational, and restructuring projects.
- Coordinate and expand existing public and private, district and state-level services which impact K-12 educational telecommunications, including STAR schools, the University of Alaska computer network, Livenet, and rural Alaska television

1 half-time Clerk Typist III, Range 8 (.5): $16.4

Primary responsibilities:

- Clerical support for Education Specialist in working with school districts and planning for use of education technologies in the classroom.

Travel

Travel for committee members to meet and develop recommendations for the Department on statewide education technology implementation (8 members for one 3-day meeting, with $500 average transportation cost and $285 for per diem): $6.3

Contractual

Phone, postage, photocopying: $5.3
Professional service contracts: survey of educational technology resources: $15.0
Audioconferencing with school districts and follow-up meetings with committee: $1.2

Supplies

Publications, memberships, training materials: $.5

Equipment

Two computer terminals for word processing, electronic mail system, grant management (spreadsheet) functions: $8.0 x 2 = $16.0
Desks and other office equipment: $1.0 x 2 = $2.0

FY96-00

Personal Services

Same as FY95

Travel

Department of Education technical assistance, facilitating training: $10.0

Contractual

Phone, postage, photocopying: $5.3
Professional service contracts: publications, training, planning workshops: $7.0
Audioconferencing with school districts: $2.0

Supplies

Publications, memberships, training materials: $.5

Equipment

None

Back-up

2/7/94

CSHB 106 (HES)

Education Technology Program

Sponsor Statement

Alaska must prepare its children to compete in the global marketplace. The computer revolution that has transformed the way industry and government conduct business is creating new demands on America's educational system. Mastery of computers is now required for virtually all occupations, regardless of whether they are technical, professional, entry-level or executive-level. It is required for technological competitiveness.

Expanding the use of technology in classrooms is an important aspect of education reform. Because teachers and students will not learn the desired skills without ongoing, intensive access to technology, state support is needed to help districts acquire needed hardware, instructional software and other technologies for library and classroom use.

Educational leaders agree that access to computers and networks can aid in the instruction of numerous subjects. Classroom access to telecommunication networks enables cost-effective use of "distance delivery" techniques, expanded access to libraries, and cooperative projects among schools.

Please see the attached article by Charles R. McClure, which presents a good overview of these issues. McClure writes in "Network Literacy in an Electronic Society: An Educational Disconnect?" [from *The Knowledge Economy, The Nature of Information in the 21st Century*, 1993-1994, annual review of the Institute for Information Studies.] that

> pro-active information policies and education are needed to improve literacy and to narrow the widening gap between the richest and poorest segments of society. "This challenge is one that we cannot ignore. If we fail to act, fail to accept this challenge, the various segments of our society will become increasingly disconnected and intolerant of each other."

Access to education technology resources varies in schools throughout the state. Some schools are far behind.

Summary of bill

Briefly, the bill would:

• establish the **Alaska Education Technology Program** in the Department of Education. The program must include

(1) **technical assistance** to districts, schools and libraries for the purpose of planning for, purchasing, using and evaluating the results of education technology;
(2) **training** for teachers and other employees in the use of education technology;
(3) a plan for **coordinating and expanding existing networks** for educational uses.

• establish the **Alaska Education Technology Fund**; the commissioner of Revenue is the treasurer of the fund.

The **purpose of the fund** is to (1) enhance the quality and equity of education at public elementary and secondary schools by **providing a portion of the money needed to purchase and maintain education technology** in classrooms; (2) provide **training** in the use of education technology to help students achieve student performance standards; and (3) provide **access to networks** for public schools.

• require a **local match for funding** on a sliding scale formula.

The requirements for an application are outlined in detail. Before a grant is awarded **a school must prepare a comprehensive plan** explaining how it will use the technology to improve student performance, how it will train teachers and other instructional personnel in curriculum application and implementation, and how it will evaluate program.

• establish an **Education Technology Committee,** consisting of the director of the division of libraries, archive and museums and seven members appointed by the Governor. The seven include four educators with demonstrated education technology experience from districts of varying sizes; one university and one DOE employee with demonstrated experience; and one employee of the Department of Administration with telecommunications expertise.

• require the committee to develop appropriate guidelines to ensure an **equitable distribution of funds** over a five-year period.

• amend the "**school report card**" requirement to include a report on "uses of education technology by classroom teachers that have improved student performance and the results of periodic evaluations of education technology" acquired under the Alaska Education Technology Fund program.

• require the DOE to conduct, before accepting applications for funds
(1) a **survey of education technology resources** in public schools and libraries in the state; and
(2) **statewide planning and grant writing seminars** available to all public schools, districts and libraries.

Funding

To fully implement the program described in the bill, a substantial financial commitment in the neighborhood of **$50 million is needed.**

HB 107 proposes that the program be funded over a five-year period partly from General Obligation bonds approved by the voters:

*$40 million from G.O. bonds, and
*$5 million to 10 million from the General Fund to cover non-bondable costs such as teacher training (up to $2 million GF per year).

HB 107 has not yet received a hearing in the House HESS Committee.

Fiscal notes

In addition to these "big picture" costs, several fiscal notes accompany HB 106 (in thousands):

• Department of Education

Basic Education	$132.8 (first year; future amounts decline)
Libraries, Archives & Museums	$74.0 (first year; future amounts decline)

Funding for these fiscal notes would enable the department to initiate the program.

Most resources initially would be devoted to
*__statewide survey__ of technological status in schools and libraries;

*participation in development of structure and policies governing education **networks** (example, Satellite Interconnection Project);

*assessment of opportunities to **implement technology** in Alaska schools **more cost effectively** . (Examples -- investigate methods to obtain lower rates through bulk purchasing arrangements from hardware and software vendors; explore ways to enable more sharing of training and network resources).

*assistance to local libraries, schools and districts with **development of plans** for purchase and use of educational software, materials and equipment; retrofit of buildings; training; and technical support.

Even a small amount of state support could be effective in supporting school districts, which are at varying stages of technological development and commitment. Teachers also have varying amounts of technological skill and interest. A training/technical support network could be effective in meeting diverse needs in this environment.

• Department of Revenue
Treasury Revenue Operations $25.0

It is my understanding that these costs would not arise until bonds are sold or funds are appropriated to the Alaska Education Technology Fund.

Summary

Alaska's current fiscal condition demands that we rethink the value of all state programs. Implementing an effective education technology initiative is worthwhile, even when compared to the value of existing programs it would displace.

We must push forward in the search for an education system that is equitable, relevant, and effective. **All** Alaska students must have access to information technology resources and networks. Establishing a state education technology program through HB 106 is a logical, cost-effective next step.

January 26, 1994

SECTIONAL ANALYSIS

CSHB 106(HES)

An Act Establishing the Education Technology Program

Section 1

Findings and Purpose.

Section 2

The "School District **Report Card To The Public**" requirement in AS 14.03.120(e) is amended to include a report on "uses of education technology by classroom teachers that have improved student performance and the results of periodic evaluations of education technology acquired" under the program established in this bill.

Section 3

The **Alaska Education Technology Program** is created in the Department of Education. The department will offer technical assistance to schools and publicly funded libraries in planning, purchasing, using and evaluating results of education technology. The department will provide training to school and library employees in the use of education technology. The department will develop a plan for coordinating and expanding the use of existing networks and investigating the development of new networks for educational uses.

The **Alaska Education Technology Fund** is established in the Department of Education. Proceeds of the fund will be used to provide a portion of the money needed to purchase, install, and maintain education technology for use in Alaska public and secondary school classrooms, provide training for teachers and other instructional personnel in the use of the technology, provide network access for public schools and publicly funded libraries through the University of Alaska computer network or other means, and provide a portion of the money needed to purchase computer and resource sharing systems for public libraries.

The fund consists of legislative appropriations to the fund and public or private donations made for the purpose of the fund. The Commissioner of Revenue is designated as treasurer of the fund.

The items that must be included in an application to fund a project or grant are specified for schools and libraries. Before a grant or project is awarded **a school must prepare a comprehensive plan** explaining how it will use the technology to improve student performance, how it will train teachers and other instructional personnel in curriculum application and implementation, and how it will evaluate program. Publicly funded libraries must provide a plan explaining how the project will improve the services of the library or access to resource sharing and how it will provide ongoing training for library personnel in the effective use of education technology.

Money in the fund that consists of proceeds from the sale of G.O. bonds may not be awarded as a grant. The state board shall adopt regulations that allow a school district, a public school, or a publicly funded library to obtain education technology under a permit or lease with the department; this provision will enable the department to purchase equipment with G.O. bond monies and then allow the equipment to be used by a school, district or library under a lease or permit. Grants can be awarded for training (G.O. bond funds cannot be used for training).

The Department of Education shall include in its annual report a report on the projects receiving education technology funding.

A school district or publicly funded library must provide a share of the project cost in accordance with a formula specified in AS 14.30.820 (b) and (c).
The duties of the Commissioner of Revenue with respect to the fund are outlined.

An **Education Technology Grant Committee** is created consisting of seven members appointed by the governor and the director of the Division of Libraries, Archives and Museums. The seven include four educators with demonstrated education technology experience from districts of varying sizes; one university and one DOE employee with demonstrated experience; and one employee of the Department of Administration with telecommunications expertise.

The Committee shall review and approve project and grant requests using specified criteria.

The committee shall develop appropriate guidelines to ensure an equitable distribution of project and grant funds over a five-year period.

Members of the Committee serve without compensation but are entitled to receive per diem and travel expenses.

Terms are defined.

<u>Section 4</u>

Before accepting project or grant applications, the Department of Education shall conduct a survey of existing education technology resources. The department also shall conduct statewide education technology planning and grant writing seminars available to all public schools, school districts and publicly funded libraries.

<u>Section 5</u>

Sunset clause. The Alaska Education Technology Program established by this legislation is repealed June 30, 2000.

<u>Section 6</u>

Effective date.

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FAX: 907 333-0707

March 9, 1993

The Hon. Cynthia Toohey, Co-Chair, and
The Hon. Con Bunde, Co-Chair
House Health, Education and Social Services Committee
via fax 465-2278

Dear Ms. Toohey and Mr. Bunde:

I am writing in support of HB 106, Education Technology and HB 107, Bonding which I understand you will hear tomorrow.

As is stated in the bill's Findings and Purpose: "education technology has the potential to improve the academic performance of students..."

It most certainly does, and if through the assistance provided by this legislation school districts select good instructional software and available staff development, it has been demonstrated time and again that our kids will show meaningful learning improvement. On request I will be glad to provide you with dozens of pertinent reports from school districts across the country and now similar reports from a few of Alaska's school districts are available.

This bill's reference to improved academic performance as an objective should encourage student use of computers and other technology in ways in which you and I do not work with these machines.

Basically, you and I use computers as tools; we have, for the most part, already acquired our basic communication skills and have less need of the very sophisticated core subject integrated instructional software on the market today.

Students need access to both. If it were merely a case of exposing students to basic computer use as is common in the workplace, such could be fully accomplished in the final semester of high school and this bill would be unnecessary.

I very much hope that you will work towards a favorable vote in House HESS. Thank you.

Sincerely,
Jostens Learning/Alaska, Inc.

Rob Lapham
President

Network Literacy in an Electronic Society: An Educational Disconnect?

Charles R. McClure

School of Information Studies
Syracuse University

> We're all connected by communications miracles. It's the people, still fumbling with the Switch Hook Flash who are stuck in the Stone Age
>
> *Gleick, 1993, p. 26*

The skills required to use the switch hook flash on one's telephone pale in comparison to the skills and knowledge that are needed to use resources and services in the evolving National Information Infrastructure (NII) and the Internet/National Research and Education Network (NREN). While some people begin and others expand and refine their network skills and competencies, the vast majority of the public has no skills related to using these new communications technologies and many live in fear of a passing thunderstorm that might force them to relearn (again) how to reset the LCD time displays on their VCR or microwave.

There is an educational disconnect between the rapidly developing communications technologies and information resources available to the public, and the public's ability to use these resources. An elite few, typically academics, researchers, technology enthusiasts, and "network junkies," are network literate. While [illegible] 'f between these network literate "cybernauts" and those who are not continues to widen, the education system continues to be largely oblivious. Individuals in this emerging electronic society primarily learn on their own to be productive in and empowered by this new environment, or they are left behind.

Significant changes in the communications infrastructure are affecting the very fabric of society. Information technologies in telecommunications, cable television, wireless satellite transmissions, the Internet/NREN, and others now provide an incredible and seemingly endless array of information resources and services. Experts knowledgeable about these technologies tell us that future uses and applications are limited only by one's imagination ("The Info Highway," 1993). Network literacy, the ability to identify, access, and use electronic information from the network, will be a critical skill for tomorrow's citizens if they wish to be productive and effective in both their personal and professional lives.

The NII, an amorphous term for the collection of these information technologies and the infrastructure that supports them, appears to be taking shape (U.S. Congress, 1993a). We are moving toward establishing a ubiquitous electronic network that connects different information technologies to endless streams of digital data throughout the country and the world. Indeed, the "network" is an evolving term that includes these various computer, telecommunications, cable TV, and other technologies.

Meanwhile, the telephone, telecommunications, and cable television companies are battling for the rights (and the profits) for wiring individual homes into a massive array of information providers, resources, and services (Stix, 1993). But while the battle for connecting individual homes to this evolving information infrastructure is still developing, it is clear that the Internet/NREN already provides a great deal of connectivity throughout the country and will have a significant impact on society. Indeed, the "networked society" is already taking shape.

While the technology developments related to networking are significant and draw much attention, there is also an infrastructure that supports these technologies. The nontechnological aspects of the infrastructure include the human resources, political, and social processes; organizational support; and the tools (both physical and attitudinal) that people need to use the new technologies. The technological infrastructure that supports the Internet/NREN continues to grow at a much faster rate than our knowledge about how to use the network—to say nothing of the switch hook flash—the network's impacts, its uses, and its effects on organizations and individuals.

Despite the traditional role of libraries in providing a range of information resources and services to the public, federal policy and planning have been inadequate to assist libraries transition to the networked environment. Nor has there been adequate planning or assistance to the public in learning how to use and access these electronic resources. Making these resources available to the public, learning how to communicate and use the network, and ensuring network literacy among the population are critical to the success of the NREN and to the people in the networked society.

In our fascination with the new information technologies, we have given inadequate attention to how society will migrate to this networked environment. Will the networked society result in excluding a range of services and opportunities to those who are unable, for whatever reason, to move to the networked environment? Who will be responsible for educating people to use the networking technologies and take advantage of the wealth of resources currently available and yet to be developed? How will the public participate in decision making about technology applications that will affect the fabric of their society if they are network illiterate?

The purpose of this paper is to explore educational and societal issues related to network literacy. How we address and resolve these issues will have a significant impact on how society evolves, how notions of literacy and a literate society evolve, and the degree to which social equity can be enhanced in this country. The country must develop strategies to develop the Internet/NREN as a vehicle for (1) "reconnecting" different segments in our society, (2) promoting a network literate population to ensure a social equity, and (3) enhancing the role of libraries and the education community to accomplish these objectives.

NETWORKED INFORMATION RESOURCES AND SERVICES

The term *networked information* applies to a vast range of electronic information and services now available through the Internet. It is not the purpose of this paper to review the extent and nature of these resources and services since others (LeQuey, 1993; Krol, 1992) already have done so. There are thousands of discussion groups; data bases and sources to access information from governments, commercial providers, and other individuals; sophisticated scientific applications; books and journals in digital format; electronic card catalogs of many libraries throughout the world; weather reports and restaurant guides; and much, much more.

Information that has been networked, i.e., made accessible via one of the over thousands of worldwide networks comprising the Internet, puts new dimensions on the impacts and uses of information (see following section). But uses and applications of the Internet have gone far beyond ordinary electronic mail (e-mail). To cope with the vast amounts of information available over the network new communication techniques and information resource discovery tools are available and being used (Brett, 1992), including:

- *Listservs and discussion groups:* Users who share a common interest in a particular topic can subscribe to a "listserv," where a message posted to that list will be sent automatically to everyone subscribing to that list. There are thousands of such lists on every conceivable topic imaginable. For example, there is a PUBLIB listserv in which individuals exchange information related to public library activities. Someone can post a note to such a listserv and immediately have it sent to thousands of other people interested in that topic.

- *File Transfer Protocol (FTP):* Individuals and organizations have placed vast amounts of information on file servers at many different sites around the world; using FTP, users can log in to a remote computer system, identify a particular file, and retrieve that file directly into their computer. For example, a file containing *Alice in Wonderland* at Project Guttenberg can be FTP'd to an individual's personal computer to be read whenever desired.

- *Telneting:* Once an address is known for a particular data base, the user can log in to a remote data base and search that data base for information; for example, users from around the world can log in to a data base at the Library of Congress and determine the current status of legislation.

- *Gophers:* This technique identifies files on the Internet by keyword searching, connects the user to the desired file, and the identified file then can be searched and downloaded (if desired) directly into their computer. For example, within a gopher program, users might search on the term *environmental pollution* locating 12 different data bases covering that particular topic, users can select one they wish to search and be seamlessly connected to that data base.

- *Wide Area Information Server (WAIS):* A WAIS is similar to a gopher in that both identify and access remote data bases; a WAIS, however, ranks the likelihood that a particular data base has the information one needs and can do full-text searching of multiple data bases.

These, of course, are only some of the services and techniques that people can use to identify, access, search, and obtain a wealth of information over the Internet. Krol (1992) and Kochmer and Northwest Net (1993) are two of the best guides currently available for how to use and search the Internet.

This environment promotes a very pluralistic albeit constantly changing and chaotic approach for accessing and using information in a networked setting. And while there is still much need for more user-friendly programs and services over the network, and while some of the issues related to privacy, intellectual property rights, pricing of services, and acceptable use of the Internet (to name but a few) remain thorny and contentious, growth and use of the Internet proceeds exponentially.

For example, one recently developed service is called AskERIC, which is an Internet-based question-answering service for teachers, library media specialists, and the education community. It is supported by the Department of Education through the ERIC Clearinghouse at Syracuse University ("AskERIC: ERIC and the Internet Continued," 1993). By sending an e-mail message over the Internet with the request for information to <askeric@ericir.syr.edu> users can obtain a response, usually within 24 hours, about virtually anything related to education. In addition, the librarian answering the question at the ERIC Clearinghouse may direct the user to additional Internet resources, provide digital information from the ERIC data base, or attach a range of additional information in his/her electronic response to the user.

The impacts of having access to and use of the Internet are extensive. One business executive (Levin, 1993) commented:

> The Internet gave us the power to do something significant and the ability to do it quickly. In business terms its a first-quarter success. We can work quickly with experts around the world and we can get rapid feedback on early revisions. It improves our customer support, which increases our income from sales.

Another example of impact comes from a television manager in Omaha, Nebraska (Stix, 1993, p. 105):

> My daughter was scheduled for surgery in October of 1991 for correction of scoliosis (curvature of the spine). In late summer of that year, I decided it was important to learn more about scoliosis. A library catalogue search over the Internet led me to discover that another daughter had symptoms that could mean our family was affected by a serious hereditary disorder. . . . I used a specialized Internet service, WAIS, that let me search multiple databases. The bibliographies led me to physicians who knew how to diagnose and treat it. *The Internet may have saved my daughter's life!* [author's emphasis].

Health care delivery over the evolving NII is another area where rapid changes will occur. The Consumer Interest Research Institute concluded that (1993, pp. 12–15):

> Powerful new information technology applications are emerging which can make home based health care surprisingly effective:
>
> - *Computer-based medical records.* Computer based medical records are a "foundation technology" that will make possible a wide range of new applications. They will record and store patient information including patient problems, test results, orders submitted, treatment plans, X-rays and other images.

> - *Health information and communication systems.* Easy consumer access to health information will be crucial for making a disease prevention/health promotion strategy work. Consumers will have greater health information available to them at home including clinical advice about specific diseases, information on their own conditions, access to their own medical records, disease prevention/health promotion information geared to their individual health status, etc.
>
> - *Diagnostic and therapeutic expert consultation.* By 1995, expert systems are likely to be used increasingly on physicians' workstations for consultation and quality control. . . . In the late 1990s they will be linked to the electronic medical record and knowledge bases that will advise the practitioner on the logic and medical literature supporting specific decisions.

These experiences and visions—as well as thousands of other "success stories"—dot the Internet landscape. The new communication techniques and the resources and services available over the Internet will continue to change the way we work and live. Those not connected or unable to use the Internet, however, may find themselves increasingly disadvantaged in the workplace, in dealing with daily issues, in being an informed citizen, and in living a quality life.

A POLICY PERSPECTIVE ON THE INTERNET/NREN AND LITERACY

Although the intent of this paper is not to provide a policy analysis of the Internet/NREN and of literacy, it is interesting to juxtapose a brief overview of these two areas. There have been few efforts to consider relationships between these two policy areas. Yet the successful development of the NII will require both a new expanded information policy system and network literacy throughout society.

Internet/NREN Background

The Internet is a currently existing, operational network of networks. The NREN is a program, a concept, and a vision of an interconnected future. The Internet was not created at a single point in time but has been an evolving structure since the late 1960s. The term NREN is often used as shorthand for a ubiquitous, national network connecting computers, people, data bases, digital libraries, and a host of other resources residing on the network.

Projects underwritten by the Defense Advanced Research Projects Agency (DARPA) in the mid- to late 1960s resulted in the ARPANet, an experimental packet-switched computer network that began in 1969. ARPANet provided both operational functionality as well as an opportunity for further research into advanced networking technologies. The Transmission Control Protocol/Internet Protocol (TCP/IP) emerged from the research in the ARPANet environment. These protocols allowed the concept of the Internet, a network of interconnected computer networks of all sizes—from local area networks (LANs) to wide area networks (WANs) to become a reality. Lynch and Preston (1990) and McClure, et al. (1991) provide overviews and history of the Internet.

In the mid- to late 1980s, the National Science Foundation (NSF) funded several supercomputer sites to serve as national supercomputer resources and developed a high-speed backbone network (NSFNet) to connect them. This initiated the second phase in national network development. NSF also coordinated a tiered structure of interconnected computer networks by funding the establishment of regional, or mid-level, networks. These regional networks interconnected educational and research organizations, institutions, and their individual computer networks, and they provided access and connection to the NSFNet backbone. The NSFNet backbone is one of several federally funded backbone networks, connected together through the Internet.

The Internet is not only a United States computer network but a truly global network, connecting an estimated 12–14 million users on thousands of networks. In recent years, the Internet has shown tremendous growth in number of users, networks connected, and traffic. Rutkowski (1993) details this tremendous growth and predicts that exponential growth of the Internet, in terms of users, connected networks, network hosts and registrations, and traffic will continue for the foreseeable future.

Now in the early 1990s, the Internet is in another transitional stage. The NSF has been reducing its subsidies to the regional networks in recent years and is guiding the Internet toward privitization and commercialization. Privitization means that the federal government will no longer directly subsidize network services and connections. Commercialization will allow the lifting of current restrictions on traffic flowing over the network and acceptable use of the network will not be limited to network traffic supporting research and education. The direction and character of the moves toward privitization and commercialization have sparked widespread debate within the networking community (DeLoughry, 1993).

As a federally funded, multiagency initiative, the principal goals of the NREN program are: establishing a gigabit network for the research and education community and fostering its use; developing advanced networking technologies and accelerating their deployment; stimulating the availability, at a reasonable cost, of the required services from the private sector; and serving as a catalyst for the early deployment of a high-speed general purpose digital communications infrastructure for the nation. Despite these goals, the NREN means different things to different people. The policy debates will continue, but network literacy issues have yet to be raised and receive adequate attention.

Current and Proposed Internet Policy Instruments

The High Performance Computing Act of 1991 (P.L. 102-194) authorized the creation of a National Research and Education Network. After several years of legislative action, the Act was signed into law in December 1991. McClure, et al. (1991), provide a comprehensive legislative history of the Act and related legislative initiatives. In the Act, the NREN is one of several components in a high-performance computing and communications program. In the fiscal 1993 proposed budget for the high performance computing program by the Office of Science and Technology, only 15 percent of the funds are allocated to the NREN. The majority of the funds are targeted at the high-performance computing systems and the advanced software technology and algorithms components.

Section 102 of the Act describes the NREN, and section (b) specifically discusses "access" to the network:

> Federal agencies and departments shall work with private network service providers, State and local agencies, libraries, educational institutions and organizations, and others, as ap-

propriate, in order to ensure that the researchers, educators, and students have access, as appropriate, to the Network. The Network is to provide users with appropriate access to high-performance computing systems, electronic information resources, other research facilities, and libraries. The Network shall provide access, to the extent practicable, to electronic information resources maintained by libraries, research facilities, publishers, and affiliated organizations.

While public access is prominently mentioned in this section, the sense of this section is severely compromised by phrases such as "as appropriate," "with appropriate," and "to the extent possible."

The Clinton administration has expressed commitment to advancing the information infrastructure and increased deployment of information technology in the cause of education, research, and national competitiveness. A February 1993 policy statement states (Clinton and Gore, 1993):

> Public investment will be provided to support technology that can increase the productivity of learning and teaching in formal school settings, in industrial training, and even at home. New information technologies can give teachers more power in the classroom and create a new range of employment opportunities. Schools can themselves become high-performance workplaces [p. 14].

Regarding the importance of "Information Superhighways":

> Access to the Internet and developing high-speed National Research and Educational [sic.] Network (NREN) will be expanded to connect university campuses, community colleges, and K–12 schools to a high-speed communications network providing a broad range of information resources. Support will be provided for equipment allowing local networks in these learning institutions access to the network along with support for developing of high performance software capable of taking advantage of the emerging hardware capabilities [p. 35].

The policy paper goes on to discuss the importance of using the new information technologies and the national network for enhanced economic competitiveness; making a range of government information and services available to the network; and expanding access to the NREN.

In spring 1993, Representative Boucher (Virginia) introduced H.R. 1757, the High Performance Computing and High Speed Networking Applications Act. The bill was renamed the National Information Infrastructure Act of 1993 when it passed the House in summer 1993. Section 2 (3) states:

> High performance computing and high speed networking have the potential to expand dramatically access to information in many fields, including education, libraries, government information dissemination, and health care, if adequate resources are devoted to the research and development activities needed to do so.

Section 2 (5) states:

> The Federal Government should ensure that the applications achieved through research and development efforts such as the High-Performance Computing Program directly benefit *all Americans* [author's emphasis].

And Section 305 (b) states that the program will:

> train teachers, students, librarians, and state and local government personnel in the use of computer networks and the Internet. Training programs for librarians shall be designed to provide skills and training materials needed by librarians to instruct the public in the use of hardware and software for accessing and using computer networks and the Internet.

This bill is important since it includes language supporting training issues for networking, extending the role of libraries and the education community in developing and operating the national network, and promoting the development of networking applications and demonstration projects. The bill recognizes the importance of helping individuals to move into the networked society successfully. As of August 1993 the bill has passed the House and awaits Senate action.

Literacy Policy Perspectives

Policy instruments related to literacy have evolved from a number of agencies and initiatives. For example, the Adult Education Act (P.L. 89-750) promotes the development of a range of basic literacy programs to adults: the Library Services and Construction Act (P.L. 88-269) provides for Department of Education grants to states for public library services such as literacy programs: the Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-148) amends the Adult Education Act to provide literacy programs and amends the Education for Economic Security Act to authorize mathematics and science education programs.

In general, however, these initiatives provide support and funding for the individual states to create and run a range of "literacy" programs. It is unclear how successful these efforts have been. Some have argued that there is no accountability from the states regarding these programs and that the results have been mixed at best (Bishop, 1991). Moreover, these efforts typically concentrate on (1) improving adult reading skills, (2) promoting math and science education, and (3) job training—not on network literacy or information problem solving skills.

For example, one of the National Education Goals that resulted from the meeting between President Bush and the state governors in 1992 (U.S. Department of Education, 1992), was that by the year 2000:

> Every adult will be literate and have the knowledge and skills necessary to compete in a world economy and exercise the rights and responsibilities of citizenship.

Currently, it is estimated that there are some 30 million functionally illiterate Americans in this country. Thus, how this goal will be accomplished is unclear. How these adults will be "literate" in a networked society and what might constitute such literacy is also unclear.

Probably the most important recent policy instrument related to literacy is P.L. 102-73, The National Literacy Act of 1991. A major thrust of this law is its creation of the National Institute for Literacy. Section 102 (3) states:

> A national institute for literacy would (a) provide a national focal point for research, technical assistance and research dissemination, policy analysis, and program evaluation in the area of literacy; and (b) facilitate a pooling of ideas and expertise across fragmented programs and research efforts.

The Institute can also award action grants to be given to volunteer groups that provide literacy training. Because the Institute is still in its infancy, it is unclear how successful it will be in dealing with the plethora of literacy problems and policies.

Literacy policy and support at the federal level is uneven, at best. Recently, in spring 1993, the Clinton administration proposed the elimination of $8 million in literacy projects from the Library Services and Construction Act, Title VI. For fiscal year 1993, that program accounted for some 250 awards, administered by state and public libraries. In the overall scheme of the U S. federal budget, $8 million may be trivial. But in terms of support for dealing with literacy issues, $8 million is significant.

In perhaps the best recent analysis of policy issues related to literacy, the U.S. Office of Technology Assessment (1993, pp. 127–28) concluded:

> The Federal response to the problem of adult illiteracy consists of many categorical programs—at least 29, perhaps many more, depending on the definition used—that in some way aid adult literacy and basic skills education. Although the individual programs have solid records of accomplishment, together they create a Federal role that is complicated, fragmented and insufficient, and which, by it very nature, works against development of a coordinated Federal adult literacy policy.

Federal policy instruments related to literacy issues are limited to a very traditional interpretation of "literacy." Overall, the literacy policy framework can be best described as one that has been given much rhetoric but has received very limited direct support.

Assessment

Until the Clinton administration, the federal policy framework for creating the Internet/NREN has emphasized the development of new networking technologies and creating a "level playing field" for the private sector to develop the network. Inadequate policy exists supporting public-sector uses of the Internet/NREN. The library and education community had minimal input and impact on developing the NREN plan. The policy framework has promoted the use of the Internet/NREN among researchers and scientists working primarily on "grand challenges" rather than developing it as a "public right" to which all citizens are entitled. This may change with Clinton administration policy initiatives and the introduction of H.R. 1757 in March 1993.

Moreover, development of the Internet/NREN is uneven. Gigabit transmission speeds are being developed while the typical American classroom has no telephone line to connect to the network; some individuals have free (often subsidized) use of the Internet and others must pay significant fees; the gulf between network literacy and illiteracy continues to widen; and overall, large segments of the population appear likely to be bypassed as the networked society evolves. How society will migrate to this networked environment is unclear.

Interestingly, the Department of Education has limited involvement in the deployment and planning of the NREN or the NII. Despite some recent activities for promoting literacy and the passage of P.L. 102-173, there is only beginning understanding of literacy in an electronic age or for the networked society. Inadequate thought appears to have been given to the educational roles of national networking or how the network could be used to enhance the country's educational institutions.

Federal policy related to literacy is very decentralized and dependent, to some degree, on a host of private initiatives and local efforts—all largely uncoordinated. In addition, literacy policy is best characterized as developing basic reading and writing skills. Moreover, "OTA finds that technology is not a central consideration for most literacy programs" (Office of Technology Assessment, 1993, p. 15). Literacy in terms of information literacy, information problem solving skills, or network literacy are not considered in the existing policy framework.

Apparently, the belief is that public uses of the network will occur naturally with little or no federal, state, and local planning and support. Either the private sector will provide for public uses and educational applications, or the library and education community will marshall the resources needed to move the population into the networked environment. *Somehow, someone* or *some institution* will assist the country to move to the networked environment and provide access to information resources, services, and holdings in an electronic format.

INFORMATION IN A NETWORKED ENVIRONMENT

There is considerable discussion and debate about what networked information is, how its access or lack of access affects a range of societal activities, and how information can be best managed to improve societal productivity. Generally, information is considered as data or signals that affect the uncertainty state of an individual. That is, for something to be considered as information it must either make the individual more or less uncertain about a particular situation or phenomenon (Whittemore and Yovits, 1973, p. 222).

As a resource, information is unique in that it has a number of characteristics that separate it from traditional types of resources (adapted from Yurow, 1981, p. 54):

- the information is not used up by being used.
- the information can be possessed by many persons simultaneously,
- it is difficult to prevent persons who wish to do so from possessing particular parts of information or acquiring information without paying for it,
- the value of information for a particular consumer often cannot be determined until the information is disclosed to that user,
- information can become obsolete, but it cannot be depleted,
- frequent use of information does not wear it out, and
- the technical units of measurement of information, e.g., bits, packets, etc., lack meaning and fail to carry meaning for the consumers of that information.

Thus, information fails to adhere to traditional aspects of a "resource," making it difficult to develop policy for how best to acquire, manage, and use it in a basic market economy such as that in the United States.

This description of information, then, raises the issue of the degree to which it might be best considered as a public good. Some information might be best seen as "public," that is, belonging to the public at large (e.g., much of the government information produced by the U.S. federal government); other information might best be seen as "private," that is, owned by an individual and either kept for that person's own use or sold if a market price can be determined.

More recently, the notion of "value added" has been applied to information as a conceptual approach for better understanding its characteristics (Taylor, 1986). In this model, a range of different value-added services and processes can be added to information as a means of enhancing its usefulness. For example, an author writes a book; to add value to that book she hires someone to produce an index for the book; a publisher adds value to the book by having it copyedited, and so forth.

Understanding these basic attributes of information is important if we are to understand educational issues and concerns related to information in a networked society. One significant change from traditional notions of information to information in a networked environment is less emphasis on information as affecting the uncertainty state of the individual and more on information as an empowering tool. Such an empowerment tool, when properly managed, and when appropriate value-added process are attached to the information, can assist an individual to make better life decisions and contribute to the overall productivity of a society.

NETWORKED INFORMATION AND THE NEW LITERACY

The term *literacy* means many things to different people. In recent years, different types of literacies have been proposed and defined. Introducing the term *network literacy* into this already confusing array of terms and definitions requires some discussion of the various terms and how they are being used.

Types of Literacies

With the range of services and resources available over the Internet, what constitutes literacy given this evolving networked society? P.L. 102-73, The National Literacy Act of 1991, Section 3, states:

> The term "literacy" means an individual's ability to read, write, and speak English, and to compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and develop one's knowledge and potential.

This notion of literacy is the traditional view—and one that is increasingly out-of-date.

Computer literacy, for example, is an additional extension of traditional literacy, requiring that individuals can complete basic tasks on a computer such as word processing, creating and manipulating data on a spreadsheet, or using other types of software. The notion of *media literacy* recently has been introduced and is described as follows (Aufderheide and Firestone, 1993, p. 1, v):

> Media literacy, the movement to expand notions of literacy to include the powerful post-print media that dominate our informational landscape, helps people understand, produce and negotiate meanings in a culture made up of powerful images, words and sounds. A media literate person—and everyone should have the opportunity to become one—can decode, evaluate, analyze and produce both print and electronic media.

Thus, media literacy is a step beyond traditional notions of literacy although it does not specifically mention computing skills or skills/knowledge related to locating, processing, exchanging, and using information in a networked environment.

Probably the most encompassing notion is *information literacy.* The Association for Supervision and Curriculum Development stated in a 1991 resolution (Breivik, 1992, p. 7):

> Today's information society transcends all political, social, and economic boundaries. The global nature of human interactions

> makes the ability to access and use information crucial. . . . Information literacy, the ability to locate, process, and use information effectively, equips individuals to take advantage of the opportunities inherent in the global information society. Information literacy should be a part of every student's educational experience.

Although it might be assumed within this definition, the resolution could be strengthened to make clear that information literacy includes an "ability to locate, process, and use information effectively" *regardless of delivery mechanisms and the type of format in which that information appears;* that is, to be literate, one must be literate with both print and electronic formats.

Hancock (1993, p. 1) provides additional detail describing information literacy, concluding that "education systems and institutions must take seriously the challenges of the Information Age. This includes restructuring the learning process to reflect the use of information in the real world, [and] changing the role of the teacher from presenter of prefabricated facts to facilitator of active learning." Information literacy thrives in a resource-based learning environment rich in a variety of print and electronic information.

Ochs, et al. (1991) provide an excellent literature review of information literacy. Figure 1 describes a very useful set of goals and objectives related to developing information literacy skills. The goals and objectives

Figure 1 Information Literacy Program Goals and Objectives

A. Understand the role and power of information in a democratic society. Students can describe and understand:

- how scholars and researchers use information and keep currently informed;
- how practicing professionals use information and keep currently informed;
- how the use of information can improve the quality of scholars' and professionals' work;
- the commodity nature of information: who generates, controls, and uses information—in particular, the role that governments play in the dissemination and control of information;
- the costs of misinformation; the possibilities of abuse and its consequences.

B. Understand the variety of the content and the format of information. Within their discipline, students can:

- distinguish popular from scholarly treatments of a subject;
- distinguish between primary and secondary sources;

- define various standard formats for the storage of scholarly information, e.g., print, microform, optical, floppy and compact disk, and magnetic tape;
- evaluate the quality of information and the usefulness of the content and format of a particular information tool based on relevant criteria.

C. Understand standard systems for the organization of information. Within their discipline, students can:

- define types of data bases and their organization, e.g., records, fields, and the retrieval function/process;
- recognize that different types of reference sources lead to various forms and formats of information;
- define standard terms such as bibliographic citation, periodical index, abstract, and citation index;
- differentiate between the types of materials typically represented in a library's catalog and those that are not;
- determine the index structure and access points of print or computerized information resources.

D. Develop the capability to retrieve information from a variety of systems and various formats. Within their discipline students can:

- construct a logical plan to organize their search for information;
- describe the difference between controlled vocabularies and keywords and use both efficiently in their search strategy;
- effectively use logical operators (e.g., and, or, not) to link their search terms and intersect concepts in various electronic information systems;
- understand and apply the concepts of truncation and field qualification in various electronic information systems;
- describe and use appropriate services which are available to assist them in locating information;
- successfully navigate within the libraries they use;
- accurately interpret bibliographic citations from print and computerized information resources and locate the materials they represent;
- operate a standard personal computer, develop mastery of certain programs/software, and maintain a working awareness of others.

E. Develop the capability to organize and manipulate information for various access and retrieval purposes. Within their discipline, students can:

- use a bibliographic file management package to organize downloaded citations and personal files of references;
- conduct their own needs assessment, based on relevant criteria, to identify suitable software packages appropriate to a given application;
- use electronic spreadsheets to reformat and analyze numeric data which has been either downloaded or manually entered into the package;
- use a word processing package to format papers, reformat downloaded references and construct bibliographies;
- write correct bibliographic citations for books, journal articles, and conference reports.

Source: Ochs, et al., 1991, pp. S3–37.

were developed in the context of undergraduate student skills and knowledge, but they are useful in expanding our thinking toward network literacy skills. Moreover, the objectives on this list suggest the importance of such skills in not only higher education, but as basic skills for leading a productive life in a networked society.

Although the objectives listed in Figure 1 tend to be "library oriented," they offer an excellent perspective on what types of generic skills we need to be teaching the public if they are to be productive in a networked environment. But at the core of the notion of all the various literacies is the idea of information problem-solving skills.

Literacy and Information Problem-Solving Skills

These skills, or the "Big Six Skills," as described by Eisenberg and Berkowitz (1990), suggest that people should successfully solve problems and make decisions by being able to engage in six key information problem-solving activities (see Figure 2). People involved with the Internet recognize the importance of such skills in training and education programs. What they sometimes fail to recognize, however, is the importance of developing Internet skills within the contexts of (1) real need and (2) the overall information problem-solving process.

The first context is real need: curricular, life, or work. While it is certainly possible to learn skills in isolation, practice and research confirm that people learn best when the use and purpose are clear. Students can probably learn to communicate via e-mail or to access a NASA data base, but they will eagerly engage and internalize these skills if they see how they directly relate to their school assignments, personal interests, or work requirements.

The second, and often overlooked, context is information problem-solving process itself. Computer and telecommunications technologies are supposed to extend our abilities to solve problems. That sounds fine in the abstract, but what does it really mean? Again, practice and research tell us that when people understand how specific skills fit into an overall model or process, the power and usefulness of the specific skills are expanded.

Task definition is step one of Eisenberg and Berkowitz's Big Six approach to information problem-solving. Electronic communication is also a powerful tool for consulting with others about the best strategies for seeking information (step 2), to locate and access the information

Figure 2 Internet Capabilities in an Information Problem-Solving Context

The Big Six Skills	Internet Capability	Application
1. Task Definition		
1.1 Define the problem	E-mail	to seek clarification from teachers
1.2 Identify information requirements of the problem	E-mail	to consult with group/team mems.
	Discussion/interest groups (listservs, news-groups)	to share and discuss concerns/ questions/problems with persons in similar settings or with experts
2. Information seeking		
2.1 Determine the range of possible sources	Electronic libraries, data centers, resources	to be aware of options, to determine possible and priority sources
2.2 Evaluate to determine priority sources	WAIS, Gopher, various Internet resource guides	to determine possible resources, to search for types of files and data bases available
	Use of AskERIC, NICs	to consult on resources, files, data bases
	E-mail	to consult with group/team mems.
	Electronic discussion groups (listservs, news-groups)	to request recommendations from persons in similar settings or from experts
3. Location and Access		
3.1 Locate sources (intellectually, physically)	Archie, Veronica	to search for the location of specific files or data bases
3.2 Find information within sources	WAIS, Gopher	to search by subject within/across sites
	Telnet, remote login, ftp	to obtain remote access to computers and electronic libraries
4. Use of information		
4.1 Engage (read, view, listen) 4.2 Extract relevant info	Download and file transfer, ftp	to get the relevant information from a remote computer to your own
5. Synthesis		
5.1 Organize information from multiple sources	E-mail	to share drafts and final communications
	Listservs, newsgroups	to share papers, reports, and other communications
5.2 Present information	Electronic journals	to present papers and reports
	Ftp and Gopher sites	to archive reports, papers, products
6. Evaluation		
6.1 Judge the product (effectiveness)	E-mail	to gain feedback
6.2 Judge the process (efficiency)	Listservs, newsgroups	to gain feedback

Source: Michael B. Eisenberg, Director, ERIC Clearinghouse on Information & Technology, School of Information Studies, Syracuse University, Syracuse, NY 13244.

itself (step 3), to extract relevant information (step 4), to present the results (step 5), and to seek reaction to your work (step 6). Therefore, it is essential to design and deliver Internet and technology training within the overall problem-solving context.

The two contexts, need and process, provide the necessary anchors for meaningful technology training—and increasing network literacy. This is true regardless of whether those receiving the training are students gaining their first glimpse of the Internet, unemployed workers involved in retraining programs, or corporate executives seeking to stay on top of emerging technologies. Figure 2 offers examples of how Internet capabilities can be placed in the Big Six information problem-solving context. These are, of course, just some of the options. The chart is easily modified as new Internet functions and resources are made available or as teachers and students find new ways to apply existing capabilities.

Notions of information problem solving and the Big Six Skills can be used to enhance our conceptualization of various types of literacies and how they are related to each other. Of concern are (1) we cannot wait until college for such skills to be obtained, (2) how those who have not gone or do not intend to go to college would obtain such skills, (3) the degree to which members in the education and library community have such skills and could impart those skills on others in the general public, and (4) a range of additional skills, unique to the network, need to be added to the list.

Recasting Notions of Literacy

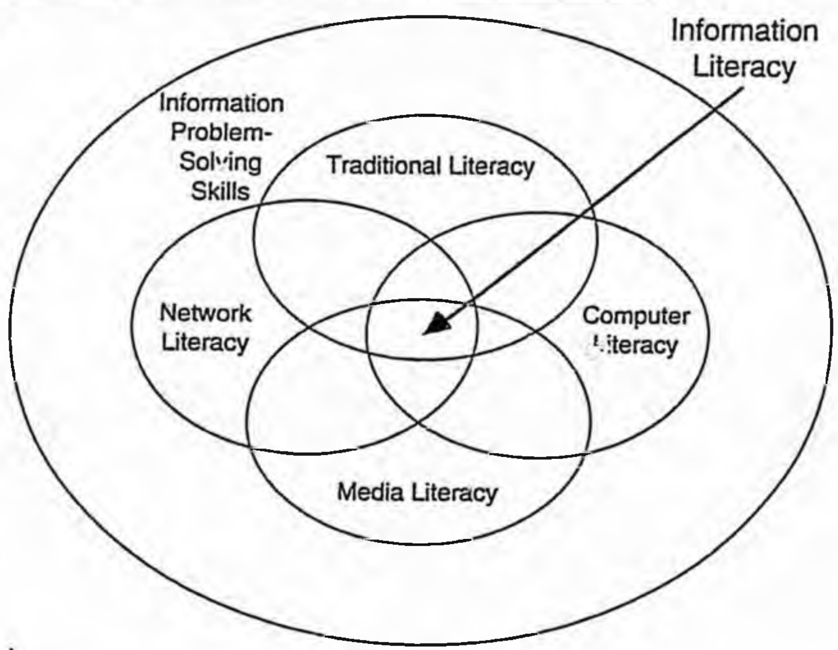
Recasting information literacy notions into the networked society are mind boggling. Project Literacy U.S. estimated that as many as 23 million adult Americans are functionally illiterate, lacking skills beyond the fourth-grade level, with another 35 million semiliterate, lacking skills beyond the eighth-grade level (White House Conference on Library and Information Services, 1991). It must be remembered that these numbers consider literacy in a print-based society and not in a networked society.

Figure 3 suggests a possible approach for thinking about literacy in a networked society. At one level, an individual must be able to read and write—traditional notions of literacy. At another level, the person must be technically literate, e.g., be able to operate computer, telecommunications, and related information technologies. At a third level, people need media literacy; at yet another level they need network literacy. All of these types of literacies can be cast in the context of information problem-solving skills.

Papert (1993) explores the importance of redefining literacy in a networked society. He discusses "knowledge machines" that provide children with interactive learning opportunities that include virtual reality and an ability to have freedom to explore and interact in an electronic knowledge arena:

> School will either change very radically or simply collapse. It is predictable (though still astonishing) that the Education Establishment cannot see farther than using new technologies to do what it has always done in the past: teach the same curriculum. . . . I would go further: the possibility of freely exploring worlds of [electronic] knowledge calls into question the very idea of an administered curriculum.

Figure 3 Thinking about Literacy Concepts



But what Papert does not tell us is what, specifically, are the skills and knowledge that these children will need to be literate in this networked environment, and how they will be taught these skills.

A beginning discussion piece for the knowledge and skills that might comprise network literacy for the general public includes:

Knowledge

- awareness of the range and uses of global networked information resources and services;
- understanding of the role and uses of networked information in problem solving and in performing basic life activities;
- understanding of the system by which networked information is generated, managed, and made available.

Skills

- retrieve specific types of information from the network using a range of information discovery tools;
- manipulate networked information by combining it with other resources, enhancing it, or otherwise increasing the value of the information for particular situations;
- use networked information to analyze and resolve both work- and personal-related decisions and obtain services that will enhance their overall quality of life.

Such knowledge and skills cannot be seen as "supplemental" to traditional literacy, but rather as part of a reconceptualized notion of literacy in an electronic society.

These skills and knowledge are targeted at the *general* public for *network* literacy. Likely as not, they will require other "literacies" to already be in place (see Figure 3). Additional knowledge and skills certainly can be included in this beginning list. But even these knowledges and skills listed above, while seemingly basic and rudimentary to the already network literate, will require national commitment and a range of programs if they are to become commonplace in society.

Answers to what constitutes network literacy and how network literacy relates to other types of "literacies" requires immediate attention and research. But as more information services and resources are networked, those individuals who, for whatever reason, cannot access and use them will be severely disadvantaged in society. They may be unable to obtain good jobs; they may not be able to communicate effectively with governmental units; they may not be able to exploit a range of self-help or entertainment services available over the network; and they may become disenfranchised from mainstream societal goals and values. Implications from such a widening gulf between the network literate and the illiterate are significant and require our immediate attention.

INFORMATION IN THE EVOLVING NETWORKED SOCIETY

Even those who are creating the networked society cannot predict how it will evolve. It is still too early to determine how the public can best be connected, which applications will be most useful to the public, which types of services should be made publicly available and which will be costed, and what might differentiate roles among the government, the public sector, and the private sector in developing and operating the Internet/NREN.

What we do know, however, is that information in this evolving networked society may have different characteristics than information in the prenetworked society. The following aspects of information in a networked environment will require us to rethink educational programs to ensure network literacy.

Pervasiveness of Electronic Information

Increasingly, information is in a digital, electronic format. Currently, information tends to be (1) created in electronic format and then, if necessary, transferred into a paper format, or (2) created in electronic format and never migrated into a paper format. The vast majority of Bureau of the Census data, climate and weather data beamed down from satellites, and a range of research data will never be migrated into a paper format. Thus, increasingly, users of information will either have to identify and access information in electronic format or they will be unable to use it at all.

Convergence of Information Technologies

The computer that sits on my office desk is (a) a computer, (b) a CD-ROM reader, (c) a fax machine, and (d) a worldwide telecommunications node! To refer to this machine as a "mere" computer is an insult! Increasingly, it has become almost impossible to determine where a telecommunications technology, a computer technology, and other information technologies begin or end. Mergers among cable TV companies, computer companies, software producers, and telephone companies testify to the fact that the new information technologies will be multi-tasked and seamlessly combine many technologies into one package.

Transferability of Digital Information

Related to the convergence of information technology is the transferability of digital information. Once information is in a digital format, it can be transferred, manipulated, edited, revised, and sent through endless transmitters and receivers. A digital picture of the Mona Lisa can be enhanced, changed, "brushed up," or otherwise manipulated, sent over a network, downloaded and "brushed up" again with existing software. Once information is digital, it can go anywhere, to anyone, at any time. Society will be in a sea of information and only those information services and products that meet real needs, offer true user-friendly software, and make life easier (as opposed to more difficult) will prosper.

Information for Electronic Services Delivery

To date, emphasis has been placed on delivery of electronic information rather than delivery of electronic *services*. Dumping gigabites of data on the network is not the same as providing services to successfully use that information in one's daily life. The ATM machines at local banks are only the beginning. Increasingly government services, for example, will be delivered through a range of electronic kiosks and directly to the home (McClure, et al., 1992). Shopping, financial services, entertainment, public education, and other services will be commonplace on the network. Individuals unable or unwilling to take advantage of these electronic services—especially government services—will be increasingly disadvantaged.

New Information Navigation Skills

In the short term, people will be forced to "drink from firehoses" as a glut of information resources and services overwhelm them. New information navigation skills on the network will be a prerequisite for successful use. Already, it is clear that if individuals cannot use a "gopher," a WAIS, or "telnet" to an "FTP site," they will be hopelessly swallowed in a sea of information and resources—drowned, as it were, in information. Traditional navigational tools such as the card catalog at the library, the Sunday newspaper listing of television programs, or reliance on one or two "key" newspapers or journals will be grossly inadequate to identify and retrieve networked information.

"Bottom-Up" Information Services Development

Due in part to some of the above characteristics, individual infopreneurs have it in their power to develop, test, market, and distribute a range of information products and services. Such services and development efforts have been largely in the domain of large companies. No more. The nature of the information technology allows amoeba-like developments by individuals with curiosity, perseverance, and good ideas. The rapidly expanding community networking movement is a good example of this phenomenon (Civille, 1993). Individuals who wish to take advantage of the new technologies, who know how to operate them, and see possible applications can develop these services from their home—either to enhance the quality of their life or for economic gain.

Filtering and Synthesizing Information

With the glut of digital information, filtering and synthesizing that information and determining which information is needed in what situations will be a critical concern for individuals in the networked society. The only way to deal with such large amounts of information is to develop mechanisms to filter and synthesize it. Such information retrieval techniques will have to be uniquely individualized in their design. "Profiles" of the information needs of individuals will be converted by "know-bots" that scan the network for specific types of information of interest to the individual, synthesize that information, and report it in a timely and organized fashion. Knowledge management will be much more important than information management.

Information in Search of People

In the past, it has been extremely difficult for individuals to "publish" their ideas or make them widely available to a large audience. In the future, the problem will be the reverse. There are thousands of messages posted on Usenet discussion groups today that are never read; endless papers and articles posted on the network that are ignored; and hundreds of unread e-mail messages deleted from reader files every day. The network has made it easy to produce and send information; the problem is to get people to read or review the information service or product sent them. The tyranny of information overload, despite sophisticated filters and synthesizing devices, is likely to be resolved by ignoring most information.

Privacy Protection

Because of many of the characteristics outlined above, the networked environment will increase the difficulty of protecting individuals' privacy. The Privacy Act of 1974 (5 U.S.C. 552a) and the Computer Matching and Privacy Protection Act of 1988 (P.L. 100-503) provide a number of important safeguards to ensure that the government, or others, do not divulge certain information about individuals. The success of these policies in the networked environment, however, is unclear.

New information technologies, and the increased use of authentication devices to confirm transactions between sender and recipient (especially for certain personal services e.g., social security information) will strain our ability to keep private information about ourselves to ourselves. Without adequate policy and enforcement, governments and commercial firms can easily maintain files of "personal data" linked to specific individuals that can be matched to other files to produce, for example, composite "buying patterns" that include specific types of purchases by specific individuals, demographic information about a person's household and income, and other types of information.

ISSUES AND IMPLICATIONS

Literacy in, and for, an electronic society will require a major overhaul and rethinking. As the educational system currently operates, it is ill-prepared for the challenges it faces in migrating individuals from a print-based society to a digital, network-based society. There are a number of issues that will need to be addressed if we are to move successfully into a networked society where all members of society have a level playing field to be empowered by the network.

Increasing Awareness of the Importance of Network Literacy

The first issue that must be addressed is increasing the awareness of government policymakers (at all levels of government) and the public at large that notions of literacy have changed, and will continue to change in the future. Literacy cannot be defined simply as the ability to read and write at a fourth-grade level. It includes a range of technologically based skills as well as information problem-solving skills.

Increasing awareness is linked to demonstrating the importance of networked literacy and the impact of network literacy on:

- the individual's ability to operate successfully in a networked environment;
- society's ability to empower the individual to be a productive member of society;
- the economic productivity of the country and the ability of the United States to compete successfully with a knowledgeable and technically skilled workforce.

Such impacts will have a significant effect on how well this country will maintain leadership not only in industry, but in health care, manufacturing, delivery of services, and the individual's pursuit of happiness.

Reaching Agreement on What Constitutes Information and Network Literacy Skills and Knowledge

A major impediment to developing programs for increasing networking literacy in this country is that we have been unable to operationalize skills, competencies, and knowledge that could constitute "network literacy." Debate continues about how best to define and measure traditional notions of literacy—to say nothing of networked literacy. Yet, until we can operationalize the term *network literacy*, we certainly will not be able to teach it and determine the degree to which individuals have gained such skills.

And as suggested by the opening quote to this paper, the existing level of knowledge and skills of most people in this country (to say nothing of those worldwide) in dealing with the new information technologies is abysmal. The reality is that if you cannot read, you cannot use the network. Reaching agreement on what literacy skills are essential for the public will require much coordination among federal, state, and local governments, private foundations, and others. Unfortunately, many of these same individuals themselves are unfamiliar with what the network is and how it works.

Revising the Federal Policy Framework

The brief overview of policy related to the Internet/NREN and literacy suggests that a significant disconnect exists. Not until the proposed H.R. 1757, the High Performance Computing and High Speed Networking Applications Act, has there been some linkage between development of the Internet/NREN with education and training concerns. While the linkage between the development of the network with education is laudable, H.R. 1757 still does not address literacy issues, i.e., educating the general population, or in some cases, retraining the population to be able to work and live in "Cyberspace" (Communications, Computers and Networks, 1991).

A federal policy initiative that has as its objective to develop a program that will train or retrain—or even make available—network literacy skills to the population is essential. Such a policy could also coordinate and organize the efforts for developing network literacy at state and local governmental levels. Such a policy framework would need to bring together the efforts of a number of federal agencies such as the Department of Education, the National Commission on Libraries and Information Science, the Agriculture Extension Service, and the National Literacy Institute—to name but a few.

In addition, a revised policy framework for this area needs to recognize the importance of libraries in promoting network literacy and serving as a vital link between networked resources/services and the public. Recent research suggests that the library community is beginning to redefine its roles and responsibilities to move more

effectively into the networked society (McClure, Moen, and Ryan, 1993). But a clear mandate by federal policy to coordinate the education and library community to work together in this area is essential.

Reinventing Education and Libraries for the Networked Society

There has been considerable discussion about "reinventing" a range of services and institutions in this country. The Clinton administration, for example, is attempting to reinvent government. Education and libraries are additional institutions desperately in need of being reinvented. *A Nation at Risk* (U.S. Department of Education, 1983) identified a raft of problems with the American education system. Now, in 1993, there is general consensus that those problems still exist, and if anything, have only become worse. Many libraries lack infrastructure, public support, and leadership in visioning their role in the networked environment (McClure, Moen, and Ryan, 1993).

Hughes (1993) notes that the intensified commercialization of the network, the lack of attention to public uses of the network, and our inability to confront issues related to educating the public for the networked society will result in

> an acceleration of the decline, or in some places the death, of the public education system. It simply won't be able to compete for the attention of students. And those parents who want a decent education for their kids will get it—commercially. Including offerings over the infotainment net. And then will act to stop or reduce taxes for a broken public system. Which will further decline. And in the long run be reduced to educational welfare for the have nots.

Schools and libraries may not be able to continue what they have always done in a networked environment since the networked environment is substantially different from the traditional school and library environment. These two institutions need to be reinvented, they need to rethink their roles and services in a networked society, and they need to determine their responsibilities for transitioning the public into the networked society in a way that individuals are empowered and advantaged.

Libraries can serve as an electronic safety net for the American public to ensure basic access to electronic information. Public libraries are especially well-suited to assume this role as they already serve such a role in a print-based society. Not only can they provide access to electronic information and provide connectivity for those otherwise unable to link to the network, they can also provide training and education to the public at large in how to access and use networked information. Despite the lack of federal policy supporting libraries to move into this area, there is evidence that this can be accomplished with adequate planning and resource support (McClure, et al., 1993).

Creating a Level Playing Field between Public and Private Interests

Increasingly, development of the Internet/NREN appears to be a commercial venture. The Bush administration promoted commercial development of the Internet/NREN, and it appears that the Clinton administration will continue this policy—although with some restrictions and modifications (U.S. Congress, 1993b). Investment from the private sector in the national information infrastructure certainly is welcome and appropriate. Such an investment, however, cannot be made without also supporting public and educational uses and access to the network.

We cannot afford the development of a national network that provides unlimited access to entertainment, home shopping, and other commercial activities—with hundreds of interactive multimedia channels that are all pay-per-view or pay-for-access (Hughes, 1993):

> TCI, US West-Time-Warner, AT&T and the MCI's of the world are now falling all over each other in the race to push the pipe in your front room, entertain you to death, interactively.... This administration is urging these "private companies" on as a way to build the infrastructure.... But, with the tidal wave of entertainment/home shopping interactive telecom via fiber, ISDN, cable about to wash over the U.S., the "serious" Internet is going to look like a tiny mountain rivulet in comparison. I think we [the United States] are in for some gigantic problems.

Commercial applications cannot be developed to the exclusion of public applications and uses of the network. Public service and

educational applications on the network for the nation's elementary, secondary, and vocational schools, as well as independent learners, must be nurtured and promoted.

There are, however, areas where both the public and private sectors have mutually supportive goals. The goal of educating the public to be network literate certainly can be supported by all. From the public sector perspective, network literacy will be a prerequisite to operate effectively in society. From the private sector perspective, there must be a network-literate population or there will be no market to purchase the new and innovative gadgets that continue to be introduced. These and other common goals must be recognized so that partnerships between the two groups can be formed.

Promoting Research

A range of research initiatives related to educational matters is needed to facilitate the transition into the networked society. Research initiatives in the following areas are needed:

- *Policy research.* Two key thrusts can be identified in this area. First, we need a comprehensive analysis of existing policy in the areas of Internet/NREN development, literacy, electronic privacy, and related policy instruments. Second, we need to develop and assess policy options that have as an objective the provision of educational initiatives to prepare individuals to be productive members in the networked environment.

- *Applied research.* A range of social and technological topics related to educating for the networked environment remain to be addressed. To what degree are those who are network literate more or less productive on what types of tasks? What variables affect the development of network literacy in individuals? Would cost savings result from delivery of networked government services, for example, if we had network-literate individuals in society?

- *Descriptive studies.* Baseline data is needed that describes the number and types of users of the existing network. What are the demographic characteristics of users and nonusers of the network? What trends can be identified in terms of the use of the network among the various population segments?

- *Program development.* Currently, it is unclear what types of, how many, and which sponsoring agencies and institutions will be needed to educate and retrain the population to be productive members in the networked environment. Further, we have yet to understand how best to marshal the new information technologies to help us promote network literacy in our schools, workplaces, and homes.

The above topics are intended to be suggestive, not comprehensive. What government agencies, foundations, or other organizations will be able to take leadership in this area for promoting such research? At the moment we are woefully ignorant about topics related to how information can be best managed and used in a networked environment.

THE NEED FOR VISION

Probably the most important challenge for exploiting information in a networked environment is extending our horizons of what is possible and developing new visions. A vision is a dream of what the network should be in the future and how people and institutions will use the network. A vision statement is a description of a possible future state or set of functions for developing a network literate society. Getting the "vision thing" right requires that it address:

> [people's] physical and economic well-being, their social need to be treated with respect and dignity, their psychological need to grow and develop, and their spiritual need for meaning and significance (Lee, 1993, p. 28).

Vision statement development requires us to make explicit our assumptions about the future and to envision a future state of the networked society in light of these assumptions and in light of societal goals and resources.

A primary purpose of such visioning is to describe and explore *visions* of what constitutes educated individuals in a networked society. In terms of strategic planning we need to develop a range of possible visions, identify those that are most important and would benefit society the most, and then take appropriate steps to ensure that the vision evolves as defined. A vision statement provides a target we can move toward and a vision of what we would like to occur, and suggests resources needed to reach that vision.

In the policy process vision statement development is a precursor to setting mission, goals, objectives, and tasking programs to accomplish the objectives. It is essential that this development precede the traditional activities of strategic planning to ensure the development of visions, to encourage stakeholder groups to think in terms of new opportunities, and to define possible states of being that would be especially appropriate for the networked society.

In thinking about developing a vision for the education and library community, stakeholders need to:

- state societal assumptions on which the vision is based,
- identify societal assumptions on which the vision is based,
- identify institutional assumptions on which the vision is based,
- recognize impacts, benefits, constraints, and limitations of the vision for individual segments of the society,
- consider resource needs to realize the vision, and
- produce draft vision statements for public debate and discussion.

Group processes among a broad range of stakeholder groups regarding these points are essential as they encourage policymakers to consider factors that will affect the success of the network in the future and possible services that should be provided given changing environmental conditions, and to better identify and accomplish educational objectives.

For example, one vision of education in the networked society is to have all public libraries connected to the national network. Any person could access the array of information resources and services simply by using the "network room" in the library. Students could work interactively on lessons, adult learners could tap into instructional tools and persons providing support to use those tools. Virtual learning communities (Schrage, 1990) could form and grow.

Electronic resources of all types and forms would be publicly available for those who cannot connect from the home. Librarians and educators would serve as electronic intermediaries, navigators, and instructors—being actively involved in assisting people to best use the network. Parents, students, adult learners, educators, and others could work interactively and interdependently on projects and activities that we can only begin to imagine now. The public library, as a nonpartisan, publicly supported institution with strong local community ties, is well-suited to serve in this role.

This, of course, is just one of many possible visions. Minimally, the key stakeholder groups that need to participate in such a discussion are information providers from the commercial and public sectors, government policymakers, educators, librarians, parents, and individuals and firms that design instructional materials and equipment. Constructive policy debate among these groups (and possible others) in terms of visioning has not occurred. Discussions about how the network *should* evolve, how people *should* be able to use the network, and how individuals will be *empowered* by using the network (as opposed to entertained) are essential.

RECONNECTING SOCIETY

Maintaining the status quo for network development will ensure an ever-increasing gulf between the network literate and illiterate. Those disempowered from using the network, those without access to a network "safety net," and those who simply are bypassed by the network will be increasingly disadvantaged and unable to lead productive work or professional lives. As suggested by the recent report resulting from White House Conference on Libraries and Information Services (1991, p. 6):

> As dependence on information grows, the potential increases for emergence of an Information Elite—the possibility of a widening gap between those who possess facility with information resources and those who are denied the tools to access, understand, and use information. . . . Today, now more than ever, information is power. Access to it and the skill to understand and apply it—increasingly is the way power is exercised.

To not be on the network, to not be able to use networked information, and to not take advantage of a range of networked information services and resources will ensure second-class status in this society.

But "information gaps" in our society are widening. Increasingly, various population segments are disenfranchised from accessing information due to race, gender, family income, geographic location, and a host of other reasons. A report issued by the Freedom Forum Media Studies Center states (Pease, 1992, p. 8):

> Neglecting the needs of minorities and others who may be underserved [in the networked environment] would only exacerbate their disenfranchisement from the information marketplace, said Julius Barnathan, senior vice president for technology and strategic planning of Capital Cities/ABC, Inc. "There's no concern for the minority, for the people who live in rural communities," he said. "We find that education and illit-eracy are getting worse, not better. So we need an information system to do one thing: educate. We've got to educate people so they can use these devices."

Disparities between the richest and poorest segments of society continue to widen, and social equity issues, i.e., the degree to which all people may legitimately make the same claims on social resources, are exacerbated by the evolving NII (Doctor, 1993).

Moreover, to the degree that information in the network is available to some and not to others, we may witness the development of a hyperpluralistic society. The hyperpluralistic society is one that is composed of thousands of small-interest groups that know only limited pieces of information and are unable to understand and assess larger societal concerns. They typically are interested in only one or two issues or topics and develop skills—either in the print or in the network world—to support those interests. Making it easier for like-minded people to maintain communication, as suggested by Cleveland (1991, p. 40) can exacerbate this hyperpluralistic society.

Such impacts from the networked environment are difficult to predict, but require thinking and debate *now*. Information in a networked society takes on characteristics and impacts that we are only now beginning to identify and recognize. There is an educational imperative to assist individuals—be they in school, in the work force, or at home. They need to know much more than how to use the "switch hook flash" on the telephone. They must learn how to use the network and to exploit the digital information for personal growth, work force advancement, and national economic productivity. Development of formal policy and programs to support this retooling of American society is essential.

Technology in general, and the development of the NII in particular, must be seen as a dynamic social and cultural phenomenon. As Winner (1993) notes, one view of technological change is as a pump for economic development. But it can also be seen as loom from which the fabric of society can be reweaved. He argues that policymakers thus far have inadequately considered "what Walter Lippmann called the public philosophy—a vision of the purposes that bring us together in society in the first place." Network literacy, reconnecting society, and ensuring social equity in an electronic society are parts of this public philosophy that still require attention, public policy debate, and resolution.

This challenge is one that we cannot ignore. If we fail to act, fail to accept this challenge, the various segments of our society will become increasingly disconnected and intolerant of each other. It is a challenge that will require long-term program and resource commitment. But perhaps most importantly, it will require a commitment to *people*, a commitment to provide equal opportunity to all members of society, and a commitment to promote the self-worth and individual productivity of *all* members of society.

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INTRODUCTORY ESSAY
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THE ROLE OF TECHNOLOGY IN AN INFORMATION AGE: TRANSFORMING SYMBOLS INTO ACTION
Stephen H. Haeckel and Richard L. Nolan

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opinion

Today's Schools Need High-Tech Teaching Tools

Terrel H. Bell

Our failure to address the antiquated state of education is largely responsible for the economic predicament we find ourselves in today. While 10 percent of the American workforce may be the best-prepared in the world, 90 percent is widely considered to be among the least-qualified of any industrial nation. With the Cold War behind us, the wars of the future will be trade wars characterized by technology, competitiveness, creativity, quick response and rapid change. Victory can be achieved only by a learning society.

How can we prepare our children for the technological world of today, with the educational theories and tools of yesteryear? Just as the abacus was replaced by pencil and paper, the slide rule, and the hand-held calculator, education too must keep pace with the technological revolution that surrounds us. Today's knowledge explosion requires schools to fundamentally change the way teachers teach, and the way students learn. Any supermarket checker is supported by more sophisticated technology than our teachers, whose methods of teaching have remained virtually unchanged since Gutenberg.

Any supermarket checker is supported by more sophisticated technology than our teachers.

If the Pony Express had not lost sight of its focus — that it was in the information delivery business, and not in the horse business — it would still be in competition today. Let's not sit idly by and watch the United States suffer the same fate as the Pony Express.

A lesson for political leaders in the benefits of educational technology can be found just outside the nation's capital in Prince George's County, Md. This predominantly working class suburb was once viewed as the thorn of Washington, D.C., flanked by the rosy affluence of neighboring Montgomery and Fairfax Counties. Today, it enjoys new respect through its commitment to educational technology in the public school system.

Since beginning to invest in education, Prince George's has experienced an increase in the test scores of its children over the past six years—to the point where it is gaining rapidly on Montgomery and Fairfax Counties. As a result of Prince George's County's commitment to technological and scientific education, a child can start off in a magnet school with special programs in 13 areas (including talented and gifted, science, math and technology, French, Montessori and creative and performing arts), go to the county's Challenger Center, win a place at a special science-oriented high school, and move on to any of the state's colleges and universities. And as the quality of its school system rises, so does Prince George's County's allure to businesses.

I would like to emphasize that there is no substitute for a good teacher. Teachers, in the past, were successful because they did not have to deal with the knowledge explosion that we have today. We must acquire a means of teaching that can keep up with this knowledge explosion, meet the individual needs of students, provide equal opportunity for learning, individualize instruction to the maximum extent possible—and we must do so without hesitation!

Technological innovations can help teachers "teach smarter" and increase student performance. No longer must some students be assigned unproductive "seat-work" to keep them busy while the teacher is trying to meet other students' needs. Educational software ultimately decreases the student/teacher ratio, as it increases higher-order thinking and problem-solving abilities. And it is much more affordable to update than to continuously replace textbooks.

We have found that in mathematics, reading, science, language arts and even in English for Speakers of Other Languages (ESOL), dramatic gains in motivation, performance, cooperation and independent study were realized across the board by students using instructional technology. By allowing each student to control his or her own pace of instruction, both low-achieving and high ability students come to know success.

In Dalton, Ga., "the Carpet Capital of the World," the community was threatened when the workforce, 56 percent of whom had less than a high-school education, was faced with having to master the manufacturing technology critical to survive in today's marketplace. Since embarking on a far-reaching and highly innovative educational-improvement partnership that embraced computer technology, the high-school dropout rate in the area has fallen from 43 percent for 1983-86 to 35 percent for 1987-90.

In Washington, D.C., the Women's Leadership Group and the Metropolitan Boys & Girls Club made a generous donation to a children's club located in the heart of the drug world. They gave the club a variety of technology tools—camcorders, computers, desk top publishing equipment. Using computers, the children conceptualized and produced a teen TV video and supplemental materials. The program, called "Stop Having Babies," dealt with the growing problem of teenage pregnancies. The children developed a rap song and participated in role playing. They also used the computer to create the graphics for the TV program. Forty packages containing the video and print material were made and presented before some 50,000 of the boys and girls from athletic programs throughout the district.

These are but a few examples of communities that are making strong commitments to education reform by bringing instructional technology to the classroom. They realize that they are in the people business—not the pencil business, not the paper business, not the bookbinding business. The simple fact is that we cannot talk about education reform, and long-term economic recovery, without talking about the application of technology in the classroom.

Terrel H. Bell is an author, lecturer and educational consultant. As U.S. Secretary of Education in the Reagan administration he established the National Commission on Excellence in Education.

TECHNOLOGY

What's Holding Us Back?

Four barriers to technology in schools.

BY DORIS RAY

American homes, communities and workplaces have VCRs, CD players, telephones, fax machines, computers, TV sets, and a growing list of other electronic gadgets. Schools' technology resources, on the other hand, remain shamefully inadequate. Teachers struggle for access to equipment, training and technical support; students compete for time on computers that are older than they are; and the newer, more sophisticated technologies—the ones that can bring sound, moving images, and distant connections to the classroom—are all too rare.

Technology seems to have fizzled in schools. Every day, children step back into history when they enter classrooms. Why isn't technology transforming schools the way it is other institutions? The reasons are knotted together by complex dynamics, and they are deeply embedded in the system of school.

VISION AND GOALS

In theory, technology decisions are made in light of a school's vision for its future. In practice, however, even if a vision and goals exist, they often have little bearing on decisions about technology. There's a high school I know of that was constructing a new "high-tech, optical-fiber wired" facility—but had no set group

Unless everyone in a school works toward a common vision, decisions about technology are nothing more than shots in the dark.

responsible for technology. A planning group is now in place, but without representation from others working toward the school's goals—the restructuring committee, staff development committee, or the school's major math, science and technology project.

Unless everyone in a school works toward a common vision and aligned goals, decisions about technology are nothing more than shots in the dark.

PLANNING AND DESIGN

Information about technology can be extremely complex, and technology itself changes almost overnight. As a result, technology planning is particularly difficult for schools and often ends in gridlock, with decisions made prematurely from sheer frustration or anxiety. Too often, planning is a single-year, one-shot process carried out under the pressures of time and budget. Too many design decisions—which focus on where in the school to put machines like computers and VCRs—are based on what is already known and proven, thus tending to support structures already in place (and already outmoded). It doesn't have to be that way. One thoughtful superintendent, faced with a major high school renovation, used it as an opportunity to engage the faculty in planning the new facility based on the kind of curriculum, instruction, and assessment they envision for themselves and their students. The technology planned for the new building will support the new learning environment: student workplaces, a central printing and graphic arts laboratory, and technology-equipped performance and demonstration spaces where students can show what they know and can do.

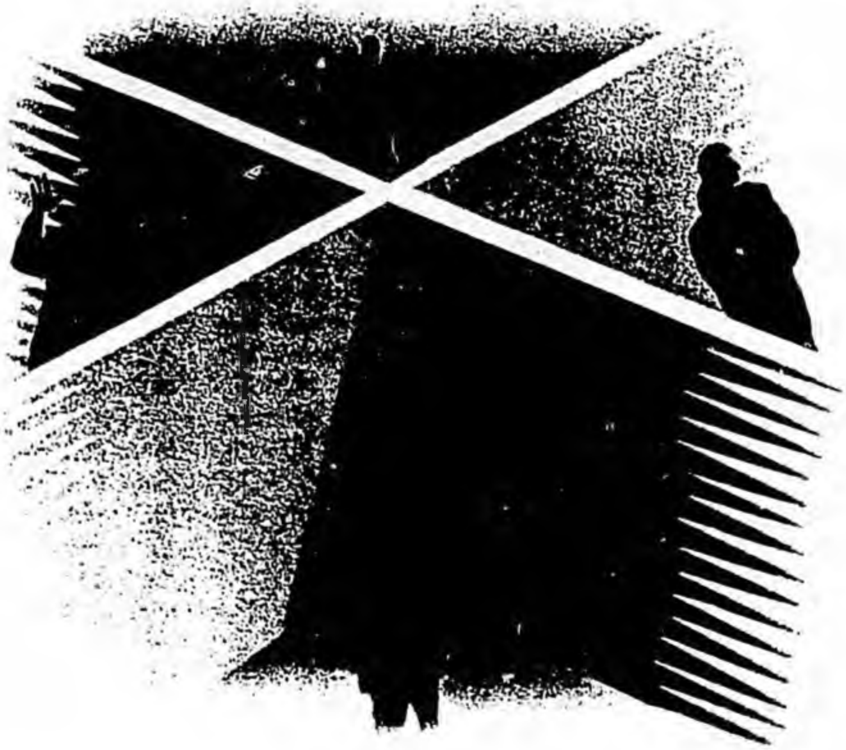
INFLUENCE AND DECISION MAKING

Children and teachers are the minority in schools when it comes to influencing technology decisions—even though they are most often the end-users of whatever machinery the official school leaders procure. Their voices are seldom sought out and rarely heard, and their potential contributions to the larger technology picture are not taken seriously. For example, one high school's only computer lab, shut down after school hours for lack of staffing, was reopened only after students spoke out and mobilized their parents to pressure the administration for access. The no-cost solution—a teacher's offer to supervise the lab instead of doing bus duty—

had earlier been rejected by the principal. Students, parents, and teachers can and must develop a voice, and have a more direct influence on decisions that affect their school lives.

RELATIONSHIPS

"The biggest problem besetting schools is the primitive quality of the human relationships among children, parents, teachers, and administrators," writes Roland Barth, senior lecturer at Harvard University. A team of researchers from the Claremont Graduate School recently published a report, *Voices from the Inside,* that



bears out Barth's position. A school is a set of complex and often dysfunctional relationships. Many school people feel at risk—psychologically, emotionally, even physically. Many kids feel they may not live to be adults. And both students and teachers often feel they can't speak out against the problems they perceive around them, because they may be putting themselves at even greater risk every time they tell the truth.

Improving relationships in schools and building a sense of community and shared purpose stimulates energy, excitement, passion and commitment, and creates meaning. Inasmuch as people are more willing to spend their resources on what is meaningful to them, improving relationships actually creates time and money—the lack of which everyone agrees gets in the way of technology's progress!

ULTIMATELY, A MATTER OF TIME

Technology has barely a toehold in schools today. But even if the current generation of school leaders does absolutely nothing, schools inevitably will be transformed by technology. Already, more of it makes its way into our schools every day, nestled in students' book bags, gym bags, and pockets—often to educators' chagrin.

"Children are the Nintendo Generation," writes technology observer Elliot Soloway, "and we are denying them their identity." A student wearing a Sony Walkman is scolded for wearing it in school because it may interfere with learning. But the Walkman might contain an audio book. Next year, the Walkman may be a CD-ROM player, and contain an entire library. Then what will schools say to students and their parents?

It's only a matter of time before the technology that is transforming the rest of our world begins to substantially transform our schools as well. The only question really is whether educators want to direct the coming changes or be directed by them. Either way, one by one, the excuses will crumble; the barriers will fall. ■

Doris Ray is a senior project manager specializing in school restructuring at the Maine Center for Educational Services.

TOOLS FOR SCHOOLS

Educational Technology Market Shares

1991

1996 (projected)

▲ Integrated Learning Systems
39.6%
41.4%

▼ Stand-Alone Software
21.9%
16.5%

▼ Videocassettes
14%
10.2%

▼ Satellite/Cable/Interactive TV
8.2%
6.2%

▲ Videodisks
6.1%
10.5%

▼ Distance Learning
6.1%
5.1%

▲ CD-ROM
3.8%
9.9%

▼ Online Services
0.3%
0.2%

Source: SIMBA Information Inc., 1992

The High-Tech

BY TRACY LA QUEY AND CONNIE STOUT

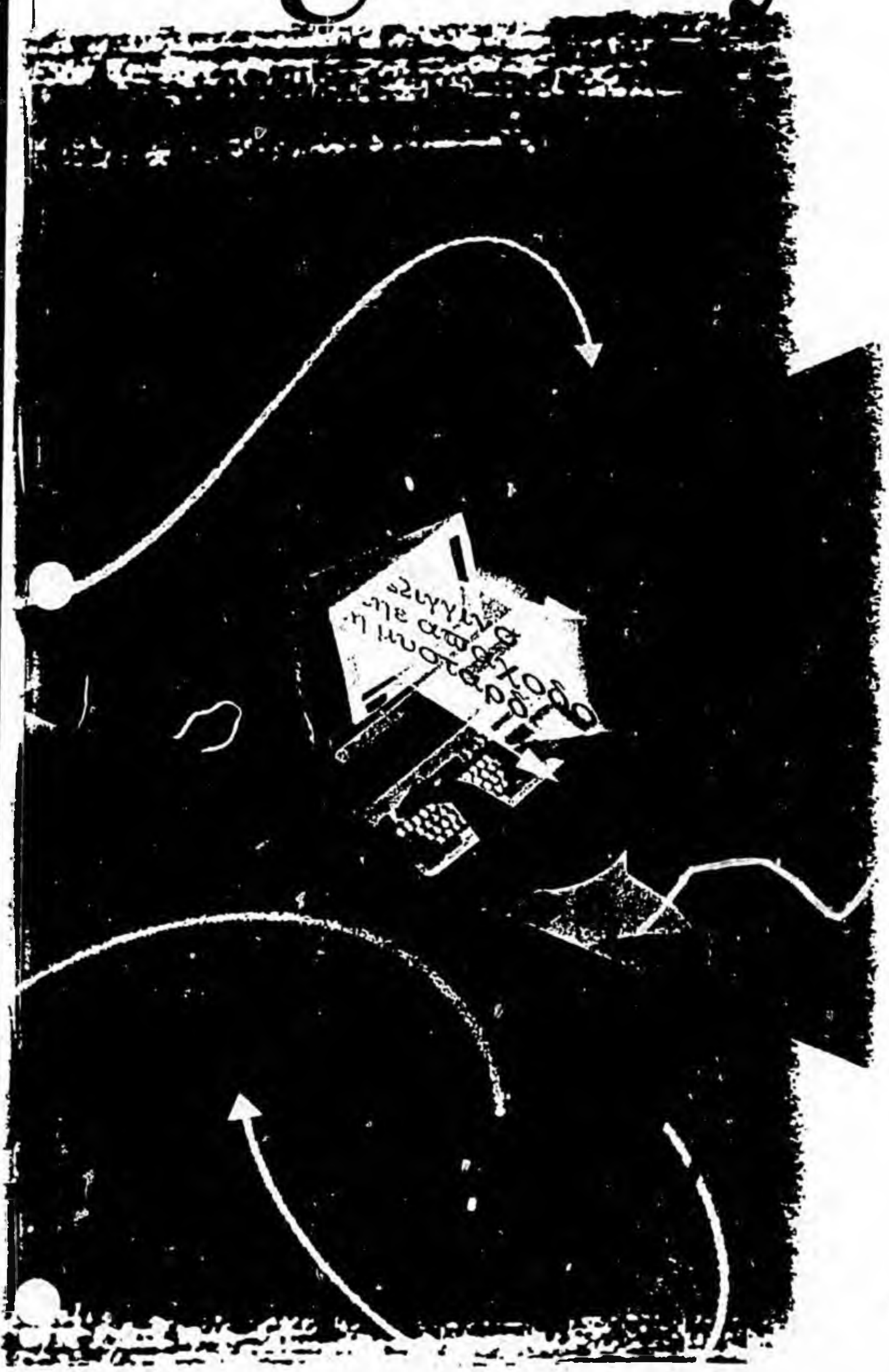
During the Presidential campaign, candidates Clinton and Gore called for the creation of a technological superhighway, "a door-to-door information network to link every home, business, lab, classroom and library by the year 2015." For educators, such a highway already exists—albeit in a sprawling, somewhat chaotic form. It's the Internet, a public network of networks that already connects some 10 million people in the United States and far beyond. And it is being touted as the best available networking infrastructure for the education community by people who use it, providers offering services on it, and officials who make policy concerning it.

For many in the nation's elementary and secondary schools, however, the Internet is alien territory. Its signage and rules of the road seem indecipherable, its entrances are rife with potholes, and once on its maze of roads, the uninitiated can find it hard to locate—or even remember—the most promising destinations.

Yet thousands of teachers and students make the journey every day anyway, and many more are expected to join them in the coming years. Their relationship to the Internet raises interesting questions about the potential impact of telecommunications on K-12 education and reveals some important barriers that must

Highway

Girding the globe, the Internet beckons educators into the future. But will K-12 ever get past the on-ramp?



be overcome if that potential is to be realized—if elementary and secondary school people are to be full-fledged, welcome travelers along the superhighways of America's future.

HOW IT GREW

The Internet began as an experimental Department of Defense network, becoming operational in 1969 with a small number of university research sites around the United States. It gradually built up momentum as whole networks of computers began logging on, and then expanded at a lightning pace in the late 1980s, covering the globe. Today the Internet directly connects with almost 50 countries and, through electronic mail, touches over 100. Encompassing more than 9,000 networks, it is expected to reach an estimated 20 million people over the next year.

The Internet has become a huge virtual library and conference center. Thousands of independent resources offer free information on almost any subject under the sun. And thousands of interest groups provide forums for discussions on topics ranging from current political events to ancient history.

If, as predicted, federal legislation targets the Internet as a crucial building block of the information infrastructure, its reach and resources can only be expected to expand further.

but listen Bill

"If we are using technology simply to make learning more efficient or cost-effective, we must ask ourselves, 'What is learning for?' Efficiency is a technical answer. It's about means, not ends, and offers no pathway to an educational philosophy. It says 'how,' instead of asking 'why.' Educators should be barred from installing technological black boxes in our classrooms until they have disclosed their reasons for offering an education in the first place. Such reasons are to be found where machines do not dwell."

—Neil Postman, chairman, Culture and Communication, New York University

POTENTIAL FOR K-12

The phenomenal growth rate, the support from government and learning institutions, the explosion of valuable information resources—all of these make the Internet attractive to the K-12 community. Indeed, elementary and secondary school teachers and students make up one of the fastest growing groups on the Internet. While there is no national data on the exact number of school users, 22 states have programs for accessing the Internet. In Florida and Texas, 50 and 75 teachers subscribe to the Internet each day. Many who have experienced the technology endorse it—and the concept of wide-area networking in general—as a catalyst to educational reform, for a variety of reasons.

Access to information: The Internet offers a wealth of free services for teachers and students. For example, they can access Spacelink, a service run by the Marshall Space Flight Center in Huntsville, Ala., that offers curriculum guides and the latest space shuttle reports. They can receive weather reports from the University of Michigan. CNN and Newsweek both offer online guides for their classroom news services. In addition, the Internet provides teachers and students access to vast databases and to knowledgeable parties in any number of fields.

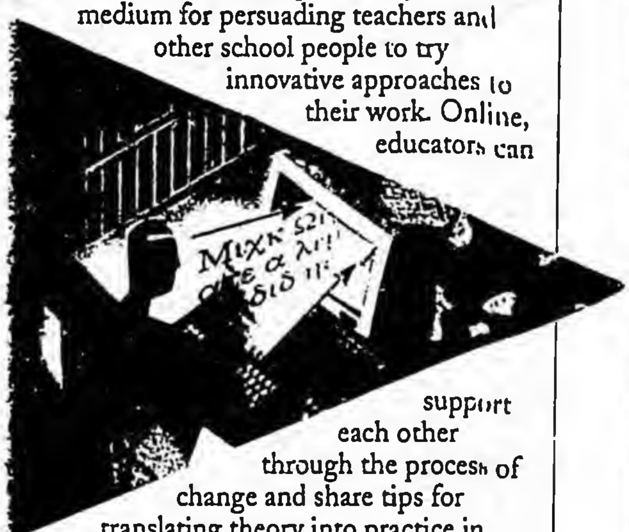
Collaboration in learning: While the school environment can be isolating—limiting interaction between students and teachers in different classes, grades, and schools—the Internet encourages collaboration. Teachers can consult with faraway colleagues, perhaps even team-teach on line, and develop projects with professionals not traditionally involved in K-12 education. Students can participate in cooperative and distance-learning projects like the ongoing comparison by students in different countries of local grocery products and prices—a project that integrates math, social studies, language, and geography.

Teachers like Pat Gathright of MacArthur High School in San Antonio, Tex., are true believers in the benefits of networking. "I have the sole responsibility on my campus for the yearbook, newspaper, Journalism I, and Photojournalism," she says. "Few of my fellow teachers can come close to understanding what my job is like or help me with some of the problems I face each day. But I know that I can log onto the Internet and share with my journalism friends across the state a desktop publishing trick that I learned at a workshop, a place to find information on a story my students are working on, or just news about my day."

Experts on-line: Teachers can also engage in dialogues with field experts and give students access to primary resources. For example, at Fredericksburg (Tex.) Middle School, children are learning how the information in their science textbooks can be applied to the real world—in the words of people who use science every day. Teacher Kirk Beckendorf explains, "About 20 scientists have agreed to communicate with my students and answer their questions via E-mail. You can literally see the students' self-esteem and interest in science expand when they receive a personal reply from scientists."

New roles for teachers and students: Telecommunications technology—and by extension, the Internet—has the potential to radically change the roles of both the teacher and learner in the classroom. To make effective use of this universe of information, students must be able to articulate the problem they are investigating, identify and access resources, synthesize and analogize as they work in tandem with their peers throughout the world. At the same time, their teachers must make the transition from being lecturers to being coaches, researchers, and managers of learning.

Dissemination of new ideas: Many involved with educational reform see telecommunications as a potentially effective medium for persuading teachers and other school people to try innovative approaches to their work. Online, educators can



support each other through the process of change and share tips for translating theory into practice in their classrooms. In some cases, the medium itself may promote innovation. So found a recent educational forum paper entitled "Telecommunications as a Tool for Educational Reform: Implementing the National Council of Teachers of Mathematics Standards." It posited, "Telecommunications technologies may be one of the most effective ways to achieve widespread interpretation and practice of the mathematics promoted in the standards. They can link people across time and distance, enhance relationships, and help transfer information in different forms...."

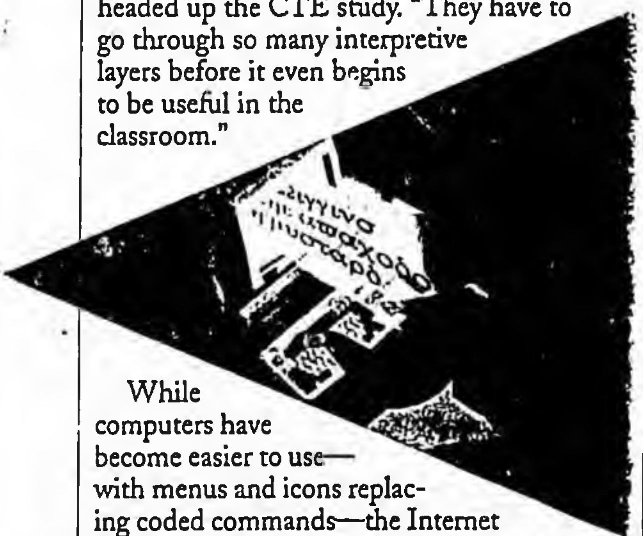
LOGO DESIGN BY GORDON REYNOLDS

FACING ROADBLOCKS

Despite its versatility and richness, the Internet has not been widely adopted by the K-12 educational community. In a recent study by the Center for Technology in Education (CTE) at Bank Street College, less than half of the target group of technology-adept educators—most of whom had been using computers for more than five years and were engaged in some form of wide-area networking—had access to the Internet. Those who did used it for professional activities—sending E-mail, gaining access to other computers, and perusing news bulletins—twice as often as for student learning.

There are serious barriers now preventing widespread access to, and use of, the Internet—barriers that must be addressed by policy-makers and service providers if teachers and students at the precollegiate level are to feel welcome on the highway.

Unfriendly territory: Its research and academic origins make the Internet tricky territory; the very richness of its information resources can be overwhelming. "It is absolutely *not* a resource accessible to educators who are not extremely savvy about technology," says Margaret Honey, who headed up the CTE study. "They have to go through so many interpretive layers before it even begins to be useful in the classroom."



While computers have become easier to use—with menus and icons replacing coded commands—the Internet has not. Slowly, Internet users and service providers have begun to come forward with solutions to the interface problem. The University of Washington, for example, developed a user-friendly E-mail application called PINE, which it happily shares with K-12 networks as well as universities.

Because no one entity is responsible for this huge conglomerate of networks, the Internet offers little help to the novice. But the guidance gap is beginning to close. Introductory books and resource catalogs are now available in chain bookstores, and training needs are

TELECOMMUNICATIONS

Supporting Excellence, Online

Can telecommunications in schools promote educational excellence and help bring about school change? To take the pulse of current opinion on questions like these, AMERICA'S AGENDA invited a group of school and business leaders to participate in an online discussion on the MetaNet, a Washington, D.C.-based electronic information network. This is some of what we "heard":

Eric Zelmer, *research statistician, Ameritech, Chicago, Ill.:* "Telecommunications offers a partial solution to very important educational issues such as student boredom and lack of parental involvement. At Ameritech we are working to make the telecommunications infrastructure available to more schools, and to encourage information providers to create curriculum materials that are interesting, learner-directed, and relevant to a great mass of students."

Robert Ware, *president of IRIS, a telecommunications network for educators, Washington, D.C.:* "Telecommunications in schools promises to change the way students study as a result of changing the way they access pertinent information. Instead of going to the library for a book, students with access to the Internet and online information can make use of virtually any information that has been put into digital form and made available on our national and global networks. This information is current, high-quality, and easy to access."

Bonnie Price, *high school English teacher, Whittier, Calif.:* "Telecommunications gives students and teachers a chance to share with a real audience—their peers in distance places. Once the four walls of a school have been made transparent, schools will never seem the same again. There are schools I interact with around the country on a daily basis whose teachers I speak with but have never met. My students now write to other students to share who they are, and what their cultures are like. These people are truly in the midst of a profound change as they rethink what it is to learn."

John Braden, *Advanced Business Institute, IBM, White Plains, N. Y.:* "In my mind there is no question but that telecommunications promotes excellence and bolsters learning, but there are real equity issues that need to be addressed. Many schools lack access to online networks and computers, and technological difficulties, as well as the difficulties of learning these new ways of thinking, hold some schools back. It's hard to talk about promoting excellence without mentioning the need for teacher support and training—teachers are the players that make this new learning paradigm work."

This AMERICA'S AGENDA *discussion was moderated by Susan Mernit. For information on the Meta Network, write: MetaNet, 2000 North 15th Street, Arlington, VA 22201; or call: (703) 243-6622.*

listen Bill

"Ethical, not technological, literacy is our major educational problem. While more children know how to operate a computer, millions don't know the difference between right and wrong. Gore's electronic superhighway will make America infrastructurally competitive, but educating for character is essential for us to be truly competitive. Respect and responsibility must come before hyper-communication. To quote Theodore Roosevelt, 'To educate a person in mind and not in morals is to educate a menace to society.'"

—*Thomas Lickona, professor of education at SUNY Cortland, author of* Educating for Character

beginning to be addressed. The Texas Education Network (TENET), for example, offers a comprehensive Internet training program plus teacher-useful applications, all accessible through an easy-to-use menu interface. In less than 18 months, 19,000 educators and administrators have signed up for accounts on TENET, greatly surpassing the Texas Education Agency's initial estimates.

The equipment gap: Usage concerns aside, connecting to the Internet is easy and cheap: All you need is a modem, telephone line, and personal computer. But many districts still do not have the necessary tools. David Brittain of the Florida Department of Education sees lack of equipment as a major barrier prohibiting schools from joining the Internet. "Though they are now rather inexpensive," he says, "modems are not out there in large numbers."

Even if schools have modems, they often don't have phone lines. A recent survey conducted in Texas counted 84,683 phone jacks in 1,058 districts. However, most phones were in the administrative offices; only 2 percent of the classrooms has access to a line. The most common reason was not the potential distraction, but the cost. Many school districts are required to pay business rates for phone lines—making one line per classroom more than most schools can afford. In the future, some schools might opt for a wireless solution—using cellular technology—to avoid the cost of this "umbilical cord" to the outside world.

The numbers game: To provide access to large numbers of students and teachers, districts must begin linking their local area networks (LANs)—which are multiplying rapidly—directly to the Internet. This means a higher speed, full-time connection, but requires an initial investment of special equipment, provider fees (for commercial Internet carriers that sell services to schools), and lease of dedicated phone lines. In addition, the LAN connection isn't really feasible where the only network available is administrative and not adaptable for classroom use, or when the LAN uses hardware, applications, and protocols that don't talk to other systems.

Fear of change: The very potential of telecommunications to transform classroom culture may be the biggest barrier to enthusiastic adoption by educators. "In well-connected classrooms, teachers will no longer be the filters and disseminators of information," says Michael R. Haney, associate program director of the Teacher Enhancement Unit at the National Science Foundation (NSF). "Teachers are not going to take the first step until they can envision what lies ahead."

THE NEARING FUTURE

Ready or not, K-12 educators may soon find themselves connected to Internet, or something like it, as a matter of public policy. Both the Clinton Administration—under the leadership of Vice President Al Gore—and Congress seem to be heading in that direction.

In 1991, then-Senator Gore sponsored a bill to establish the National Research and Education Network (NREN), a high-speed, coordinated network which will connect all American academic and research institutions and federal agencies. Ultimately, the NREN will be the education successor to the Internet in the U.S. Gore's bill called for approximately half a billion dollars in funding—including $15 million to NSF and $1 million to the Department of Education—but most was used for projects already planned.

This year's model: A second Gore bill that was killed last summer is now being reconsidered as Senate Bill 4. It establishes the idea of the national information superhighway, with the NREN as an important component. The bill proposes about $60 million for developing the education network, but is very vague as to how funds should be used. Meanwhile, the House is said to be working on its own bill with specific allocations for education, including separate provisions for K-12 versus post-secondary, and actual connection versus training. Observers predict that if Gore presses the issue in the White House or if Secretary of Education Richard Riley takes it on, some version of a networking bill will pass. And if K-12 educators become more active in the debate, their needs are more likely to be reflected in its design and implementation.

A question of equity?: Part of the process will be persuading lawmakers—and the public—of the importance of making the Internet and its resources available to all sectors of the education community. In this global economy, it is an equity issue. These information resources cannot and must not be accessible only to those in the universities and research labs, disenfranchising a whole sector of the population. Grown carefully, the Internet and, in the future, the NREN, can enable all educators—and all students—to access the benefits of information technology. ■

Tracy LaQuey is education marketing development manager of Cisco Systems, Inc., and principal author of The Internet Companion: A Beginner's Guide to Global Networking *(Addison-Wesley, 1993). Connie Stout is director of the Texas Educational Network (TENET).*

Clinton Seeks Better Link Between Education, Technology

President Clinton last week proposed a radical new federal policy that would forge links between education programs and technological resources.

In a policy statement released by the White House, Clinton said workforce preparation programs have failed to develop needed ties with new technology. He called for more federal involvement in modernizing teaching resources, and for schools' job skill-related curricula to reflect more up-to-date concepts.

"We are moving in a new direction to create an educational and training system that challenges ... our students to reach for resources beyond their classrooms," Clinton stated.

The education part of Clinton's plan is split between strategies addressing school management and updated and enhanced curricula. The ultimate goal, he said, is to "increase the productivity of learning in formal school settings."

Clinton said he will push for the federal government to provide elementary and secondary school access to Internet, a network set up by the government that is used to share research databases and messages among higher education institutions and research facilities.

He also said he will urge developing a National Research and Education Network (NREN), a more advanced telecommunications "superhighway" that could handle video and large amounts of information. The president wants school access to NREN as well.

In addition, the president's plan would target funds to help schools develop "high-performance" software tc take advantage of emerging hardware capabilities. Ultimately, the improved technology would place students in "an environment that can closely approximate real work environments."

Clinton said the White House will create an interagency task force to establish software and communication standards for education and training.

A White House spokeswoman said Clinton plans to present the policy in a congressional bill, but said Clinton first wants to gather input. ###

Legislative Update

Congress is considering a spate of legislation that would reauthorize federal elementary and secondary education programs and reform schools. In addition, a fiscal 1993 supplemental appropriations bill with significant education funding has advanced in the House.

Recent or Upcoming Action ...

<u>Education Department Fiscal 1993 Supplemental Appropriations</u>

President Clinton is requesting supplemental fiscal 1993 appropriations, including $500 million for a summer Chapter 1 program and $2 billion to pay off a shortfall in Pell Grant funding. The economic stimulus plan he outlined this month also includes some proposed Education Department funds for fiscal 1994, including $870 million for school reform legislation--with state grants for systemic change--he plans to send Congress within a month. Clinton plans to propose a full fiscal 1994 budget April 5.

Last action: House Labor, Health and Human Services and Education Appropriations Subcommittee approved the supplemental appropriations plan Feb. 24.

Next action: The House Appropriations Committee has not scheduled a vote on the measure.

(more)

The Impact of School Library Media Centers on Academic Achievement

Keith Curry Lance
Lynda Welborn
Christine Hamilton-Pennell

State Library & Adult Education Office
Colorado Department of Education

The Impact of
School Library Media Centers on
Academic Achievement

EXECUTIVE SUMMARY

This study provides evidence of the positive impact of library media centers on academic achievement in 221 Colorado public schools during the 1988-89 school year. In contrast to previous research on the relationship, this study uses schools rather than students as units of analysis, considers service outputs as well as resource inputs, and rules out the effects of selected school and community conditions which might have explained away this relationship.

The findings of this study indicate the importance of library media expenditures--and particularly the staff and collections they make possible--in promoting academic achievement. The importance of the library media specialist's instructional role is also verified.

Highlights:

- Where LMCs are better funded, academic achievement is higher, whether their schools and communities are rich or poor and whether adults in the community are well or poorly educated.
- Better funding for LMCs fosters academic achievement by providing students access to more library media staff and larger and more varied collections.
- Among predictors of academic achievement, the size of the LMC staff and collection is second only to the absence of at risk conditions, particularly poverty and low educational attainment among adults.
- Library media expenditures and staffing tend to rise and fall with total school expenditures and staffing.
- Students whose library media specialists participate in the instructional process are higher academic achievers.

Also included in this report are the most current and comprehensive annotated bibliography on this subject anda a timeline chronicling the evolution of such studies.

7.1 FINDINGS

In assessing the impact of school library media centers on academic achievement, potential predictors were drawn from the LMC as well as its school and community contexts. All potential predictors for which data were available were considered. Following is a summary of the findings reported in preceding chapters:

- **The size of a library media center's staff and collection is the best school predictor of academic achievement.** Students who score higher on norm-referenced tests tend to come from schools which have more library media staff and more books, periodicals, and videos.

- **The instructional role of the library media specialist shapes the collection and, in turn, academic achievement.** A library media center should be staffed by an endorsed library media specialist who is involved not only in identifying materials suitable for school curricula, but also in collaborating with teachers and others in developing curricula. These activities require that the media specialist have adequate support staff. This involvement in the instructional process helps to shape a larger--and, presumably, more appropriate--local collection. Students who score higher on norm-referenced tests tend to come from schools where this instructional role is more prominent.

- **The degree of collaboration between library media specialist and teachers is affected by the ratio of teachers to pupils.** Collaboration of this type depends on the availability of both media specialist and teacher to engage in this important work. Specialists who play an instructional role tend to have teacher-colleagues whose workloads also permit such collaboration.

- **Library media expenditures affect LMC staff and collection size and, in turn, academic achievement.** Not surprisingly, the size of the LMC collection is related to the amount of funding available for such purposes. Students who score higher on norm-referenced tests tend to come from schools which spend more on library media programs.

- **Library media expenditures and staffing vary with total school expenditures and staffing.** It is also little surprise that the funding and staffing levels of library media programs rise and fall along with those of other school programs.

- **Among school and community predictors of academic achievement, the size of the LMC staff and collection is second only to the absence of at-risk conditions, particularly poverty and low educational attainment among adults.**

7.2 QUESTIONS & ANSWERS

This study was undertaken to answer three questions about the relationship between library media programs and academic achievement. Following are those questions and the answers based on the findings of this research:

- *Is there, in fact, a relationship between expenditures on LMCs and test performance, particularly when social and economic differences between communities and schools are controlled?* **Yes. Students at schools with better funded LMCs tend to achieve higher average test scores, whether their schools and communities are rich or poor and whether adults in the community are well** or poorly educated.

- *Assuming that there is a relationship between LMC expenditures and test performance, which intervening characteristics of library media programs help to explain this relationship?* The size of an LMC's total staff and the size and variety of its collection are important characteristics of library media programs which intervene between LMC expenditures and test performance. Funding is important; but, two of its specific purposes are to ensure adequate levels of staffing in relation to the school's enrollment and a local collection which offers students a large number of materials in a variety of formats.

- *Does the performance of an instructional role by library media specialists help to predict test performance?* Yes. Students whose library media specialists played such a role--either by identifying materials to be used with teacher-planned instructional units or by collaborating with teachers in planning instructional units--tend to achieve higher average test scores.

These documented answers to these questions comprise the unique contribution of this study to the research literature on the impact of school library media centers on academic achievement.

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Staff asks schools to go high-tech

By SUSAN S. CHRISTIANSON
THE JUNEAU EMPIRE

Several committees of parents and staff have asked the school board to budget for updated computer technology for classrooms next year.

A standing-room-only crowd of close to 50 teachers and community members has asked the school board for money to improve technology in Juneau's schools.

"The school district has quite dated technology. ... Children are growing up in a world very different from the world we grew up in and their ability to navigate through information will be as basic as literacy," said Karen Jordan, school district technology coordinator.

Jordan presented a detailed set of recommendations from the district technology committee, high school technology committee and district librarians – groups that have been working for many years on improving school technology.

Jordan told the board Tuesday the committees believe it is time for the district to fund technology as part of the operating budget, rather than the piecemeal approach currently used.

Though board members sympathized, they raised questions about the cost.

The groups will come back to the board with a more complete funding plan April 6.

Jordan said computer equipment has been purchased with money left over at the end of the school year, creating a system of non-compatible equipment.

"By funding technology as part of the base operating budget, it allows for prior planning and compatibility of equipment," Jordan said. "If it was in the budget to the tune of $300,000 a year, we could begin implementing the strategic plan in the district."

The committees presented a $310,000 plan for next year:

- $168,000 to purchase computer hardware and software for automating libraries at all six elementary schools.
- $87,000 to upgrade technology at Auke Bay Elementary School, and train teachers there.
- $55,000 to begin the process of implementing the high school technology plan.

Money is the issue, board members said.

Board member Phil Smith said the more than $1 million budget shortfall anticipated for next year is a reality the district has to face.

Board member Sally Rue asked for a schedule showing all the stages and dollars needed to implement the entire technology plan – "the big price tag."

Board chairman Bob Locke asked the committee develop a funding plan for the board.

"If you want to go to the assembly and ask for a bond issue to fund this, I guarantee if you don't have a full plan laid out you'll need to have it," he said.

Richard Steele, a first-year teacher in the district, told the board he worked at Southeast Regional Resource Center before teaching with the district and was appalled by the "nightmare of data collection" used by teachers, who still keep grades in grade books.

"This paper thing, good God, it is how it was done in the 1500s," Steele said.

Steele said he received a grant to buy equipment for better classroom data management, equipment that helped change the nature of his classroom.

"Kids can look at the wall and see their grade at least twice a week. Kids can keep track of their own progress," he said.

Dan Hall, a teacher at Auke Bay Elementary School, said he has been serving on the district technology committee since 1987 and people are getting frustrated.

"At the beginning we sold hot dogs and ice cream to raise money to get a computer. We all did it at first, but now we need the support of the board to make technology part of the budget," he said.

Mary Libby, a high school special education teacher, presented the board with a computerized videotape presentation done by her students. Libby said using computers helps at-risk students by providing a variety of feedback in the learning process.

"Technology is empowering," Libby said.

Lawmakers may jolt rural electrical bills

By IAN MADER
THE ASSOCIATED PRESS

Lawmakers are considering changes that would decrease the state's electrical power subsidy for rural residents by an average of $44 a year

and Juneau.

The legislation would update the subsidy rate to take into account increases in urban power rates over the past decade. The base rate in 1984 was calculated at 8.5 cents a kilowatt-hour. The sub-

Senate Bill 163, introduced by the Finance Committee, and a companion bill in the House would set the new rate and disqualify all federal and state buildings except schools.

"This will make it easier to

thority.

To fund all customers eligible for the subsidy at 100 percent in fiscal 1994, the state would have to spend about $20.5 million, Manni said. With the adjustments under the Hickel bill, it would cost $17.9

The Seattle Times The Seattle Post-Intelligencer

SUNDAY

March 7, 1993

In less than a decade, personal computers have gone from technological curiosities to everyday necessities.

Yet, as with any change that comes so fast and furious, the PC leaves many people adrift and befuddled.

Nowhere is this more true, perhaps, than in schools and with children. Most schools have computers, but they use them to varying degrees.

Many children have them at home; most do not.

The word is that computers can revolutionize learning, but it's not clear when and how this is done.

Many parents aren't sure what is happening with computers in school classrooms, and how these machines affect their children.

A TOOL FOR LEARNING

With this in mind, The Times today begins an occasional series on computers and their role in educating children.

The series, for the most part, will be a practical guide to issues ranging from how to purchase hardware and software to what different schools are doing to blend technology with learning.

It also will examine the larger questions:

How are computers changing the way children learn? What is the role of the teacher?

We begin the series today by looking at what the advent of the personal computer has meant for schools and how this tool for learning works.

After years of being ignored, misused or unaffordable, computers are becoming common tools for learning

by Paul Andrews
Times business reporter

In the beginning, the computer was extolled as Plato's wand – a magical learning tool to impart the wisdom of the Greeks, cure humankind's ills and make us all smarter.

Charles Babbage's original "Analytical Engine," conceived more than 150 years ago, had at its heart his youthful pledge "to leave the world wiser than I found it."

The early large, room-sized IBM mainframe computers in the 1960s and 1970s found some of their biggest clients to be timesharing systems at schools and universities. Apple's educational discounts helped jump-start the personal-computer revolution with the Apple II.

But the personal-computer revolution that created the post-industrial Age of Information in the 1980s has failed to live up to its press releases – in the classroom, at least.

Not all schools could afford computers. Those that could watched them languish in end-of-the-hallway labs used largely for playing video games.

Teachers looked askance at machines they did not understand and suspected could replace them. Students who latched onto computers proved possessive and unsharing, as well as predominantly white, middle-class and male.

Concerns grew that the computer was dividing the educational – and, consequently, social – landscape into haves and have-nots. Suburban schools bought more computers than those in urban or rural locations. Students whose professional parents had computers in the home, usually were more familiar with them than their classmates were.

Educators, social scientists and, most of all, parents were dubious of the computer's value as an educational tool. The computer was turning out to be less a Plato's wand than a Luddite's revenge.

That was the '80s.

This is the '90s.

A high-tech booster occupies the White House. Educational software is booming, with 1992 sales up more than 50 percent from the previous year. More computers are turning up in classrooms – every classroom, not just "the lab." An electronic information service just for youngsters – called KidStar – is in the works.

Parents are asking, are my kids learning enough about using a computer? Do I need one at home? Which kind, and what software? How can I help my school with computers?

Policymakers are warning that America's reputation for innovation and economic leadership is on the line.

"Nations that stop trying to 'reform' their education and training institutions and choose instead to totally replace them with a brand-new, high-tech learning system will be the world's economic powerhouses through the 21st century," writes consultant Lewis Perelman in his hotly debated new book, "School's Out," written at Seattle's Discovery Institute, an independent think-tank.

At a conference last month in Washington, D.C., sponsored by the Discovery Institute, attendees watched a science instructor broadcast a lesson from Kentucky by satellite to more than 500 schools in small, rural and economically

Policymakers are warning America's reputation for innovation and economic leadership is on the line

Please see **COMPUTERS** on A 14

The computer comes of age in the schools

COMPUTERS

continued from Page 1

disadvantaged communities in 28 states. Classrooms could communicate with the teacher by phone; in the not-too-distant future, they will be able to see each other as well as converse.

Spurred by a technology levy passed in November 1991, Seattle Public Schools are in the midst of a sweeping computerization project.

The short-term goal: A computer for every teacher, linked by a wired network with a computer lab so that teachers and students can exchange files and electronic mail.

The long-range goal: a computer for every kid, networked not only within the school but around the globe through telephone and satellite connections.

Already some trailblazing schools are tying into the Internet, an international network of idea sharing, electronic pen pals and vast databases carrying whole libraries of information accessible through a few typed commands.

In other words, an electronic classroom of the world.

Already, bright spots abound:

At High Point Elementary in West Seattle, with 65 percent minority students, teacher Jill Schultz's fifth-graders help each other program animated "cartoons" using Hypercard, a Macintosh program. Greg Litton demonstrates a tiger slinking across a prairie. On Elizabeth Warren's screen, the sun arcs across a blue sky.

"The white kids are in no way ahead of the blacks, and the special-education kids are always showing other kids how to do things," said Schultz, whose charges have used their computers to write thank-you notes to speakers, design posters and publish a school newspaper.

The computer, Schultz said, is a "great equalizer" not only among peers but between teachers and students.

At North Seattle's private Lakeside Middle School, where four out of every five students have access

Hawthorne Elementary teacher Jay Franco is the driving force behind opening Seattle schools' computer labs to the public.

to a computer at home, sixth-graders Rafi Finegold and James Steven do a collaborative drawing using a program that allows Macintosh Classic computers to share screens.

Book reports are put into a schoolwide database, and both Lakeside High and Middle schools will soon have electronic libraries.

"We focus on computers as a tool for everything else we do, not just an aside," said Leo Santiago, history teacher and computer director at the middle school.

At Nathan Hale High School, in northeast Seattle, a massive rewiring project is about to begin that will install fiber optic cable – thin glass strands bearing pulses of light containing information equivalent to thousands of phone connections – throughout the school. The project will put the school at the forefront of the anticipated digital revolution offering hundreds more cable-TV channels, many of them carrying sophisticated data services such as viewer-selected video on demand.

The school wants to tie into global networks, virtually eliminating "the inequity to accessing information in the classroom that's been such a problem for at least the past 200 years," said Currie Morrison, technology coordinator.

In Issaquah, consultant and parent Mike Bookey helped transform a technological backwater into a laboratory of the future beginning in 1989. With money from a $3 million levy, high-school students installed their own computer network, linked together the district's 1,200 computers and tied the whole thing into Internet, where they communicated with electronic pen pals in Europe and Japan.

District parents were so impressed they voted another $6 million technology levy.

"I was just one parent trying to get something going," said Bookey, now in demand for speeches and consulting throughout the country. "It's amazing what the kids themselves can accomplish if we just get the hell out of the way."

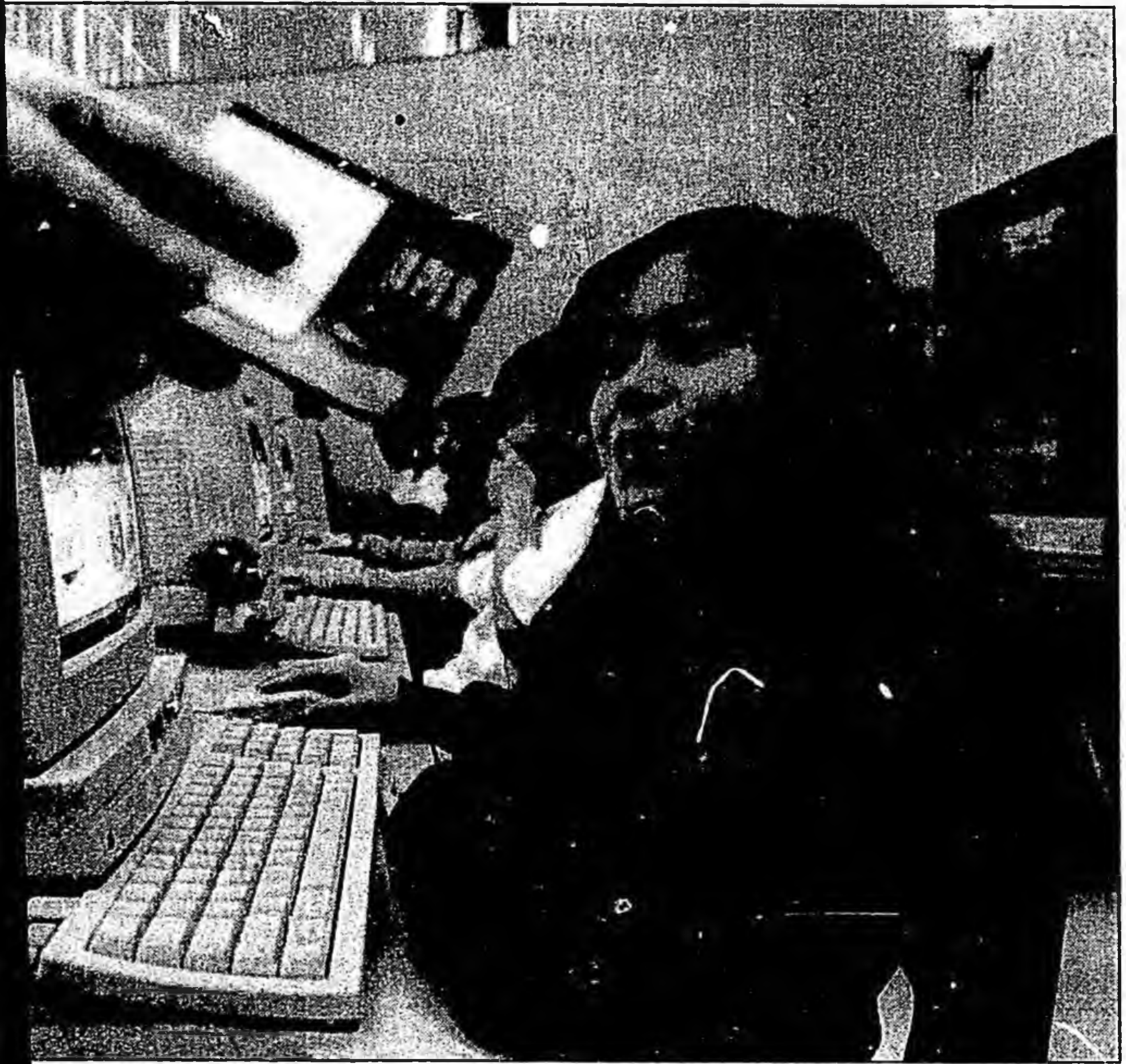
In Seattle, underprivileged kids are bused after school to the Union Gospel Mission Youth Center in Holly Park, where extracurricular computer time awaits them.

And four pioneering elementary schools in southeast Seattle involved in a broad-based "Powerful Schools" project – Hawthorne, Whitworth, Orca and Muir – as well as Colman Elementary, plan in April to open their computer lab doors one night a week to "all K-12 learners, including adults without a high school diploma," said Jay Franco, Hawthorne's computer teacher and a driving force behind the project.

Such successes are still the exception. The scourges of the '80s – new computers gathering dust, or lack of any computers at all – still blacken far too many schools.

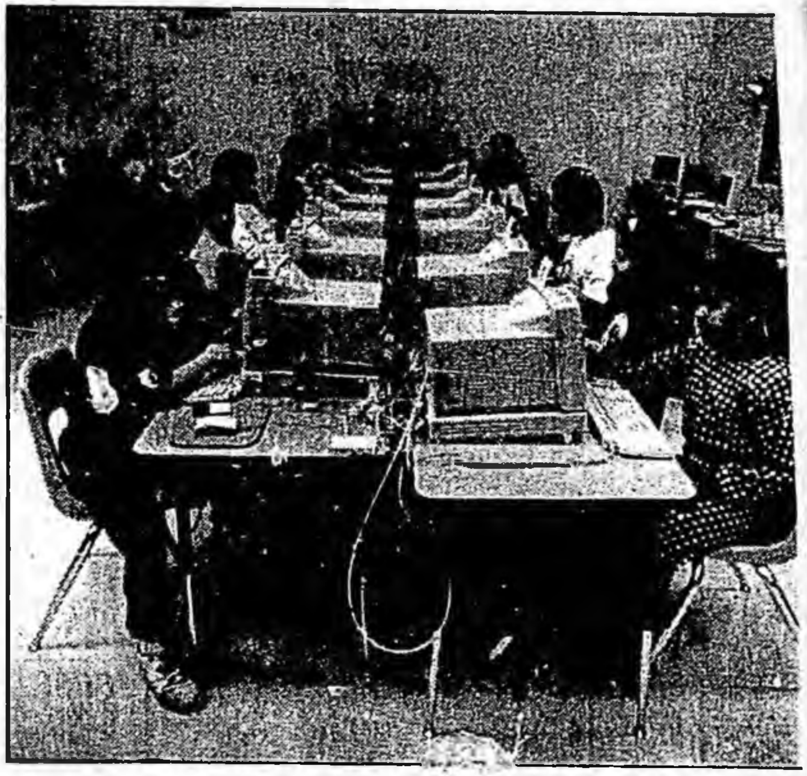
But the age of the learning tool has arrived. The computer is becoming not just an instrument of knowledge, but of communicating and sharing. •

The purpose of education is not to fill a bucket but to light a fire, wrote W.B. Yeats. In the classroom of the '90s, the computer is the match.



Jimi Lott / Seattle Times

The computer is a 'great equalizer' not only among peers but between teachers and students, said High Point Elementary teacher Jill Schultz.



Thanh-Thuy Nguyen, 8, left, gets a computer disk from teacher Jill Schultz at High Point Elementary in West Seattle. Above, students at the school work in computer class.

TECHNOLOGY

Ten Smart Lessons For the '90s

BY THERESE MAGEAU

DURING THE 1980s, WE RUSHED COMPUTERS INTO CLASSROOMS WITHOUT A CLEAR VISION OF HOW BEST TO USE THEM. NOW WE HAVE THE CHANCE TO DO IT RIGHT.

Ten years ago only a cadre of teachers, software developers, and hardware manufacturers understood the potential of the microcomputer to change how we teach and learn. Since then, educational technology has evolved from the obsession of a few techno-enthusiasts into a priority for all education.

Some observers complain we haven't moved fast enough. Others lament that we've moved too fast to implement the new technology effectively. Many teachers are afraid of the technology; administrators often lack a clear vision of the role technology should play in their schools. But as John Kernan, CEO of Jostens Learning Corp., the educational software giant, points out, "Technology has actually moved into the schools faster than any other major change in the instructional process." Now it's not just the fervent hope of the technological vanguard that American education will enter the Information Age—it's inevitable.

The successes and failures of the 1980s have yielded a rich lode of experience. *AGENDA* contacted 10 who have been on the front lines of the educational-technology movement to find out what they've learned about implementing technology in our schools. Here's what the past decade has taught them.

1 Resistance to change is one of the largest obstacles to implementing technology.

Philip Grignon, Superintendent, South Bay Union Schools, Imperial Beach, Calif.:

"It's ironic that a profession that is supposed to lead America into the twenty-first century is so resistant to twenty-first-century technology. But we tend to model those things that were modeled for us, and teachers were taught to deliver the curriculum by standing up in front of a classroom and lecturing. There's no room in that model for integrating technology into the classroom. You have to give teachers a lot of hands-on experiences for them to change their teaching, and during those experiences you have to give them a lot of TLC, because if you spook them once you'll never get them back."

Therese Mageau is an associate editor of Electronic Learning *magazine.*

[illegible]

After a decade of intensive technology purchases, virtually every school in America has at least one computer (and most have a videocassette recorder, too).

HARDWARE IN SCHOOLS

Public schools with at least one computer:[1]

1981: 18%
1984: 86%
1987: 95%
1991: 98%[2]

Average number of computers per 30 students:[1]

1984: 0.6
1987: 1.15
1990: 1.53

Predicted numbers of installed computers in schools (public and private):[2]

By June 1991:
3.5 million
(33 per school)
By June 1994:
4.8 million
(44 per school)

Schools with installed modems:[2]

1988-1989: 25%
1991-1992 (predicted): 50%

Schools owning video equipment in 1990:[2]

VCRs: 91%
Interactive video equipment: 10%
Videodisc players: 18% (doubled since 1989)
Satellite dishes: 15% (doubled since 1989)

Sources: 1. *Power On!*, Office of Technology Assessment, U.S. Congress, 1987. 2. LINK Resources.

2 Technology can inspire and motivate tired teachers.

DONOVAN MERCK, Director of the Office of Educational Technology, California Department of Education:

“Many of our teachers become revitalized when they can use more exciting tools. At first there's an aversion to using technology, but we're hearing over and over about teachers who were thinking about getting out of the business who got excited again after they started using technology. When they saw their students learning, when they had creative tools in their own hands, and when their administration supported them, they wanted to remain in the profession.”

3 Technology can be a catalyst for much broader reforms in the American education system.

JOHN KERNAN, CEO and Chairman of the Board, Jostens Learning Corp., Minneapolis, Minn.:

“We're finding that progressive school districts use technology programs to jump-start much bigger reform activities, like teacher empowerment, new governance ideas, new approaches to curriculum and instruction. While technology might represent only 20 percent of a much bigger project, it's the 20 percent that will get people excited. For instance, if a school district is interested in site-based management, the average person probably can't understand that. So progressive school districts will put a lot of technology at the site level, let the site make the decisions about technology, and then use the technology as an example of turning power over to schools.”

4 Technology should be bought only to address a specific need.

LINDA ROBERTS, Project Director, U.S. Congress, Office of Technology Assessment, Washington, D.C.:

“Based on major assessments we've done for Congress, we've learned that you have to think about the educational problems you're trying to solve before you think about what technology is appropriate. Many schools made significant investments in technology and then were suddenly faced with a problem: what do we do with it? There is clear evidence that needs have to drive technology investments.”

5 Technology alone is not the solution.

BOB TINKER, Chief Scientist, Technical Education Research Centers, Cambridge, Mass.:

“So many people thought that if you threw technology at education, problems would go away. Nothing could be further from the truth. It takes good educational practices and a lot of hard work to figure out how best to use technology to really improve student learning. In fact, it's far easier to develop new technology than it is to know how to use it effectively in education.”

6 Educational software should maximize the unique capabilities of the computer, not just recreate a textbook on disc.

P. KENNETH KOMOSKI, Executive Director, EPIE Institute, Hampton Bays, N.Y.:

“We are slowly learning how to design software that exploits the potential of the computer rather than mimics a textbook. And we are learning how to use that well-designed software. But I don't think it's happening in as many places as it needs to be happening in order to have an immediate impact on education. Computing, like every other technology that's come into education in the last 40 years, has caused a lot of excitement but no real fundamental change. Until we learn how to bring about systemic changes that will really enable us to fully utilize a technology as powerful as computing, we will never fully exploit its potential.”

Buying technology without the input of teachers will guarantee that it will not be used.

RICHARD THOMPSON,
Mississippi State Superintendent of Education:

“In the late '70s and early '80s we rushed to get computers in the hands of students. I believe that was the wrong decision. Where we've seen technology make a genuine difference is when we've given computers to the teachers first. Tapping the potential of technology means starting with and listening to your teachers.”

8 Teachers must receive sustained training to implement the new technology successfully.

BOB HUGHES, Corporate Director, Education Relations,
Boeing Company, Seattle, Wash.:

“In-service teacher training is critical. In business, approximately 2 percent of the operating budget goes toward employee training. Likewise in schools, 2 percent of a district's budget should be spent on teacher training. The districts that have made the most progress in implementing technology are those that have dedicated a part of their budget and time to in-service training. One of the most significant methods of in-service training is to put computers in teachers' hands to take home—that provides an enormous amount of training you don't have to pay for.”

9 Technology can help equalize opportunity for all students.

SHARON BELL, Chief Information Officer,
New Orleans Public Schools:

“Education should mirror the needs of society and prepare students for their future in that society. In an industrial society, people with capital have power. In an information age, people with information have power. Educational technology gives the 'have nots' the opportunity to access and manipulate information, and to make decisions based on that information. When that occurs, the 'have nots' become the 'haves.' No other technology has given our disenfranchised students that opportunity.”

10 The school context cannot be ignored when new technology is designed.

ELLIOT SOLOWAY, Professor, Electrical Engineering and
Computer Science, University of Michigan:

“You can't design software and hardware in some lab and then put it in schools and expect it to work—because it won't. That method works with consumer technology but not in schools. The overriding lesson we've learned is: Whatever the technology, we must recognize the constraints that schools must deal with. And that means involving teachers, students, administrators, and parents. This is absolutely paramount. High technology alone is not the solution, because it ignores the roles of teachers, parents, and administrators.” ■

COMPUTER-USING TEACHERS

You may find a computer in every school in America, but technophile teachers are far harder to come by. Fewer than one in four elementary school teachers, and one in seven secondary school teachers, has yet to begin using computers in his or her teaching.

ELEMENTARY SCHOOLS

Computer-using teachers, as percentage of all teachers

22%

Of these computer-using teachers, the breakdown is:

Classroom teachers (grades1-6)
72%

Special-education teachers
9%

Other teachers
30%

SECONDARY SCHOOLS

Computer-using teachers, as percentage of all teachers

14%

Of these computer-using teachers, the breakdown is:

Core-content area teachers
63%

Computer-science/vocational-education teachers
33%

Special-education teachers
6%

Other teachers
24%

Percentages add up to more than 100 due to teachers' multiple roles and computer types.

Source: Market Data Retrieval

Schools in search of top-notch programs and equal education are forging new paths in technology.

Learning across the miles

by Angela M. Mimms

Chuck ' uncan stood before his physics students and announced a quiz.

"Ah, Chuck, he students groaned.

A typical h.g.. school reaction perhaps. But the setting was not so typical. Duncan was conducting his class from a TV studio in Lexington, Ky., more than 1)0 miles away from the the groaning students at Raceland (Kentucky) High School.

Along with hundreds of students in other schools, Raceland classmates watched Duncan on a television in front of their classroom and logged their quiz answers on computerized keypads, which transmitted them instantly to their teacher. To get students even more involved, Duncan talked by telephone with students during the day's lesson.

The concept of learning over distance has been around since the 1800s, beginning with correspondence courses. But today's technology has given the concept a new identity — one that incorporates computers, satellites, fiber optics, compressed video and the like to link students and teachers across states, the country, even the world.

Increasingly, distance learning programs like Kentucky Educational Television's Star Channels are opening doors to new worlds and a quality education for a growing number of primary and secondary school students. Many states laud the programs for enabling them to offer advanced courses to rural schools limited by budgets, teacher certification or location. The programs also help urban and suburban districts make the best use of a limited number of teachers in specialized courses such as Japanese.

"We see telecommunications and information technologies being considered as probably one of the best ways to solve education problems today," said Ronald F. Bosco, president of Federal Engineering Inc., a consulting firm that works in distance learning technology.

Every state is involved in some kind of distance learning project. Here are just a few examples of the opportunities they afford:

- North Dakota students in small, rural schools for the first time are taking courses in Spanish, German, anatomy and advanced English thanks to a telecommunications program that allows teachers and students to see and hear each other.
- South Carolina students, through the state's educational television network, questioned crew members on an archaeological research vessel as they recovered artifacts from the wreck of a Civil War vessel.
- A fiber optic distance learning network in Mississippi provides high school students in four rural schools the chance to study subjects such as German, creative writing, statistics

and probability, and computer applications.

- The Nebraska Department of Education has teamed up with Nebraska Educational Telecommunications to broadcast Japanese language courses by satellite to more than 1,800 high school students in 23 states.
- In Arizona, Glendale Union High School District's distance learning network offers advanced placement courses, which allow high school students to earn college credit.
- Minnesota high school students can get a jump start on their college education by taking courses for college credit on the state's two-way interactive television network.

And back at Raceland High School in Kentucky, students are taking German, Latin, physics, discreet math and statistics courses by satellite that the school otherwise wouldn't be able to offer.

To principal John P. Stephens, the distance learning program has "made a tremendous difference."

To find out how, just ask the students. Raceland sophomore Shannon Seals is taking physics to get a step up on the engineering degree he plans to pursue in college. Junior McRae Stephenson, in her second year of German, recently qualified as a finalist in a competition to study in Germany for a year.

If not for the German class, she never would have been interested in the competition, she said. "Through the satellite system, we get so many opportunities we would never have here in Eastern Kentucky."

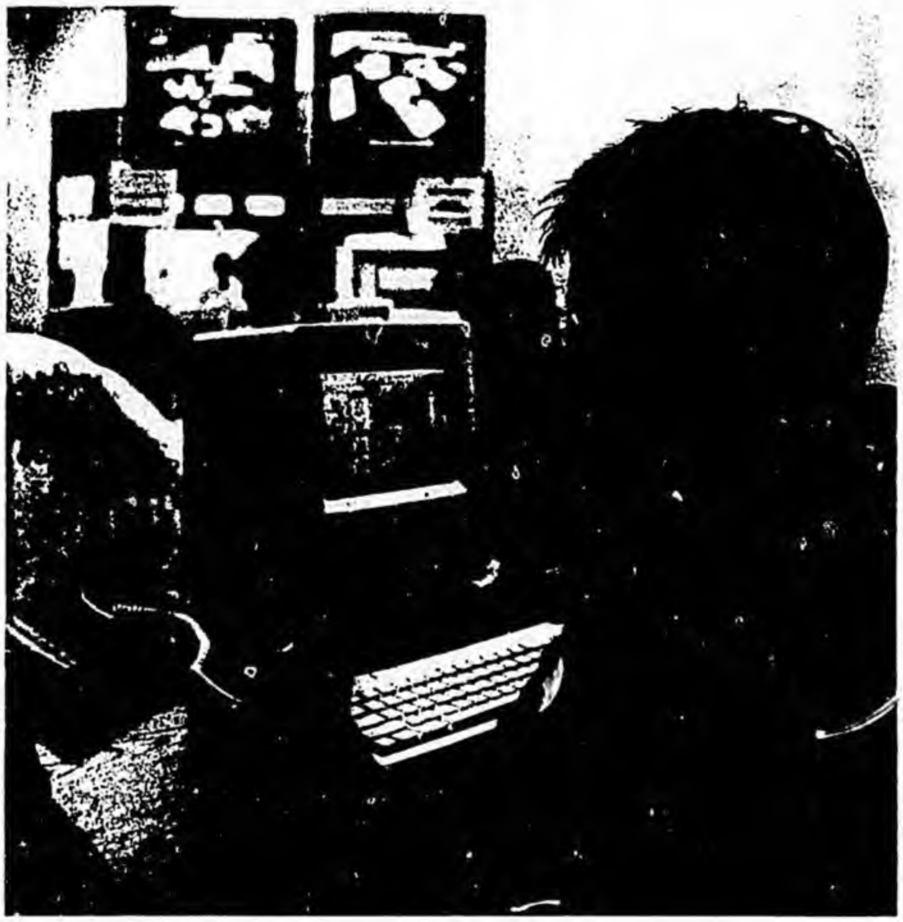


Photo courtesy of the Glendale Union High School District

Students in the Glendale Union High School District in Arizona take a computer programming class via the district's interactive video network.

A matter of motivation

The desire for quality and equality motivate distance learning programs.

In sparsely populated North Dakota, where some schools graduate only one student a year, educational inequities were bound to exist, said Kathryn Pederson, executive secretary of the North Dakota Educational Telecommunications Council and assistant director of instructional technology. To offer more courses to rural schools, the state installed two-way interactive video and audio systems. Groups of four to 10 schools are hooked up with each other so that they can share teachers and become part of a "classroom without walls."

"They're widening their world," Pederson said.

Besides sharing teachers, students are forging new relationships, even traveling to other schools to cheer for their basketball teams. One student who lingered after hours in the video classroom wasn't brushing up on his Spanish. He was asking a girl out from a town 20 miles away.

"The strengths of four little communities go into one big community," Pederson said.

The technology also works in less rural settings.

The 12,000-student Glendale Union High School District makes its headquarters just outside Phoenix. An enrollment drop forced the district to cancel classes, especially advanced placement classes with low enrollment. The district solved the problem by installing a two-way interactive video network that links its nine schools and administrative offices. Students in four locations can enroll in a class taught by one teacher from any of the other schools.

So far, student response to the program has been good, said Bruce

Florence, communications specialist with the district.

Florence and others maintain distance learning works. In fact, a growing body of scholarly literature leaves no question that the technology is effective, said Harry Miller, president of the United States Distance Learning Association.

Peter Chant, director of educational services for the Nebraska ETV Network, said students in the network's Japanese language courses have scored higher on tests than students in Japanese courses taught in a traditional classroom. Why? TV classes generally are small and attract highly motivated students. Also, the technology's novelty may get students to concentrate more, he said.

Another benefit of distance learning is that it makes the best use of an exceptional teacher. "With distance learning technology, you can multiply that teacher," Bosco said.

To a generation raised on television, video games and computers, distance learning has high-tech appeal.

"I like it a lot better because you get to do so much more stuff than a regular classroom," said McRae, from Raceland High School. Her class takes video tours of Germany and talks with other German classes around the state. One-on-one tutor sessions by phone give students a chance to practice speaking the language, she said. And the students support each other.

"It's like a team thing instead of learning on your own," McRae said. "If someone gets really lost, the rest of the class kind of pulls them along. . . . And that wouldn't happen in a regular classroom."

Teacher Beverly Waddell enjoys the classes too. As Raceland's satellite facilitator, she runs the classes and ensures students are working.

"I'm learning right along with the kids," she said.

Teachers and staff benefit in other ways. Terry Pound, associate director of short-distance learning for South Carolina Educational Television, said the state cut costs and travel time when it trained 140 bus drivers scattered among five high schools over the state's television system. A telephone in each training room allowed drivers to call in with questions and comments. The state also has a pilot program that reduces teacher travel by employing distance learning equipment for staff development sessions.

Dollars and drawbacks

Money ranks as both a drawback and a benefit among distance learning programs. Depending on the type of equipment and extent of a project, the programs can cost anywhere from thousands to millions of dollars.

> *"It's like a team thing instead of learning on your own."*
>
> McRae Stephenson
> Raceland High School Junior
> Kentucky

For instance, a school could install a computer-based distance learning program that includes audio but no television for less than $15,000, said Richard T. Hezel, president of Hezel Associates in Syracuse, N.Y. Then there's Iowa, which is installing a $93 million statewide fiber optics network. Distance learning will be only one of its functions.

But factoring distance learning's cost over several years makes the initial price tag less imposing. And in the long-run, distance learning can help schools that can't afford specialized teachers.

Funding sources for distance learning vary. Some states, such as North Dakota, have appropriated millions over several years to establish programs. The private sector contributes money and resources to many programs, while some schools participate in a matching funds system with their state.

Among other potential drawbacks is scheduling. Conflicts arise when a school subscribes to a course that doesn't correspond with the school's class schedule. For instance, courses offered through national distance learning networks go to schools in several states that run on different schedules.

Also, technology isn't fail-safe. Extreme weather can knock out satellite signals, and faulty equipment can prompt sound problems.

In addition, the more popular a program becomes, the less interactive it becomes. Raceland's McRae said a satellite course is frustrating when she has to wait for answers by phone rather than talking to a teacher in the room. Some programs, such as Glendale Union's in Arizona, solve that problem by opting for a program that serves only a limited number of schools and uses a microphone system that allows students to talk directly to teachers.

Not having a teacher in the classroom is difficult for some students, Pederson said. And it can be hard for a teacher to readily identify when a student has a problem.

Some teachers may believe distance learning threatens their jobs, but that isn't true, said Nancy Klinck, editor of *TechTrends*, a magazine published by the Association for Educational Communications & Technology. "You can never replace a classroom teacher."

Essential elements

Despite the drawbacks, distance educators believe the benefits of a well-planned program are worth the effort. They offer suggestions for schools considering such technology.

"Make sure that you have something worth sending," Florence said. A good instructional program and the need for the technology is essential.

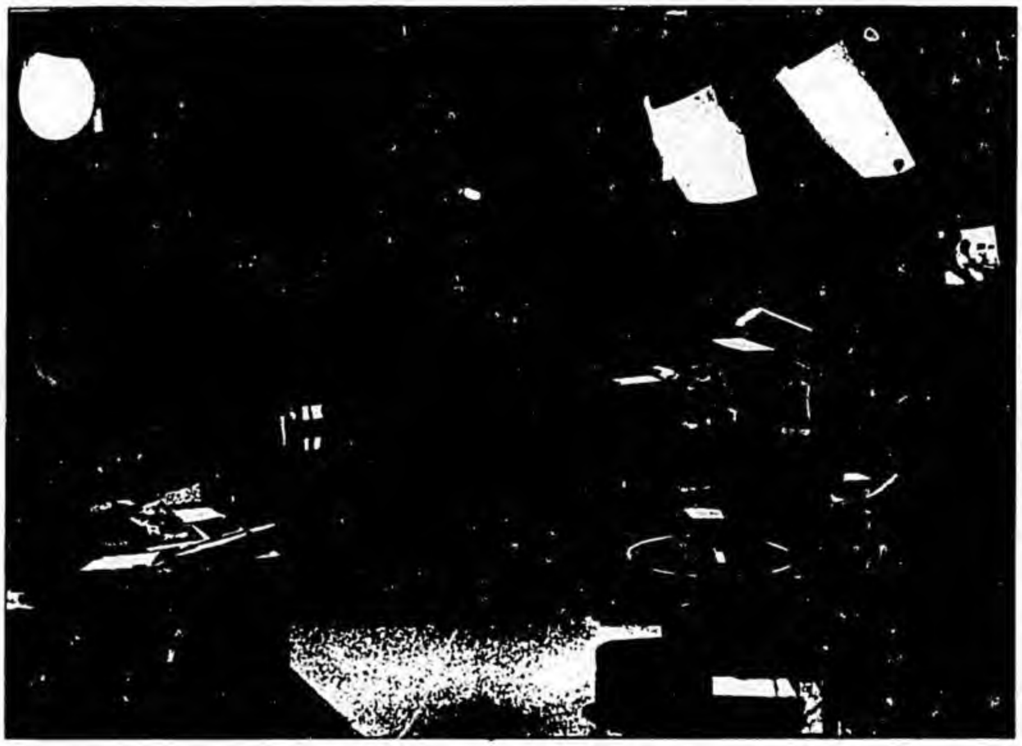


Photo cou .esy of Nebraska ETV

Teacher and crew take to the stud:o to produce a live Japanese class in Nebraska.

For distance learning to be successful, the courses demand exceptional teachers who are comfortable in front of a camera, Klinck said. Students must be motivated. And instructions and language should be clear and concise. Also, visuals presented on video need to be large enough that students can read and understand them.

Robert Young, director of the Division of Distance Learning for Mississippi Educational Television, advocates a lot of planning and training in preparation for this new way of learning and teaching. Also, he said, it is important to evaluate and revise programs.

A fast-moving future

Distance learning technology took off in the 1980s driven primarily by money and inspiration from the federal Star Schools program, which helped launch programs such as Kentucky's, said Miller, of the United States Distance Learning Association. Projects used to be easy to keep track of, he said, but with an increasing number of schools employing today's fast-changing technology, that task is getting harder.

For the future, Miller expects a move from large broadcast satellite networks to smaller programs that promote more interactivity. There's also growth in computer-based distance learning by which a teacher can communicate by computer and telephone with small classes at distant sites. Teachers can transmit images to students' computers, and teachers and students can send comments back and forth.

Miller said he thinks computer-based distance learning is developing more slowly because it's not as similar to a traditional classroom setting as televised courses. But the technology is less costly and is gaining greater accceptance as more teachers work with it.

Klinck said she expects increased cooperation among schools and industry on distance learning programs. And she said more universities will work with local schools to prepare students for college. High school students in some areas, for instance, already can access state university libraries via distance learning technology.

The day may be coming when more traditional classroom courses incorporate distance learning into their curricula, Bosco said. For instance, a French class might hold a video teleconference with someone in France to enhance a lesson.

Educators see great potential for the technology. Glendale Union hopes to include students from Indian reservations and juvenile corrections departments in its distance learning courses. Businesses also could use the technology for staff training during evenings and Saturdays as could fire departments that don't want their crews far away in case of an emergency.

"It's unlimited," Florence said. "It's just a matter of our imagination and energy." ☐

Summary of
Alaska Instructional Technology Survey
April 1993

Lois Stiegemeier

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801 W. 10th Street, Suite 200
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Executive Summary

In April of 1993, the Alaska Department of Education conducted an instructional technology survey of all schools and school districts. The purposes of the survey were to:

- Collect baseline data on the numbers and types of technologies currently employed in Alaska schools for instruction.
- Collect information on utilization of the technologies.
- Determine the level of priority for instructional technology in Alaska's schools.
- Determine what needs must be met in schools in order to effectively employ technologies in instruction.

Information from the survey will be used by the Department in developing plans for instructional technologies and working with districts in the area of instructional technology.

Responses were received from 47 of the 56 district superintendents and by 264 principals. That represents a response rate of 84% for superintendents and 53% for principals.

Major Findings

- Nearly half the superintendents and principals responding rate instructional technology as a high priority for their schools.
- Almost half the teachers in responding schools are using some form of instructional technology daily.
- Principals estimate that 37% of students are using some form of instructional technology daily.
- Wide disparities exist across the state in the kinds of technologies available in schools.
- Many computers in Alaska schools are older models limited in their applications to new and emerging instructional uses.
- Training teachers to use technology is the most prevalent need beyond additional funding for technology.

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Special thanks to Craig Kahklen and Evonne Noonan for their statistical support.

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Recommendations

- School districts placing a priority on technology's role in the schools should develop a comprehensive plan for its acquisition and implementation.

- Teachers must be trained to use technology as effectively as employees in the private sector.

- Educational equity will not be realized in the information age until all schools are capitalized with the hardware necessary to take advantage of new technologies integrating voice, video and data.

- The state should explore its role in building the wide area network infrastructure to ensure that all students in the state have access to on-line data networks, video resources, and distance education resources.

Overview

In April of 1993, the Alaska Department of Education conducted an instructional technology survey of all schools and school districts. Staff designed two survey instruments to collect data on the instructional uses of technology. The purposes of the survey were to:

- Collect baseline data on the numbers and types of technologies currently employed in Alaska schools for instruction.
- Collect information on utilization of the technologies.
- Determine the level of priority for instructional technology's in Alaska's schools.
- Determine what needs must be met in schools in order to effectively employ technologies in instruction.
- Information from the survey will be used by the Department in developing plans for instructional technologies and working with districts in the area of instructional technology. Information will also be used in responding to information requests regarding the level of technologies in Alaska schools and in responding to proposed legislation involving instructional technology.

Questionnaires were mailed to all districts and schools by the Department of Education in April 1993. No follow up questionnaires were sent to schools prior to the end of the school year. By June 1, responses were received from 47 of the 56 district superintendents and by 264 principals. That represents a response rate of 84% for superintendents and 53% for principals. Schools responding to the survey closely paralleled the demographic profile of all schools in the state. An analysis of respondents was made on the basis of building enrollments and grade levels in the school as well as the number of responses from the five largest school districts to see if the data was representational of all schools in the state or if any type of school or district was over-represented.

Table 1 shows the correlations of schools by size of enrollment represented in the survey and the statewide demographics of building enrollments.

Table 1
Building enrollments

Building Enrollment (Number of Students)	Survey Results		All Schools	
	Count	Percent	Count	Percent
0 -25	39	15%	79	17%
26 - 50	34	13%	65	13%
51 - 100	34	13%	68	14%
101 - 300	64	25%	116	24%
301 or more	90	34%	156	32%

Table 2 shows the demographics of respondents as compared to statewide demographics by school grade level:

Table 2
School types

School Type	Survey Results		All Schools	
	Count	Percent	Count	Percent
Elementary	101	39%	190	39%
Middle/Jr. High	19	7%	26	5%
High School	27	10%	54	11%
PE - 12	106	41%	192	40%
Middle/Jr. High	8	3%	22	4%

Table 3 shows the number of respondents in the five largest school districts (Anchorage, Fairbanks, Kenai, Mat-Su and Juneau) as opposed to respondents in other districts:

Table 3
District Size

	Survey Results		All Schoois	
	Count	Percent	Count	Percent
Five Largest Districts	100	38%	181	37%
Other Districts	161	62%	303	63%

As can be seen by the three tables, respondents mirrored very closely the overall demographics of schools in the state. Although there may be some differences between respondents to the survey and non-respondents, the demographic picture of the respondents is representational of all schools in the state. Thus, results of the survey can be assumed to generally apply to most types of schools in the state.

Major Findings

- Nearly half the superintendents and principals responding rate instructional technology as a high priority for their schools.
- Almost half the teachers in responding schools are using some form of instructional technology daily.
- Principals estimate that 37% of students are using some form of instructional technology daily.
- Wide disparities exist across the state in the kinds of technologies available in schools.
- Many computers in Alaska schools are older models limited in their applications to new and emerging instructional uses.
- Training teachers to use technology is the most prevalent need beyond additional funding for technology.

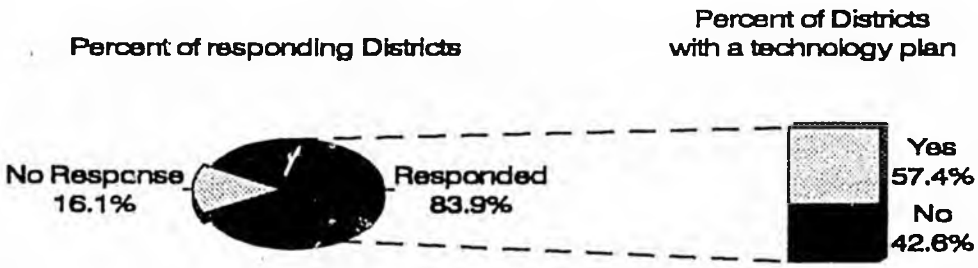
Survey Results

Superintendents Survey

Superintendents were asked three questions regarding technology in their districts. These questions were designed to elicit information regarding district level planning, priorities and communications networks.

Superintendents were asked if their district had a district wide instructional technology plan. Research has shown that planning for the inclusion of instructional technologies in schools is critical to its successful implementation and curriculum integration. Over half the districts responding indicate that they have a plan. Figure 1 denotes the level of superintendent response to the survey and those responding that have a technology plan.

Figure 1
Percent of districts with instructional technology plans



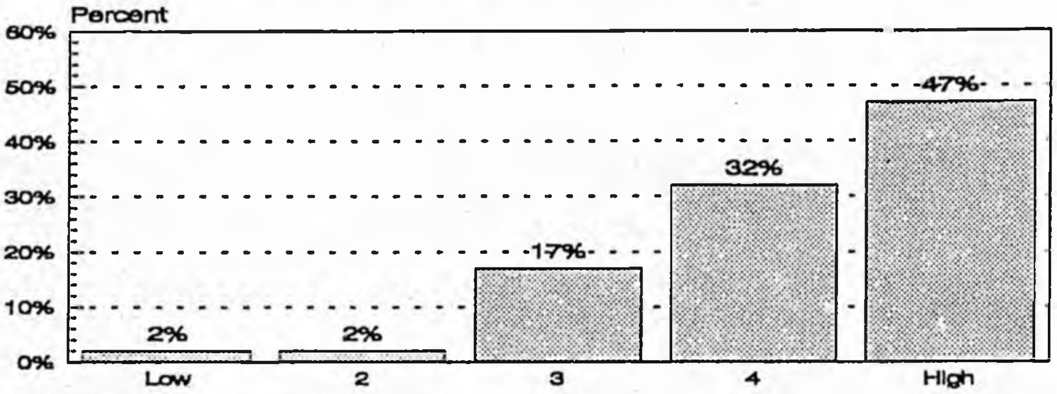
Superintendent comments regarding planning for technology were analyzed and summarized as shown in Table 4. These comments indicate that even in districts without a technology plan, the preponderance of superintendents understand the value of a technology plan and several additional districts are proceeding with developing one.

Table 4
Technology Planning Comments

Comment	Number of Responses
Planning currently underway	3
High Priority and will be developed	2
Drafted and to the board for approval	1
Needs to be developed	1
Has been subsumed into strategic plan	1
No Plan	1

Almost 80% of the superintendents see the use of instructional technology as a medium high to high priority. Only two districts felt that use of instructional technology is a medium low or low priority for their district as indicated in Figure 2.

Figure 2
Districts priority for the use of instructional technology*



*83.9% of districts responded to survey

Superintendents were asked if their district has an intra-district communications network. Slightly over 40% of superintendents report that their district has a communications network. Nearly 60% report no intra-district network. Superintendents were asked to describe the kind of network they are employing to communicate within their district. Table 5 shows the similarities in superintendents descriptions of their intra-district networks.

Table 5
Intra-District Network

Comment	Number of Responses
Fax Machines	7
IBM AS 400	5
QuickMail	4
Designing one/hope to install	3
UACN/Telecommunications	3
Macintosh/QuickMail operational in Fall '93	2
Computer/Modem	1
Finanacial use only-not communications	1
STAR schools	1
Macknowledge	1
Unixbased/IBM Powerstation	1
Electronic Mail	1
Establishing PSINet	1
Network (no identification)	1

Principal's Survey

The principal's survey was intended to elicit information regarding the kinds of technologies in each individual school, and the ways in which teachers in that school were utilizing the technologies available to them. In addition to detailing the kinds of technologies they utilize, principals were asked to determine the level of priority they placed on instructional technology and whether or not the school has a technology plan. Respondents were also given an opportunity to discuss the needs they have other than additional funding in ensuring that instructional technology be used effectively.

Principals were asked to give their best estimate of the percent of staff utilizing instructional technology daily, weekly, monthly or less, or never. Results from this question indicate that half of the teaching staff utilize some form of instructional technology daily.

Principals were asked a similar question regarding the percentages of students using instructional technology on a daily, weekly, monthly or less, or not at all basis. Principals report that 37% of the students in their schools use technology daily while 40% use technology weekly. Figure 3 compares the frequency of student and staff use of technology in responding schools.

Figure 3
Frequency of staff use versus student use of instructional technology

	Daily	Weekly	Monthly	Never
Staff	50%	29%	12%	9%
Students	37%	40%	15%	8%

The responses to these two questions indicate that both teachers and students are utilizing the technologies that they currently have in the schools. Some respondents provided comments showing what progress they had made in utilizing technology with their students:

> ***"Over a 3 year period we have gone from teaching 3 high school typing classes on typewriters to keyboarding for all 6th grade. Middle school and high school students are now completing projects onlinking and Hypercard. We have piloted a middle school "check out a Mac" program this past spring-with kids taking Macs home each evening (very popular). Next year we are placing 4 to 5 computers in each 4th and 5th grade classrooms, expanding our use of video disc technology at high***

school, and fully integrating our English 9 and computer Application I courses."

Further questions focused on the technologies indicate that there seems to be a wide disparity in what is available to teachers and students to use, however.

Computer Technologies

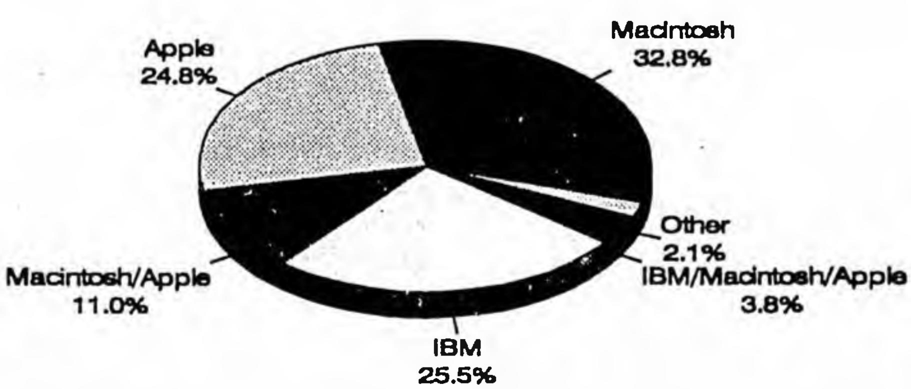
Principals were asked a number of questions regarding the configuration and uses of computer based technologies in the schools. The following information summarizes the responses from those questions.

Labs

Computers are often configured in computer labs in schools. A computer lab consists of space for a number of computers which are generally networked with printers, often with file servers, modems, and other devices (laser disks, cameras, etc). Labs generally serve entire classes of students and are scheduled for use by teachers. Principals were asked in this section to describe all the computer labs in their school. They were also asked not to duplicate their inventory with any of the other configurations generally found in schools (library media centers and classroom computers).

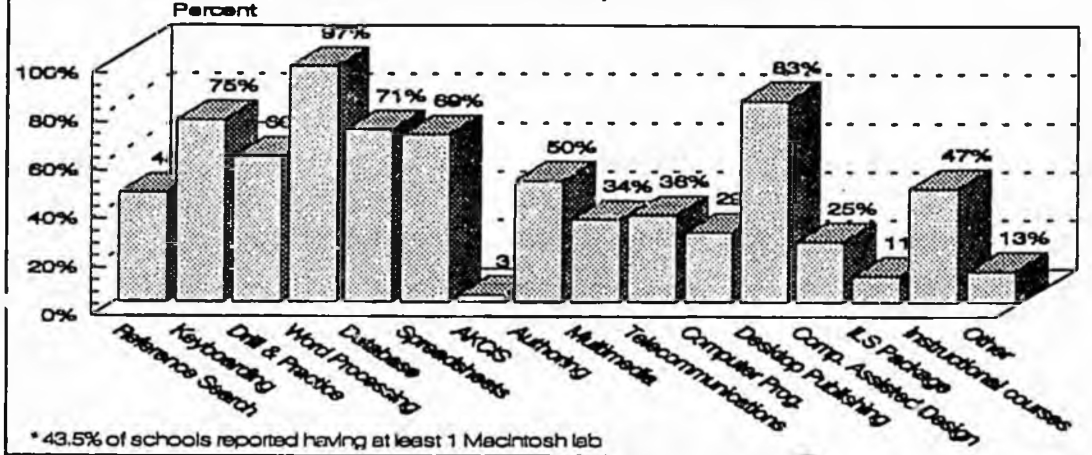
A total of 290 labs were reported in 168 schools or 64% of the schools responding to the survey. Schools were asked to describe their labs in terms of the kinds of computers, networking and other technologies connected with their labs. Most labs utilize Apple brand computers: Macintosh and Apple computers (IIe, IIc and GS) either separately or mixed together. IBM/IBM compatible labs accounted for nearly 26% of the total labs. A small number of labs utilize a mix of Apple brand computers and IBM/IBM compatible computers. Figure 4 shows the breakdown of labs by kind.

Figure 4
Types of labs in schools



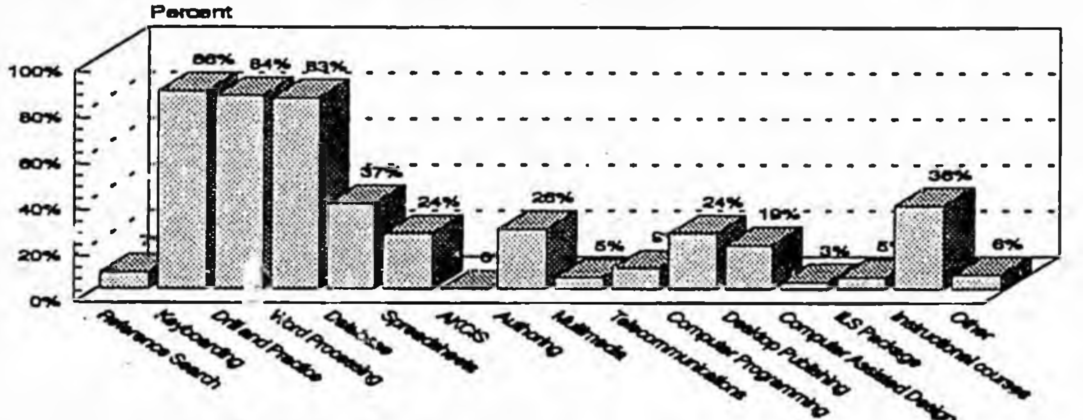
Principals also were asked to indicate the uses for their labs. Figures 5, 6, and 7 show the uses for each of the three prevalent kinds of computers.

Figure 5
Lab Instructional uses of Macintosh computers in schools*



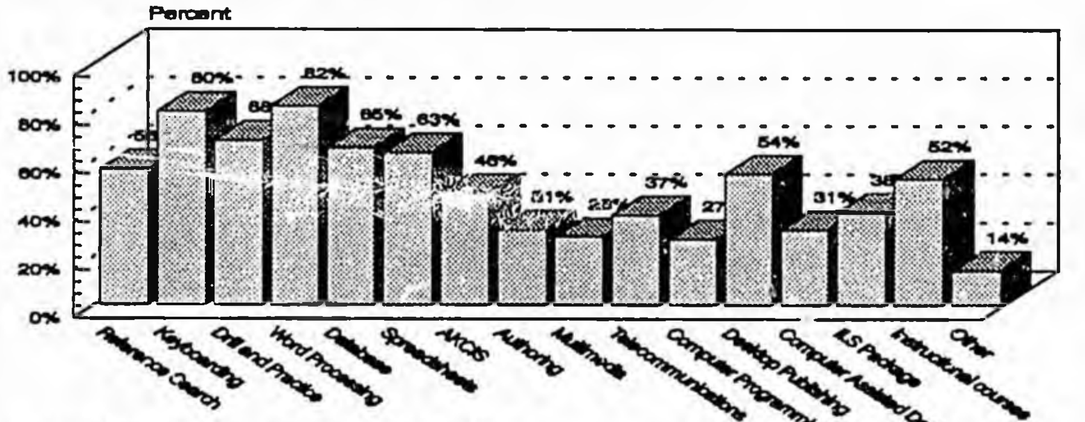
* 43.5% of schools reported having at least 1 Macintosh lab

Figure 6
Lab Instructional uses of Apple computers in schools*



*35.8% of schools reported having at least 1 Apple lab

Figure 7
Lab Instructional uses of IBM computers in schools*



*28.9% of schools reported having at least 1 IBM lab

As one would expect, computer labs which generally accommodate many teachers representing multiple curriculum areas are utilized for multiple functions. The most prevalent uses for all types of labs are word processing, keyboarding, drill and practice, databases, desktop publishing, and spreadsheets. While most most labs are used for those purposes, there were some notable differences in use by brand of computer. Drill and practice was used more often by Apple labs, suggesting that both the Apple line of computers and the types of software available for them lends itself to drill and practice use. In addition, desktop publishing is the second most used function for Macintosh labs. Little more than half the IBM/IBM compatible labs are reported used for desktop publishing and only 24% of Apple labs are used in this way. This indicates that Macintosh computers are leading the school desktop publishing market in Alaska schools. Multimedia, one of the newest uses for computers and quickly becoming a powerful instructional devise is nearly totally conducted on Macintosh and IBM/IBM compatible machines. This is not surprising since multimedia applications make power and other demands on machines that Apple lines and older machines have difficulty fufilling. Macintosh and IBM/IBM compatible machines are also used more for spreadsheet applications. Integrated Learning Systems (ILS) packages and the Alaska Career Information System (AKCIS) are accessed mainly by IBM/IBM compatible machines.

Some respondents noted that the need for updated or upgraded labs are great in their schools as typified by this comment:

> ***"We are in need of a computer lab at the elementary and/or 4-6 computer/CD-ROM laser disks in each classroom. Teachers have seen the awesome power of laserdisks, CD-ROMs, multimedia, and content area programs and are sold. We need to get them the tools to do it."***

Other lab descriptions showed the high level of sophistication achieved in some schools with networking, other high end hardware, and utilization of software that allows students a multitude of learning opportunities:

> ***"We feel that we have one of the most complete and advanced computer lab/network in the state. We strongly emphasize using the technology we have available to improve student learning and confidence."***

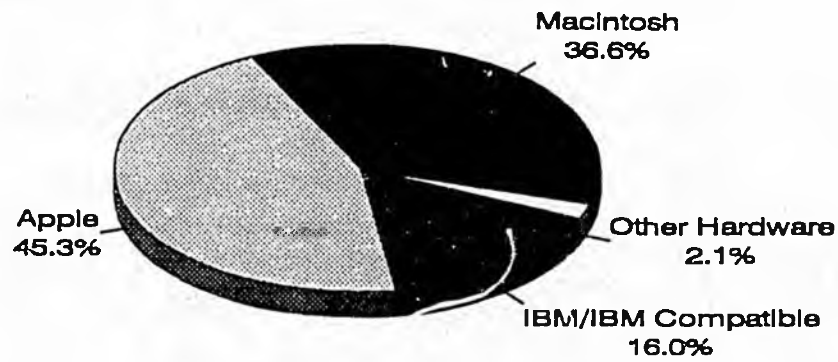
Classroom Computers

The typical number of computers found in the classroom is two; however, the number of computers in classrooms ranged from 0 to 34. Again there is a wide disparity in the numbers of computers located in classrooms where most students spend most of their time. Twenty-one schools responded having no computers in the classroom. As one respondent noted:

> ***"They (teachers) also need personal access in their own rooms to a Mac that is networked throughout the school. We can't make real progress until teachers are comfortable with technology and there is sufficient access to computers for both teachers and students."***

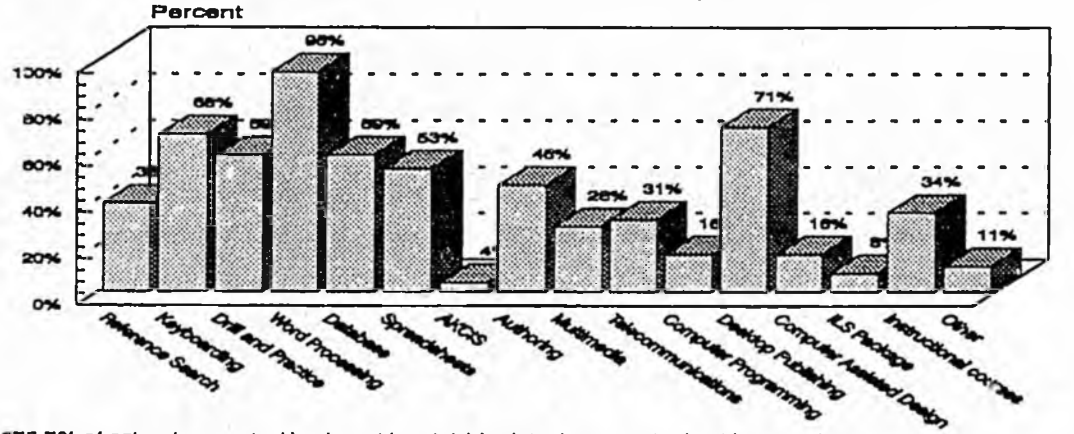
Figure 8 shows the distribution of computers in the classroom by type. Most computers found in the classroom are Apples and Macintosh with IBM/IBM compatible computers lagging behind.

Figure 8
Types of computers in the classroom



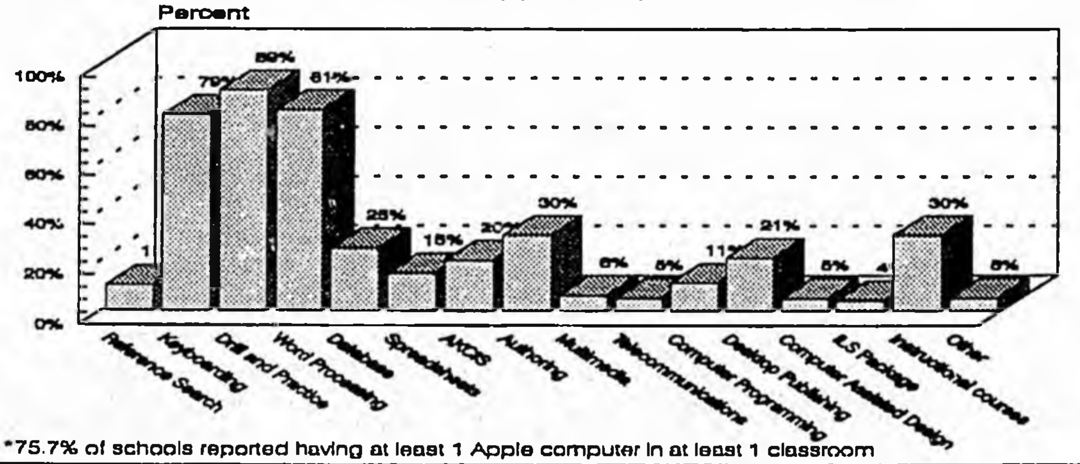
Figures 9, 10, and 11 show the reported uses for each type of computer found in class-room.

Figure 9
Classroom Instructional uses of Macintosh computers in schools*



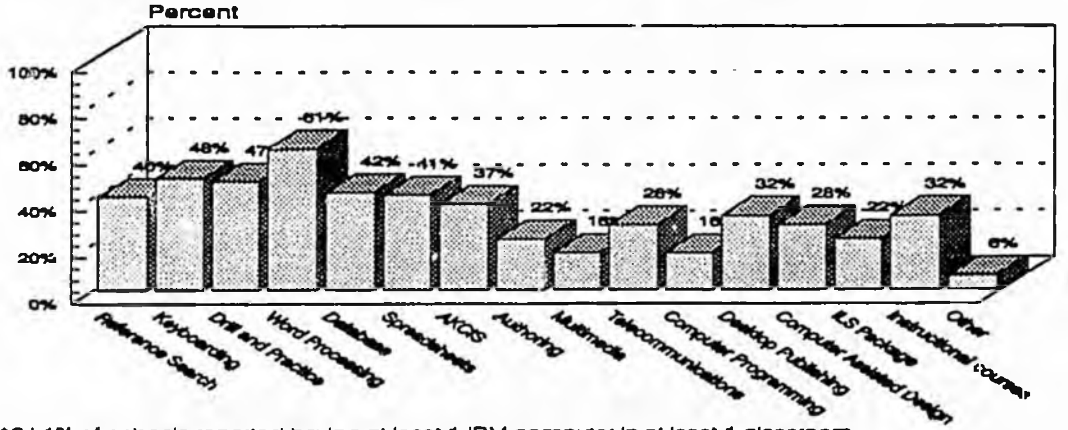
*75.7% of schools reported having at least 1 Macintosh computer in at least 1 classroom

Figure 10
Classroom Instructional uses of Apple computers in schools*



*75.7% of schools reported having at least 1 Apple computer in at least 1 classroom

Figure 11
Classroom instructional uses of IBM computers in schools*



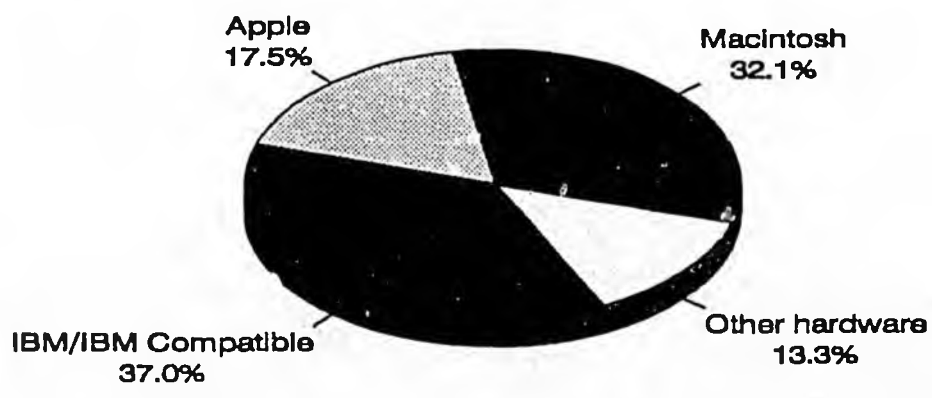
*31.1% of schools reported having at least 1 IBM computer in at least 1 classroom

Very little difference is seen in the uses of computers in the classroom and uses in the lab. The top use of computers in the classroom is word processing, followed by drill and practice and keyboarding, desktop publishing and database use. Again, however, the type of computer in the classroom makes a difference in its use. Apple computers are used more for drill and practice and keyboarding. As in the labs, Macintosh computers are used more heavily for desktop publishing than Apple or IBM. Use of IBM/IBM and Macintosh computers seems to be more evenly distributed among a wide variety of applications. IBM/IBM compatible classroom computers are used significantly more for accessing the Alaska Career Information System (AKCIS) and for Integrated Learning System (ILS) packages.

Library/Media Center

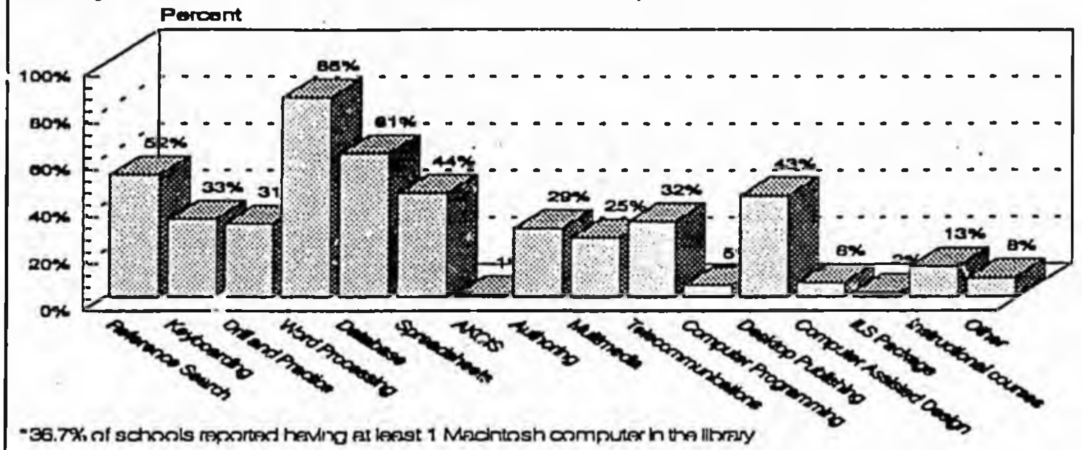
The third general configuration of computers in most schools are those in the library/media center. Figure 12 shows the distribution of computers in the library by type. Library configurations are notable in that IBM/IBM compatible computers are more prevalent than Apple brand computers.

Figure 12
Types of computers in the library



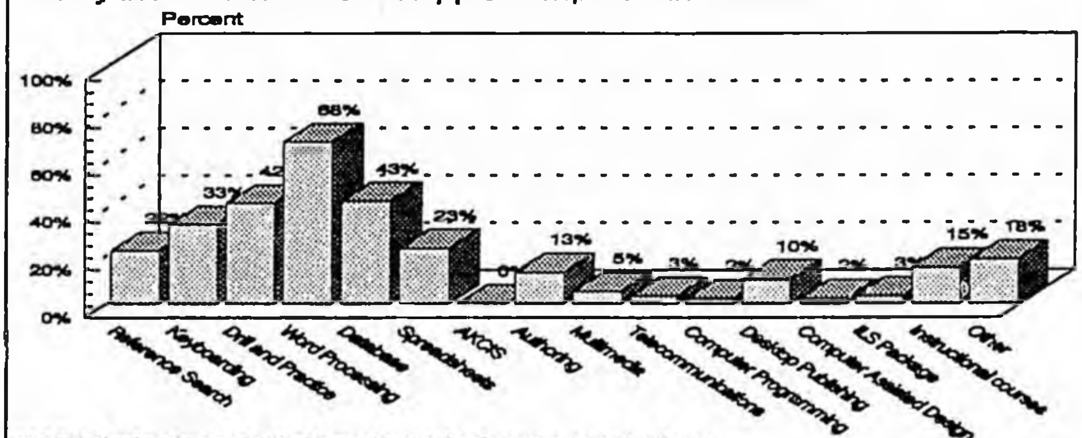
Figures 13, 14, and 15 show the reported used for each type of computer located in libraries.

Figure 13
Library instructional uses of Macintosh computers in schools*



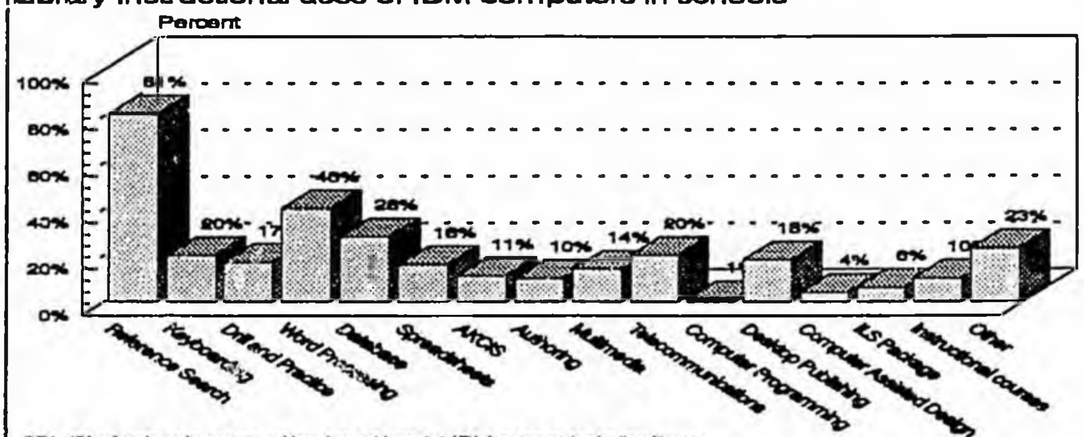
*36.7% of schools reported having at least 1 Macintosh computer in the library

Figure 14
Library instructional uses of Apple computers in schools*



*22.7% of s^hools reported having at least 1 Apple computer in the library

Figure 15
Library Instructional uses of IBM computers in schools*



*31 4% of schools reported having at least 1 IBM computer in the library

Computers located in libraries are used similarly to those in classrooms and labs, though uses more commonly connected to the library such as conducting reference searches predominate. The three highest uses of computers located in libraries are word processing, reference searches, and databases. Consistent with responses regarding hardware in the other two configurations, Macintosh computers are used more for desktop publishing and multimedia than the other types of computers. IBM/ IBM compatible computers, however report far more use in conducting reference searches. That may be due to the online or CDROM technologies employed to conduct reference searches. Apple computers are reported more heavily used even in the library for drill and practice.

Overall

Many of the computers noted in all three general configurations are older Apple IIe and IIc computers especially in the classroom where Apples represent 45% of the total number of classroom computers. These computers while still adequate for initial learning of keyboarding and word processing and still being used heavily for drill and practice are not suitable nor upgradable for the newer applications in schools—hypercard, multimedia, and many interactive uses. As these respondents noted:

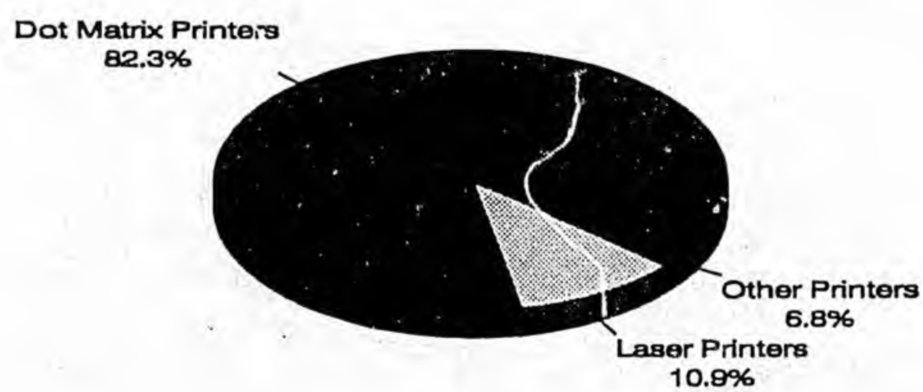
> ***"We are severely lacking in technological equipment to enhance teaching and learning. Many of our machines are obsolete. We have not even had sufficient funds to repair all of the items that have broken down during the school year."***

> ***"We need updated technology badly. I feel our staff would be more enthused than they are if we had the technology to work with. The technology in the building is very outdated nor is there enough to go around."***

Printers

Schools were asked to report how many printers they had available for use outside their computer labs. The availability of printers outside the lab gives students and teachers more flexibility in the use of computers on a daily basis. Figure 16 represents the kind of printers available in schools outside labs. As in the case of computers, the most printers available for use are dot matrix computers which is an older and more limited technology.

Figure 16
Types of printers in schools



Calculators

The National Council of Teachers of Mathematics (NCTM) has recommended students have available to them and use calculators to perform certain kinds of math functions. Principals were asked to report on the number of different kinds of calculators in their schools. Most calculators in use by schools are basic four function calculators. About 17% of the total number of calculators reported were scientific calculators generally used in secondary level mathematics classes, and only about 4% are graphing calculators, a powerful tool recently made available with widespread applications for grades 7-12. Figure 17 shows the breakdown of the types of calculators reported in the school.

Figure 17
Percent of calculators used in schools

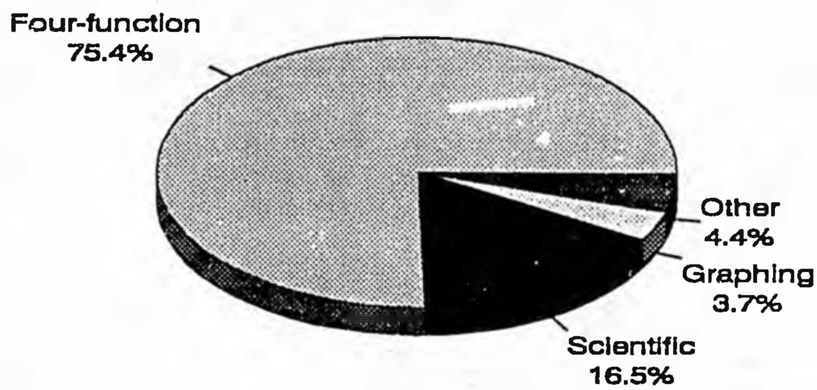
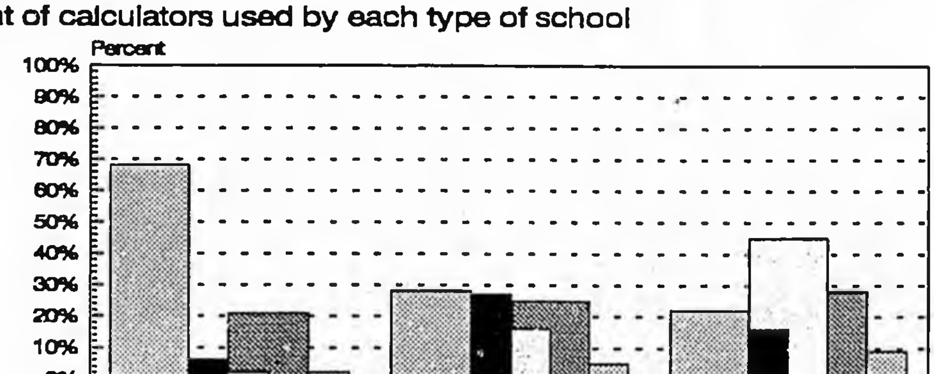


Figure 18 denotes the prevalance of each type of calculator by grade level categories of schools Most of the basic four function calculators are located in elementary schools with an additional 21% of four function calculators in schools containing grades PE-12. While 18% of the schools reported having no four function calculators; one elementary school reported as many as 500 four function calculators, again showing the wide disparity of available technologies in the schools.

Figure 18
Percent of calculators used by each type of school



	Four-function	Scientific	Graphing
Elementary	68%	28%	22%
Middle/Junior High	6%	27%	16%
High School	2%	16%	45%
PE-12	21%	25%	28%
Middle/High School	2%	5%	9%

Elementary ■ Middle/Junior High □ High School ▨ PE-12 □ Middle/High School

The number of scientific calculators are spread fairly evenly among all types of schools. However, middle/jr high schools represent only a little over 7% of survey respondents but have 27% of the scientific calculators. Nearly half of the schools reported having no scientific calculators.

Graphing calculators which are generally used in more advanced classes are found predominantly in secondary schools with a total of 45% located in high schools. Again, since high schools account for only 10% of survey respondents, this shows that the highest concentration of these tools is where one would expect them. No graphing calculators were reported in 167 schools or 63% of the schools responding to the survey. Only eight schools reported having enough graphing calculators for entire classes of students to use. Lower number of graphing calculators may be due to the recency of of graphing calculators introduction to educators and to their higher cost relative to other calculators.

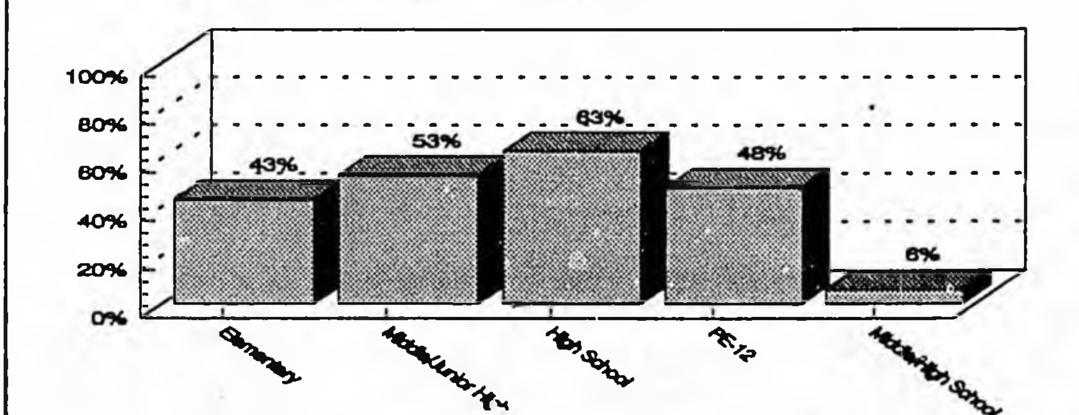
Telecommunications and Video Based Technologies

Many schools are increasingly using telecommunications and video based technologies. Networks are increasing that give teachers and students access to information and other people through telephone lines, satellite dishes and cable television. In this section of the survey, principals were asked to report on the prevalence and use of these types of technologies in their schools.

Modems

In order to access telephonic based networks it is necessary for schools to have modems. Only 175 modems were reported available for instructional use. One hundred schools (38%) reported having no modems. The maximum number reported available for instructional use by schools was 4. The data shows that more high schools responding to the survey have modems available for instructional use than other types of schools. Figure 19 shows the availability of modems by type of school.

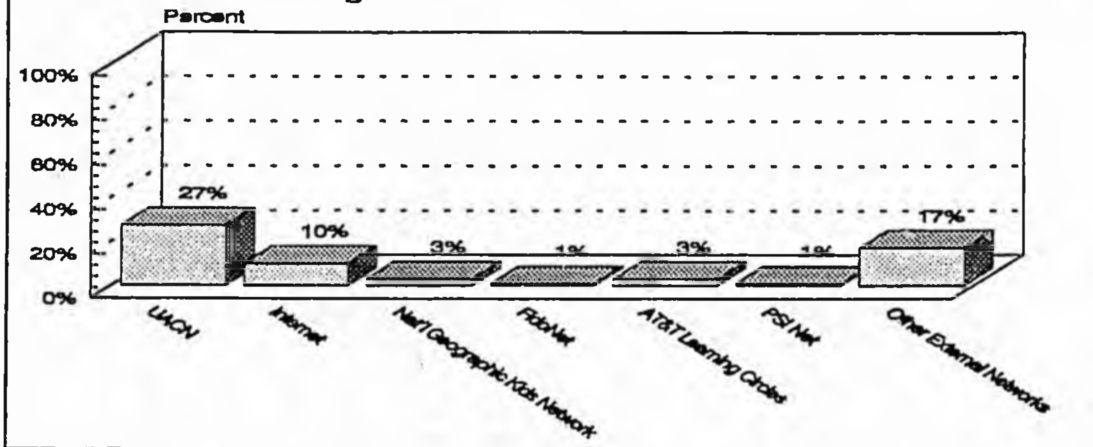
Figure 19
Percent of schools that have at least one modem



On-line Resources

Schools were asked what online services are accessed for or by teachers and students. Figure 20 shows the percent of responding schools using online networks.

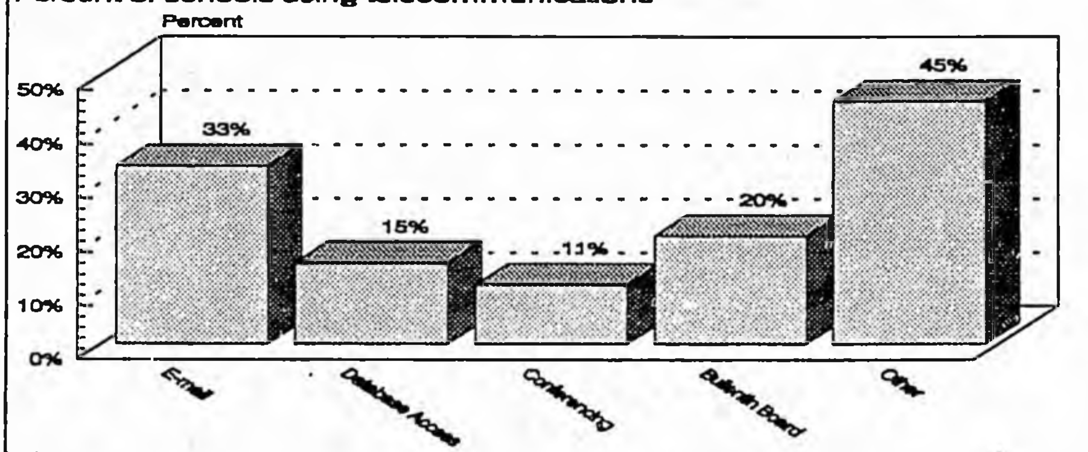
Figure 20
Percent of schools using On-line sources



More schools responding to this question use the University of Alaska Computer Network (UACN) than any other identified network. The largest use of UACN is for electronic mail followed by bulletin board access. Use of the Internet was the second highest reported network used. The Internet is a large electronic highway that allows users access to many online and data networks. Use of the Internet to access online resources indicates that some schools are beginning to utilize this powerful resource for instruction.

Figure 21 shows the most reported uses of all online services or networks.

Figure 21
Percent of schools using telecommunications



Telephones

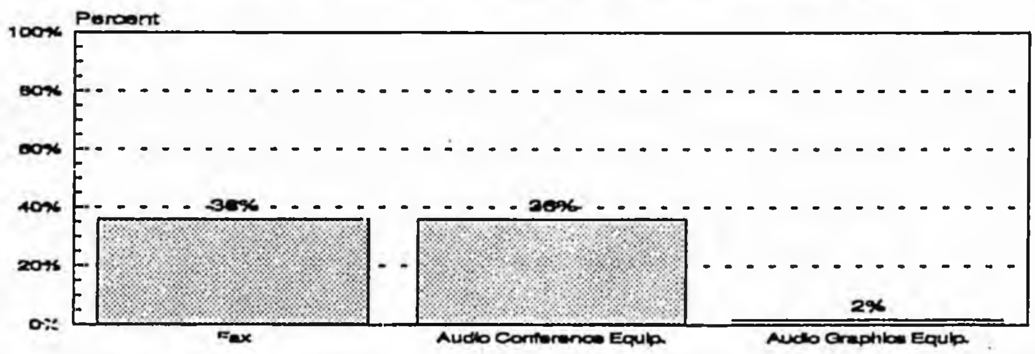
In order to access online services, utilize audioconferencing and audiographics for instruction, teachers and students must have access to a very basic technology—the telephone. Answers to the question what percentage of your classrooms have phones generated a wide disparity of responses. Nearly half of the schools responded that none of their classrooms had phones. Yet, nearly 20% responded that all of their classrooms had phones. The average number of classrooms with phones was 26.7%.

There were four districts in which all schools responding to the survey reported phones in all the classrooms. This is an indicator that some districts have committed to having phones in all classrooms. There were also eight districts in which all responding schools reported no phones in classrooms. Lack of access to phones was seen by some respondents as problematic as noted by this comment:

> ***" Besides money, we need an attitude conducive to the 21st century All the buildings have electrical conduit for TV cable and telephones/computer lines but the decision was made . . . not to install everything. Now the money is gone and so are many of our hopes. We still can't get anyone to allow us to install phones in classrooms!!"***

Schools were also asked to report on the kinds of telephone based technologies available including Fax machines, audio conference, audio graphic and other equipment and how they are used. Figure 22 shows that only about a third of the schools have FAX and audio conference equipment available for instructional use. A very small percentage of schools have audio graphic equipment. Utilization of such telephone based equipment is higher for teachers than for students.

Figure 22
Percent of schools with various types of telephone technologies

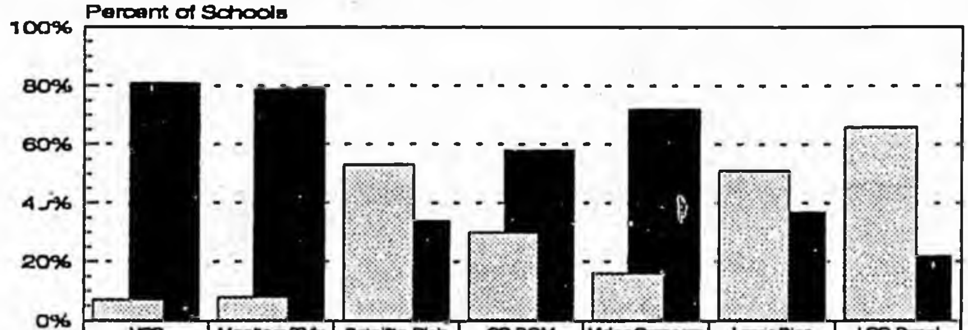


<u>Video/visual based Technologies</u>

Digitization and compression of video technologies are quickly changing the video technology landscape. Use of digitized video over fiber optic networks will allow 500+ channels of entertainment and information in the home Plans are currently underway for services on these networks that will allow video on demand, more extensive home shopping, electronic medical house calls, electronic banking, access to databases and electronic libraries, and highly interactive games. These new networks have vast potential for use by schools, however most schools do not have the infrastructure to capitalize on the potential these networks hold for education.

Most schools responding reported having the "basic" technology of videocassette recorders and monitors. Although some schools still report having no video cassette recorders (VCR's) or television/monitors, the maximum reported was 25 VCR's and 40 televisions/monitors in a school. Figure 23 compares the schools reporting not having the indicated technology to those reporting at least one. As can be seen in the graph, digital/video cameras and CD-ROM players are fairly prevalent in schools; laserdisk players and LCD display panels are scarcer technologies.

Figure 23
Comparison of school reports of video/visual-based technology

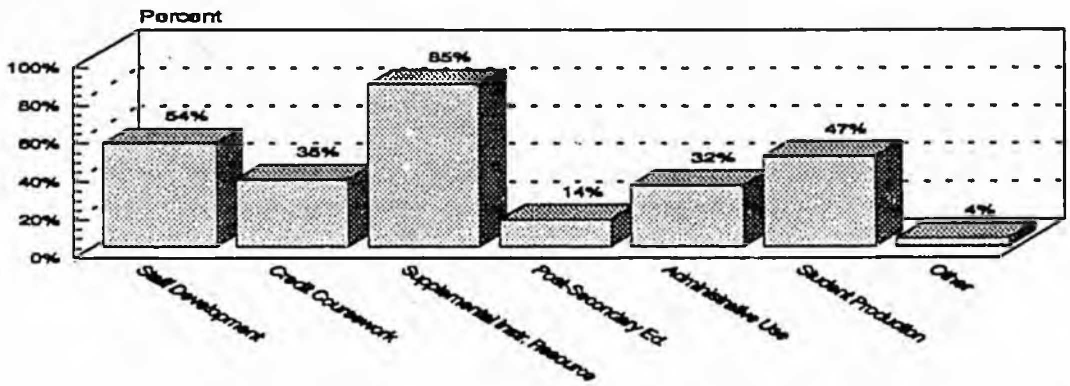


	VCR	Monitors/TV's	Satellite Dish	CD ROM	VideoCameras	Laser Disc	LCD Panel
None	7%	8%	53%	30%	16%	51%	66%
One or more	81%	79%	34%	58%	72%	37%	22%

As is the case with telephones in schools, there is wide disparity among schools with cable television. Nearly 50% of the schools reported that none of their classrooms have cable television. On the other hand, over 20% of the schools responded that all of their classrooms have cable. Schools reporting no cable in the classrooms were reviewed in light of the Alaska Department of Administration's "Inventory of Communication Facilities Serving Alaska, 1992". This review revealed that nearly one-third of schools without cable have no cable available in their community.

Schools were asked to report on the ways they are using video and visual technologies in their schools. The most common use of all video based technologies was as supplemental instructional resources as noted in Figure 24.

Figure 24
Percent of schools using video/visual-based technology for instructional uses



In other words, teachers are generally utilizing these technologies primarily as adjuncts to their classroom instruction. Staff development accounts for the second highest use of these technologies followed by student production. Some differences in uses were found among the different video based technologies. CD-ROM's most prevalent use is to provide teachers with supplemental resources (88%). The next highest use of CD-ROM is for student production (28%). Satellite technology's second highest use (74%) is in the delivery of credit coursework. This is as expected since 80% of the survey respondents with satellite capability are involved in the state's Star Schools project which delivers credit courses to students. Satellite dishes were noted by several respondents as a means to open up student experiences:

> ***"We use the satellite classes extensively, both for the students and staff development. I think it opens up the curriculum, in the small schools, for those students who are academically beyond the scope of a one-two teacher high school. Technology has to be careful not to become a tumor in the educational process, but part of it."***

Also, as expected, schools reported that the highest use of digital and video cameras in schools is for student production. The second highest use (63%) of laserdisks is for post secondary education.

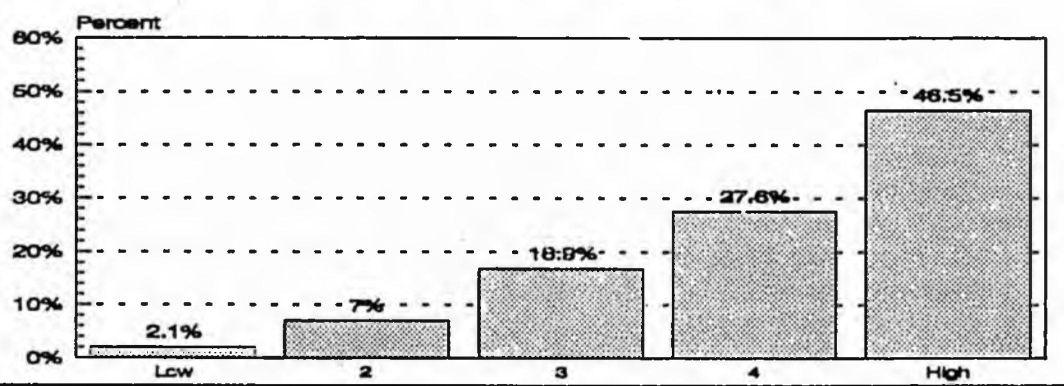
Comments from the survey indicated that some respondents feel a need for a statewide telecommunications network able to connect all schools with audio, video and data:

> ***"We need to move towards a statewide network able to access data, video conference and in general communicate. Resources and curriculum . . . need to be available to all Alaskan teachers and students. Just think about how great we can become if we share the best of what we all have to offer."***

Technology Priorities/Planning

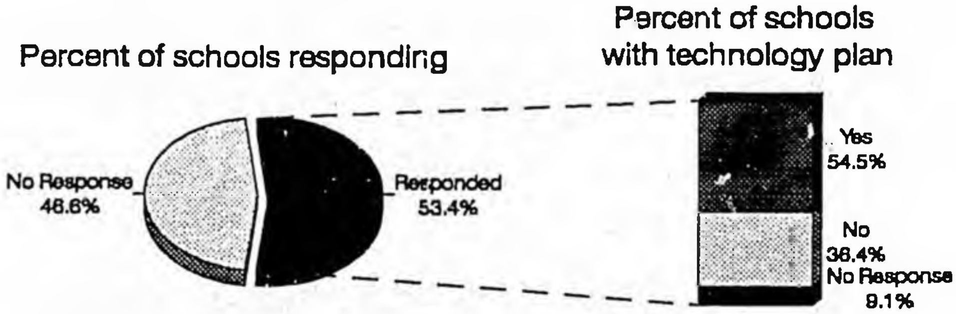
Principals were asked how high a priority instructional technology is for their schools on a scale of 1 to 5 with 5 being a high priority. The majority (74%) of respondents to the survey indicated that instructional technology is a medium high to high priority for their schools as seen in Figure 25. This correlates very strongly with the 78.7% of superintendents reporting a medium high to high priority for technology in their districts.

Figure 25
Schools priority for the use of instructional technology



When asked whether the schools had a technology plan, nearly 55% indicated they do have a plan. Figure 26 shows the percentage of schools responding to the survey and their response to this question.

Figure 26
Percent of responding schools with a technology plan



Some respondents noted that a comprehensive plan needs to be developed:

> ***"The use of instructional technology is on the rise in our district-though the district as a whole needs to develop a plan for total technological expenditures, training, monitoring, and coordination. Our students are very motivated by computer use and other technology. My staff needs the additional training required to use technology competently and instruct students effectively."***

Principals were also asked to indicate areas other than money in which their school needs assistance to effectively use instructional technology. Responses to this open ended question were analyzed and categorized. Overwhelmingly, the respondents indicated that training was the most serious need. Table 6 indicates the generalized responses and the times that comment was made.

Table 6
Technology Needs Other Than Funding

Comment	Number of Responses
Teacher training/staff development	124
Equipment/equipment upgrades	30
Personnel/support staff	17
Information on new software/media/technologies	15
Software/software upgrades	12
Time	11
District/building commitment or plan	10
Adequate funding/resources	10
Telephones/better telephone service	9
Technical support/maintenance	8
Building changes (space/wiring/rooms)	8
Building/district networking	7
Information/resources for implementation	6
Statewide network	4
State adopted technology curriculum	3
On-site technical assistance	3
Assistance in developing a plan	3
Integration into the curriculum	3

Table 6 (cont.)
Technology Nees Other Than Funding

Comment	Number of Responses
Parent training	2
Student training	2
innovative instructional approaches	2
Statewide technology plan	2
Evaluation of technology	2
Access to Internet and online resources	2

Comments in this section of the survey indicate that the biggest need in the schools is for training of teachers. As one respondent noted:

> ***"Just having computers, networks, labs, CD ROMS, etc. in a school is not enough. All staff members using this technology should receive enough inservice training during school hours to build confidence and make things "user friendly". If it is important enough to have this technology in the school, it is important enough to spend the money for proper inservicing This builds a positive attitude and promotes the full use of these new instructional tools."***

Further Comments

Finally, respondents were given an opportunity to make general comments. This section saw a variety of responses ranging from those discussing the survey itself to others noting the kinds of technologies currently used in the respondents schools. There were several redundancies with the question asking about needs other than funding. Where applicable, the responses were categorized. Table 7 lists the multiple responses found in this section and the number of incidents for each response.

Table 7
General Comments

Comment	Number of Responses
Need technology in the school	17
Plans to implement technology including new tech., Star Schools, personnel	14
Need teacher training	10
Description of current technologies used in the school	8
Information on school demographics that had a bearing on the survey	7
Need for a plan/work on a plan described	4
Need facility with technological capabilities	4
Funding	4
Need computer for each teacher	3
Multimedia interest	3
Star Schools use	3
Telecommunications interest	2
Lack of teacher/admin. understanding of technology	2
Rural Schools need technology	2
Need statewide integrated audio, video, data network	2
Comments about the survey	2

Survey Conclusions/Recommendations

Both the majority of superintendents and principals responding to the survey gave educational technology a high priority for their districts, but fewer indicated an articulated plan. Because research has shown that successful integration of technology depends on a careful plan, it is recommended that school districts place a priority on technology's role in the schools and develop a plan for its acquisition and implementation. A well developed plan includes not only a strategy for acquisition of technology, but also strategies for integration into the curriculum and training of staff. Planning must account for the long-term process of adoption of new technologies before integration into schools is successful.

Training is an issue that stands out in the survey as the number one need beyond funding. U.S. employers spend $50 billion a year to train employees often focusing on the means, both technological and human to enhance job productivity, yet school districts spend very little to train their employees in the new ways to make instruction better and more efficient use of technology. If teachers are to become leaders in the information age in a business that is basically an information business, they must be trained to use technology at least as effectively as employees in the private sector.

The survey pointed out that there is generally high levels of use by both teachers and students of the technologies now in place in Alaska schools. However, it also points out that schools are in need of upgraded equipment, newer equipment and training in order to effectively use technology to enhance learning. As one respondent stated:

> ***"There needs to be upgrading of all software and equipment. Without funds for this, it will not or cannot be done. You can only stretch money so far with the high cost of the technology. Would like to see up-to-date technology but beyond our local school budget."***

Studies have shown that people retain 10% of what they see, 20% of what they hear, 50% of what they see and hear, and 80% of what they see, hear and do. When applied to the technologies available, it is when you add the power of interactive technologies and those capable of allowing students to access and manipulate information and create meaningful products that you dramatically increase the ability of technology to enhance learning. As technology rapidly changes to an integration of voice, video and data, schools with more powerful computers connected to sophisticated networks will be positioned to take advantage of these resources.

The survey also indicates that there are wide disparities across the state and even within school districts in the numbers and kinds of technologies available for teacher and student use. Some schools have few technologies or predominantly older technologies for instructional use, while other schools have sophisticated labs, CD-ROM players, digitized cameras, telephones in every classroom or other technologies with which to work. As the resources that technology makes possible become more common and in demand in the classroom, educational equity will not be possible until schools are capitalized with the hardware necessary to access to those resources possible.

As with the hardware, access to basic infrastructures that make educational resources available to teachers and students on demand is widely disparate. Telephone lines, cable television or satellite dishes, and building networking make accessing online data networks, video resources, distance education resources, and much more possible. Again an equity issue is raised when some students and teachers have access to such materials and others do not. Equal educational opportunities cannot be really equal when some students are more prepared for life and work opportunities in the information age than others. In this regard there is a role for statewide networks or plans as this respondent notes:

> ***"An overall strategic plan for state-wide implementation of technology is in order, a wide area network connecting all schools and classrooms by modem, fax, voice and video to provide distance education, collaborative learning and exchange of powerful ideas, enough technology to make schools empowered for the 21st century."***

Public testimony

North Star Elementary
Kenai Peninsula Borough School District
P.O. Box 8629
Nikiski, Alaska 99635

Soaring into the future

Donna Peterson, Principal
Joan Kimball, Secretary

Phone: (907) 776-5575
Fax: (907) 776-8423

February 17, 1994

FEB 1 6 1994

Representative Kay Brown
Alaska State Legislature
State Capitol
Juneau, Alaska 99801-1182

Dear Representative Brown,

This letter is written in support of House Bill No. 106 - an Act establishing the Alaska education technology program.

A great deal of research and long-term awareness of educational technology has been a major effort at North Star Elementary in Nikiski, Alaska. Since our inception, seven years ago, North Star has listed technology as a top priority throughout the building. We believe that technology should be used as a "tool" in the learning and instructional environment. The potential of technology as a learning tool is largely untapped but, at least in our school, we have begun the quest for integrating technology and can provide evidence of its already successful impact on student learning.

In a transitional blend of old and new, North Star has three computer labs: 26 station Apple GS lab for computer assisted instruction; 26 station Mastery Development lab for monitoring student progress in math and keyboarding skills; and a 26 station MAC LC 520 (with built in CDs) for student production. Kindergarten through fourth graders spend 30 minutes each day in one of these labs, rotating through each on a regular basis depending on curriculum and project emphasis. Fifth and sixth graders spend 45 minutes each day in one of the labs. Classroom teachers collaborate once a week with the technology staff to plan program delivery and objectives for students.

The GS lab for computer assisted instruction was the first technological area developed at North Star and is still a strong component of our technology program. Dozens of software programs and accompanying documentation are available for classroom teachers to use in teaching and expanding their curriculum objectives. Color, graphics, sound, and animation enrich the presentation of knowledge.

Computer assisted instruction provides tireless patience and faster feedback for every user in an interactive format resembling the information world of today. An example of a program used in the GS lab is "Five Star Forecasting" where students (studying a weather unit in the classroom) practice forecasting weather based on computer simulations.

The Mastery Lab provides ongoing record keeping and monitoring of student progress in math skills and keyboarding skills. Networks of computers sharing information have allowed the individual assessment of over 300 students' math and keyboarding progress. Students are able to move forward at their own pace and are not shackled to the group movement through any given concept. Students, teachers and parents are provided with regular, detailed reports regarding individual progress. Each year, students in third through sixth grade receive approximately one month of instruction and practice in keyboarding skills. 10 words per minute is the minimum expectation for third graders. Basic math skills (addition, subtraction, multiplication, and division) are also monitored. Once these skills are mastered, upper elementary students move into the Mastery Math program - a program that tests, tracks, reports, and provides remediation tasks for students. Mastery math uses computers for these tasks so teacher can spend more time doing what they do best - instructing, evaluating, and motivating students. The Mastery Math curriculum covers topics ranging from numeration and place value through pre-algebra. These topics are divided into 205 separate objectives (52 units), each with its own worksheet and test questions. Students work at their own level. Our math computation skills on the Iowa Test of Basic Skills (I.T.B.S.) have increased dramatically since this lab has been in operation.

Our technology addition due to the Reduced Class Size Grant is the LC520 lab. This use of technology as a tool for accessing, processing, and communicating the vast amounts of information now available is one of our most exciting endeavors at North Star. Classroom teachers report gains in student writing ability - actual testing evidence will be available after the District Analytic Writing Exam in April. Students see only the abilities of these tools and are not hampered by the preconceptions many adults have. The use of word processors, art programs, and simulations are a start in providing the building blocks for those who will live and thrive in the 21st century.

While success and progress have been made at North Star, we would be the first to admit that technology integration is neither complete nor perfect. First of all, there are no timeouts while we learn, adapt and modify emerging technologies. Secondly, we are often in unchartered waters with no one to help us as we make mistakes and learn new strategies. Lastly, our student population is a moving target with constantly changing needs and abilities. The technology itself is evolving at a phenomenal rate. These all combine to create a challenge of often times heroic proportions given the short lived duration available for savoring successes. North Star is contributing to the development of an educational model that makes use of new technologies, while still maintaining the ideal and goal of providing the best possible education for every student.

With House Bill No. 106, the State of Alaska is sending the message that technology and education are important to the future of our children. Our school can be used as evidence that technology and education can work together well to increase student achievement and make a positive difference in student's lives. We would be happy to share further information with you as needed.

Sincerely,

Donna Peterson

Dr. Donna Peterson
Principal, North Star Elementary

Helen C. Barrett, Ph.D.
6426 Village Parkway
Anchorage, AK 99504
(907) 337-4676 • 786-1727

Electronic Learning Specialist
Alaska Society for Technology in Education
President 1992-93
University of Alaska Anchorage School of Education
Visiting Assistant Professor
Coordinator • Alternative Educational Services
& Distance Delivery

February 17, 1994

House Finance Committee
Alaska State Legislature

Below is my testimony today before the House Finance Committee on HB 106 that you requested to have faxed to you.

My name is Helen Barrett and I am currently the Past President of the Alaska Society for Technology in Education as well as the coordinator of Alternative Education/ Distance Delivery for the University of Alaska Anchorage School of Education. (Incidentally, I did my dissertation research on how adults teach themselves how to use personal computers while I was Staff Development Coordinator for the Fairbanks School District.) I have been supporting the Educational Technology Bill since its inception in 1990. In my opinion, time is running out for preparing Alaska's children for the next millennium.

The changes in the applications of technology to education have been dramatic over the past ten years but will pale in comparison to the changes anticipated in the next decade. With the projected implementation of the National Information Infrastructure initiative of the Clinton Administration, along with the Satellite Interconnect Project under study by the Hickel Administration, the impact of technology in education will expand dramatically, and our students and teachers need to be prepared to meet these challenges.

In the Spring of 1993, the Alaska Department of Education conducted a Technology Survey of Alaska Schools. One finding of that study was that, aside from the acquisition of new technology, the greatest need of Alaska schools related to technology was for training teachers and administrators to use what they already own. In a statewide Technology Leadership Retreat held last October, this need was further supported.

The University of Alaska is preparing to meet this need. In October, 1993, representatives from all three Schools of Education in the UA system met with President Komisar at the UA Teacher Education Colloquium. One of the recommendations of that meeting was to develop a plan to explore the broader availability of the UAS program in Educational Technology, currently only available on campus in Juneau. The Alternative Education program at UAA's School of Ed is prepared to develop a complementary Professional Development program in educational technology using a variety of open learning technologies for those teachers who simply want to increase their skills, without pursuing another degree. However, it should be noted that <u>only</u> the School of Education in Juneau has a permanent faculty position dedicated solely to Educational Technology.

The Ed Tech Bill would keep Alaska on a par with many other states' initiative toward funding educational technology. In the last year, I have been to several national and international technology conferences, and consulted with school districts in other states. It has become obvious to me that Alaska has lost the advantage we had in the early 80s related to educational technology.

There are many examples in other states where classrooms have been transformed, teachers energized, and students empowered by appropriate uses of educational technology. We need to research and publicize exemplary programs throughout our own state.

Some scholars say we have gone past the computer-based Information Age and are now entering the Communication Age, where we will find computer technology merged with television and the telephone. If the pace of change bewilders many adults, think how much we shortchange our students if we do not provide an educational system that allows them to learn using the economic survival tools of the future. To quote David Thornburg, are we preparing our students for their future, or for our past?

Thank you.

Postscript

After listening to the rest of the testimony, I have a few more comments.

There are two main methods for funding educational technology in our state: through capital dollars when facilities are built, and through operating funds, for "older" schools. This funding method has created gross inequities between schools throughout the urban areas of the state. Even in schools built since the early 80's, there is no capital funding to update equipment that is obsolete. This funding method essentially amortizes electronic equipment, with a seven-to-ten year life span, over the 30-year life span of "bricks and mortar". Furthermore, a majority of teachers received their teacher certification prior to the more recent technological developments for education.

There were two components needed in an Educational Technology development program: technology for schools and staff development for teachers and administrators. Increased funding for technology without planning and training would be wasteful of the resources. Increased funding for training without classroom-based equipment reduces teachers' motivation to learn as well as the effectiveness of the training program. Both components of a technology implementation program are essential, much as having a good instructor, an instrument, and time to practice are necessary components in learning how to play a musical instrument.

Technology has, and will, play a major role in changing the learning environment in schools: it is virtually the "Trojan Horse" of restructuring. The key to change is not only through new tools but also through a new vision and a new definition of learning, facilitated through training and development of all school staff members. Such a program should be multi-faceted--both in using technology to improve learner productivity, and in new models of teaching and learning in the classroom.

I also served with Representative Brown on the Alaska 2000 Technology Committee and one of our recommendations that was forwarded to the State Board of Education was for a technology competency requirement for teacher recertification. We have the technology and the expertise in this state to implement that requirement, if we only had the mandate and the resources.

It should also be noted that there is federal legislation that has recently passed. Below is a news item that I recently pulled off the Internet:

> Subject: Senate Passes Goals 2000: Educate America Act
> From: D. Bybee at ISTE USA National Office
>
> On February 8, 1994, the US Senate passed its education improvement framework legislation called "Goals 2000: Educate America Act". The Act was previously passed by the US House Of Representatives and it now goes to the conference committee which will fashion the final bill from the House and Senate versions.
>
> The Senate version includes the provisions for an Office of Educational Technology and guidelines for State Educational Technology Planning. Both provisions are funded in THIS FISCAL YEAR's budget. Therefore, if the conference committee keeps these Senate Bill provisions, we will have a Federal Office of Educational Technology in the Department of Education and it should develop implementing guidelines and release State Planning funds within a few months.
>
> The passage of "Goals 2000: Educate America" begins a national process of systemic school improvement. Its inclusion of specific provisions which encourage uses of technology to facilitate school improvement is a major milestone in the history of educational technology in America.
>
> Our next legislative milestone will be the PASSAGE OF SENATE BILL 1040 -- "Technology for Education Act". With technology in the framework, it is absolutely essential to have specific legislation to support its potential contributions to school improvement. S.1040 is the programmatic substance that must be built onto the framework.

University of Alaska Southeast
Juneau • Ketchikan • Sitka
School of Education, Liberal Arts and Science
Juneau Campus

March 10, 1993

To: Representative Kay Brown

From: Jason Ohler
Director, Educational Technology Program
University of Alaska Southeast

Re: HB 106, Education Technology and HB 107, Bonds for Educational Technology

Dear Representative Brown:

For seven years I have been directing a program whose primary mission is to empower teachers and students with technology in effective, creative, educationally sound, and culturally appropriate ways. In seven years I have watched as a fascination with Apple IIe computers and VHS players on the part of a few educators has grown into a desire by many to use advanced computers, telecommunications, multi-media, and other technologies to make education more meaningful, relevant, and responsive to the age in which they live.

Seven years ago Alaska had an edge in educational technology. It is my observation that Alaska has lost that edge and that teachers are frustrated with the lack of technology that they need in order to teach the skills that they know their students need to enter today's work force. It is also my observation that most educators believe that technological proficiency needs to be a basic component of a well-rounded education and that the tools needed to make this happen are, by and large, simply not there.

Your proposal offers a real chance to regain lost time and lost ground. It offers a real opportunity not only to replenish classrooms with much

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needed learning technology, but also to draw educators into the process of planning for technology and examining the best ways to use it to serve their students, school districts, and ultimately the public. I commend you on your foresight in this area and urge legislators to support your proposal.

Please let me know if I can be of further assistance.

Jason Ohler

Jason Ohler
Director, Educational Technology Program
University of Alaska Southeast
Phone: 463-5685, Fax: 586-1691, UACN: JFJBO

I am currently the Past President of the Alaska Society for Technology in Education as well as the coordinator of Alternative Education for the University of Alaska Anchorage School of Education. I'd like to express a few opinions about the role of technology in restructuring our state's schools and the effort to prepare Alaska's children for the next millennium. I have been supporting the Educational Technology Bill since its inception in 1990. Time is running out for Alaska's children.

The changes in the applications of technology to education have been dramatic over the past ten years but will pale in comparison to the changes anticipated in the next decade. With the projected implementation of the National Information Infrastructure initiative of the Clinton Administration, along with the Satellite Interconnect Project under study by the Hickel Administration, the impact of technology in education will expand dramatically, and our students and teachers need to be prepared to meet these challenges.

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The Ed Tech Bill could move Alaska into the forefront of many other states' initiative toward funding educational technology. In the last year, I have been to several national and international technology conferences, and worked with school districts in other states. It has become obvious to me that Alaska has lost the advantage we had in the early 80s related to educational technology.

There are many examples in other states where classrooms have been transformed, teachers energized, and students empowered by appropriate uses of educational technology. **We need to research and publicize exemplary programs throughout our own state.**

Some scholars say we have gone past the computer-based Information Age and are now in the Communication Age, where we will find computer technology merged with television and the telephone. If the pace of change bewilders many adults, think how much we shortchange our students if we do not provide an educational system that allows them to learn using the economic survival tools of the future. To quote David Thornburg, are we preparing our students for their future, or for our past?

Thank you.

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Testimony of Sally Rue on H.B. 106
House Finance Committee
February 17, 1994

My name is Sally Rue. I live in Juneau, and am a member of the Juneau Board of Education, but I am here today testifying as an individual, and, most importantly, as the parent of two schoolchildren. I appreciate this opportunity to testify on H.B. 106.

As you may know, Juneau voters passed a $1.9 million bond proposition last October to take the first step in funding technology in our schools. Many parents and other community members worked hard to educate Juneau voters about what it would provide and why it was good for kids, and the voters responded with their support (it won with 66% of the vote).

I support H.B. 106 and its companion H.B. 107 which would provide funding. I think it is critical that the children we are educating today graduate from high school ready to work, ready to go on to further study, ready to be productive members of this changing world of ours, in which being able to manage and effectively use the massive amount of information which now exists is mandatory.

We hear almost on a daily basis about this nation's need to be internationally competitive, to produce educated and skilled workers ready for the workplace of today and tomorrow. We hear that the jobs our children have in forty years don't even exist now, that tomorrow's workers must be flexible, creative, and lifelong learners who will change careers a number of times in their working life. We hear that workplaces must be efficient and productive.

All this is true and a good reason to begin integrating technology into our schools now.

But the most important reason to me is that it can help kids learn better and give teachers an effective tool to help meet the diverse needs of children within the classroom. Technology can be used in an almost endless variety of ways at all levels to improve teaching and learning in everything from the most basic skills to the most abstract conceptual thinking.

Let me just mention some of the benefits I see resulting from greater access to technology in our schools:

*Kids have different learning styles; some learn easily from traditional teaching methods, but many do not. Computer technology can be used by teachers to reach kids in more ways.

*Computers and other educational technology often provide tremendous motivation, especially for many kids who don't like school much (and often can make even basic practice drills rewarding).

*Within one classroom, the developmental and ability level of students can vary by 3 to 5 years; technology gives teachers one more tool to provide challenges at all levels.

*Some studies indicate that technology can be particularly effective in meeting the needs of at-risk students. In some cases reduced drop-out rates have been attributed to the introduction of technology into the classrooms.

*Technology can be valuable in integrating students with disabilities into our classrooms, and offers teachers another tool in meeting their unique needs.

*At the primary level, computers can be a powerful tool for beginning readers and writers. Kids can often accomplish writing with a computer that they wouldn't be able to do by hand because of still-developing motor skills.

*At the middle school level, technology provides access to resources and communications that bring real world issues into the classroom, enabling students to make connections between academic math or science studies and real world problem-solving.

*At the upper levels, technology can not only provide access to a multitude of resources schools could never afford to individually own, but can also provide learning tools which go way beyond what traditional methods can provide (two examples I've seen: an interactive physics program on elasticity in which the student can manipulate the elements to see how elasticity works and what happens when a factor is changed; a supply and demand curve and how different conditions change it). These are tools which can clearly help students grasp abstract concepts and apply them to the real world.

*At all levels, classroom computers can bring immediate access to a vast array of resource materials; when a question comes up, teachers and students can pursue the information while interest is high instead of having to wait for the weekly library period.

In addition to economic competitiveness and more effective learning, a final reason to put technology in our schools is equity. Many children have some degree of access to technology at home, but for many, school will be their only exposure, and it is vital that all children are afforded this opportunity.

I see H.B. 106 as an important step in assisting school districts across the state to acquire the technology needed to bring our schools into the twenty-first century. This bill takes into account the fact that districts have varying capacities for local bonding, and requires local participation, which I support.

I also like the process laid out in the bill: it contains three components which I believe are critical to any district's successful use of technology: 1) it ties technology to the district's educational goals, 2) it provides for comprehensive planning of technology and how it will be used to achieve these goals, and 3) it provides for teacher training. The provision of some general fund monies for planning and teacher training is particularly important because these are non-bondable costs, but are critical to achieving the benefits I discussed above.

I hope the Committee will support this bill, including adequate funding. Even for districts like Juneau that have taken the first step on their own, it would be of tremendous assistance in continuing to work toward fully integrating educational technology into our schools.

Thank you for your time and consideration.