



CONNECTION

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OF HIGHER EDUCATION AND ECONOMIC DEVELOPMENT

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TELECOMMUNICATIONS

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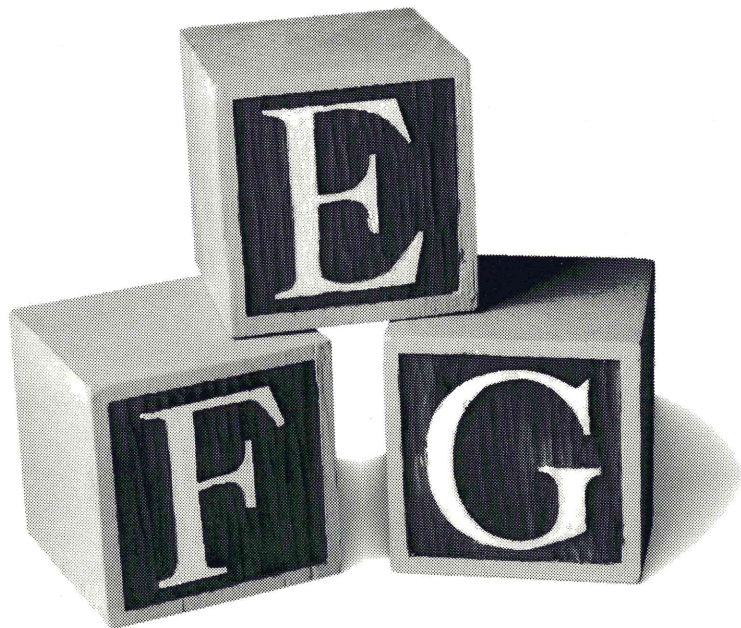
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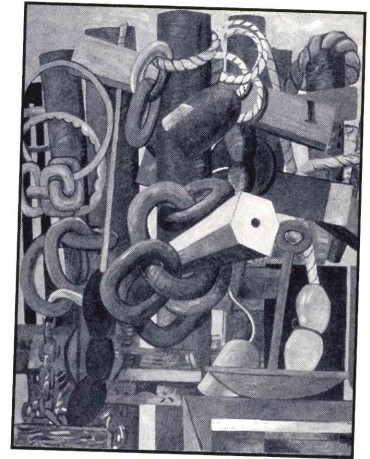


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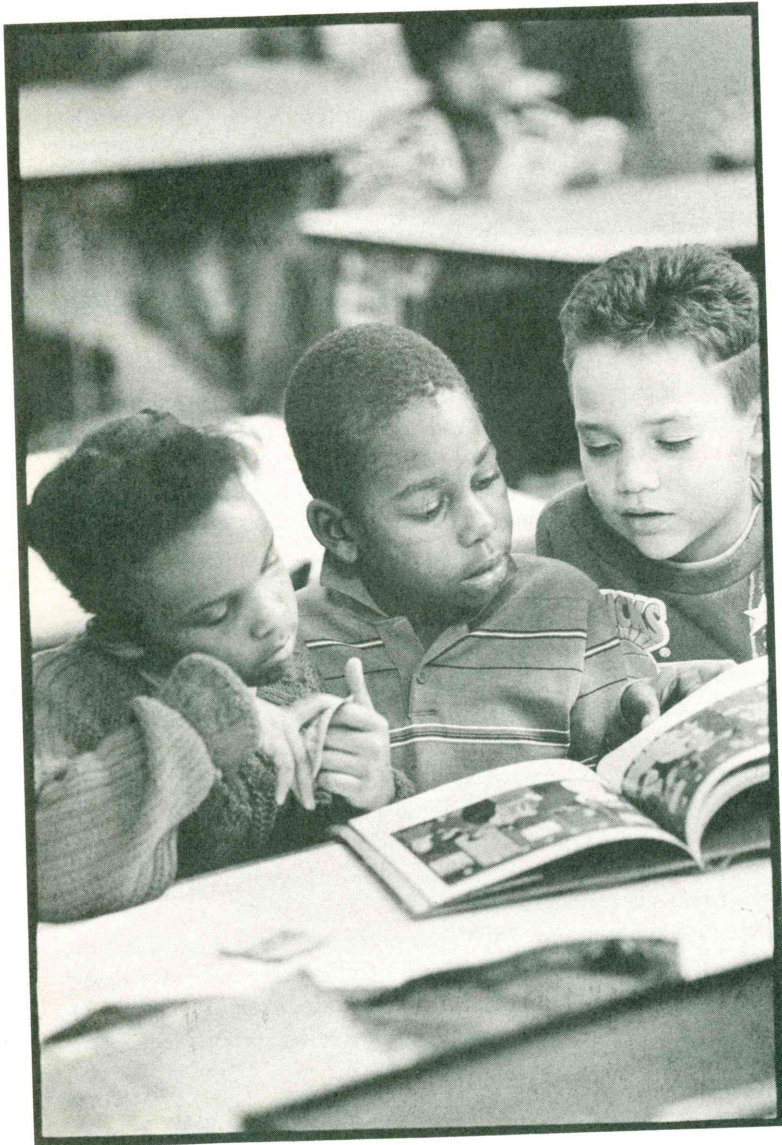
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E D I T O R ' S M E M O

Some skepticism seemed in order as we began planning for this issue of CONNECTION's "Cover Stories." If the telecommunications industry was such hot stuff, why were telephone companies churning out pink slips as fast as monthly bills? Wasn't the growing interest in on-line discussion groups a bit reminiscent of the CB radio craze? Were cellular pagers anything more than high-tech leashes for errant employees? And didn't detractors of "distance learning" have a valid argument that education was one of those fields where the human touch was absolutely essential?

As our distinguished contributors began sending in their manuscripts, however, much of the skepticism dissipated. Taken together, their essays paint the picture of a telecommunications revolution promising to liberate students, workers and others from the constraints of time and space, while permitting unprecedented interconnection and collaboration.

Congressman Edward J. Markey of Massachusetts writes of a world "where we will be able to work at home or at the beach or on the road, using super-intelligent videoconferencing equipment; where our kids will be able to tap into a world of knowledge available at their fingertips; where our doctors can make housecalls without ever leaving the office; where space and time cease to be deterrents to doing business or earning a degree or even 'visiting' loved ones."

Former U.S. Surgeon General C. Everett Koop recounts how a wounded American soldier in Somalia received triage treatment from an expert doctor thousands of miles away in the United States, thanks to a sophisticated camera in the helmet of a medical corpsman at the soldier's side.

Nathan Felde, executive director of video information service development at NYNEX, explores how networks can deliver the benefits of "being there" without the costs. Felde writes that telecommunications technologies can "reduce the occurrence and cost of ineffective teaching minutes and redundancies" and more efficiently deliver "the experiences of epiphany and enlightenment that last a lifetime."

To be sure, our commentators are not Pollyannas. Markey warns against the creation of "information apartheid — a nation of information haves and have-nots." Robert F. Tinker, chief science officer at TERC, a Cambridge, Mass., nonprofit educational research outfit, compares today's approaches to educational computer networking to the early view of steam engines merely as instruments to help sailing ships move out of calm seas. "The cutting-edge inventors of the time could not see that steam would lead to larger, all-steel boats that would not need sails," writes Tinker. "Many uses of computer networking are steam sailboats — slightly better ways of doing what educators have always done, but within the old paradigm, in which an authority conveys knowledge and students passively take it in."

All in all, our "Cover Stories" offer an even-handed look at New England's vibrant telecommunications industry and the critical role of telecommunications technologies in education and regional commerce.

A short piece in the July/August 1994 issue of *Trusteeship*, the journal of the Association of Governing Boards of Universities and Colleges, praised the lineup of articles in the recent Spring 1994 issue of CONNECTION, focusing on higher education finance, as "practical, impressive and worth reading." We hope the same can be said of this issue.

* * * * *

CONNECTION, itself, recently took a few baby steps into the telecommunications age. With the Spring 1994 issue, we began making short abstracts of articles available on the Internet. Bates College Admissions Dean William C. Hiss's exploration of financial aid and Associate Editor Julie Lanza's examination of the federal government's direct lending program were disseminated in full on the Internet by the National Association of Student Financial Aid Administrators. We reached a lot of new readers and helped save a few trees.

John O. Harney is the editor of CONNECTION.

Big Blue on Campus

Remember when "corporate classrooms" were going to make colleges and universities obsolete? In the late 1970s, entrepreneur An Wang set up the master's degree-granting Wang Institute of Graduate Studies in Tyngsborough, Mass. IBM operated a state-of-the-art educational institute in Thornwood, N.Y. But when the high-tech boom fizzled in the late 1980s, most of the would-be Corporate Ivies found education and training too expensive — and too complex — to deliver on their own.

The clearest signal yet that the pendulum is swinging back to academia as the preferred provider of higher education: A new, multimillion-dollar agreement in which a consortium of Vermont's six public higher education institutions will manage all employee education and training for IBM Burlington, the state's largest private employer.

For a decade, Vermont Technical College (VTC) has tailored certain degree programs to IBM, even offering an associate degree in semiconductor processing. But the new initiative is unprecedented in scope.

Under the pact, which takes effect in September, the institutions will assess IBM's education and training needs on an ongoing basis, develop curriculum, select course providers (including out-of-state institutions) and deliver some courses directly. Eighteen consortium staffers will work at the IBM plant as a sort of surrogate training department.

"In the early 1980s, companies viewed higher education institutions as Ivory Towers," says VTC President Robert G. Clarke, a key architect of the initiative. "But we've demonstrated over the past decade that we're very knowledgeable of their needs. IBM recognized that they have computer and manufacturing expertise, and we have educational expertise."

Female Firsts at Dartmouth

Women have arrived at Dartmouth College. Twenty-two years after admitting its first female students, Dartmouth for the first time offered fall-term, freshman admission to more women than men. The margin was merely two students, but the relative parity is significant: In 1987,

women constituted only 38 percent of Dartmouth's first-year students.

The Hanover, N.H. university reached another milestone in June, when it awarded science degrees to 21 percent of female graduates — surpassing the 17 percent goal laid out in the fall of 1990, when Dartmouth established its Women in Science Project. The project provides women with internships, tutors and other support services to encourage them to pursue science. It was initiated in response to the previous spring's dismal rate of science degrees among female students. That year, just 12 percent of women graduates earned science degrees — the lowest rate since Dartmouth graduated its first coeducational class in 1976. The highest rate was recorded in 1983, when 24 percent of women took science degrees.

No-Frills Nobels

Underfunded scientists might get some inspiration from the story of former University of Massachusetts astrophysicist Joseph H. Taylor and his former graduate student Russell A. Hulse.

The \$30,000 National Science Foundation grant that the two were awarded 20 years ago while at UMass was small even by 1974 standards: just enough for a high-speed minicomputer and plane tickets to Arecibo, Puerto Rico, site of a giant radio telescope.

But the duo's work resulted in the discovery of binary pulsars, and eventually led to confirmation of Einstein's General Theory of Relativity. In 1993, Taylor and Hulse won the Nobel Prize in physics.

Hulse, who along with Taylor is now at Princeton University, recalls the lean days in Amherst: "My whole recollection of doing work at UMass is very much tied up with government surplus equipment." The reams of magnetic tape they used were stamped, "REJECT." But the innovation demanded by such working conditions, says Hulse, made the results most gratifying.

Bolstering City Schools

Ten independent colleges and hospitals headquartered in Providence have announced a range of programs to help the city's public schools.

The institutions — including Providence College, the Rhode Island School of Design, Brown University and Johnson & Wales University — have been meeting since September 1993 in a coalition called "Health and Education Leadership for Providence." In the spring, the coalition unveiled an array of programs, including professional development institutes for teachers and administrators at the city's three comprehensive high schools; a telecommunications link between city schools and NASA's educational network; student-mentoring services; training for health careers; and a mobile health care team that will travel to city schools to provide immunizations, lead screening and other services. The coalition also plans to create a commission of college and hospital officials to help bring new business into Providence and the state.

Similar partnerships are in place in other New England cities. Boston business, education and labor leaders recently approved the third version of the Boston Compact, the trailblazing agreement in which Hub businesses pledge to hire more graduates of city schools in exchange for promises of higher test scores and lower dropout rates. New Haven and Yale officials in July unveiled a "Family Campus" program, in which public schools will be used as neighborhood centers offering students and their families services such as health care, day care and job training.

On the Road

When officials at Maine Education Services (MES) recently decided to expand college counseling services, they knew they would have to take to the road. And so the nonprofit agency created in 1988 to offer higher education loans to Maine students launched HEROIC, the Higher Education Resources Outreach Information Center.

HEROIC — a 34-foot, bright purple Winnebago — carries a desktop computer, five laptop computers, video equipment, scores of higher education directories and two credentialed guidance counselors into the most rural areas of Maine to convince high school students that college is within reach.

It is a truly heroic mission in a state where many young people rule out post-



secondary education as too expensive, too difficult or too far away. Maine's college participation rate historically has been among the lowest in the country. In a 1993 MES survey, only 56 percent of high school seniors said they "intended" to pursue higher education.

The search for college material has brought HEROIC to high schools, Boy Scout jamborees and other obvious spots for young people. Now, says MES Clinical Director William H. Stone Jr., more stops are planned at shopping malls, businesses and other hangouts of the more elusive adult learner.

Direct Lending, Part II

At least 40 more New England institutions will join the direct lending juggernaut in 1995, more than tripling the number involved in this fall's kickoff. By academic year 1995-96, 40 percent of the federally guaranteed student loan volume nationwide will be transferred to direct lending, the program that makes loans available to students directly from the U.S. Treasury.

The direct lending program eventually will eliminate private lenders, state guaranty agencies and the secondary loan market from the federal student loan system.

For now, however, New England guaranty agencies say the business they are losing to direct lending is being offset by increased student borrowing and new markets. American Student Assistance (ASA), the Massachusetts-based guaranty agency, will lose at least 23 Massachusetts institutions to direct lending in the second phase. Those institutions — along with Bay State colleges participating in the first year of the program — represent about 19 percent of the agency's pre-direct lending loan volume. But the rise in per-student borrowing, along with ASA's expansion into other states

and other types of loans (such as loans to law students) will help make up for the direct lending loss, according to ASA President Daniel S. Cheever Jr.

Larger student loans are also buoying the Rhode Island Higher Education Assistance Authority. The University of Rhode Island's participation in direct lending's second phase will mean a total loss of 22 percent of the authority's fiscal 1994 volume. But so far, the total value of loans guaranteed continues to rise, according to acting Executive Director Russell Woodward. In fiscal 1993, the authority guaranteed about \$65 million in student loans. The total in fiscal 1994: about \$120 million.

Private Giving Inches Up

Increases in private contributions to higher education failed to keep pace with the steady rise in college budgets again last year. The total value of donations to the nation's colleges and universities increased to \$11.2 billion in academic year 1992-93, a one-year increase of just 1.5 percent after inflation, according to the annual survey of the Council for Aid to Education. Meanwhile, educational expenditures climbed 3 percent.

In New England, private gifts to higher education totaled \$910 million.

Nationally, the 1992-93 percentage increase in total donations for capital purposes — to pay for future construction, build institutional endowment or retire debt — was almost twice the rate of increase in gifts made to pay for current operations. In addition, deferred gifts rose to \$669 million in 1992-93. Deferred gifts, which are typically distributed upon the death of a donor, remain a "growth area" for college development efforts, according to the survey.

Fretting about SPREs

The federal government's call for State Postsecondary Review Entities (SPREs) may spark a contentious showdown between the U.S. Department of Education and independent institutions of higher education, with states caught in the middle.

Responding to harsh complaints about high student loan default rates, the feder-

al government established SPREs at the state level to review schools and colleges that the Education Department says fail in their responsibilities to students or to the federal loan system. But many in higher education worry that SPREs could threaten the independence of private institutions.

"Triggered" institutions will be reviewed by their state's SPRE under broad standards mandated by federal authorities but made specific by each state. The standards will measure an institution's "performance" in various areas, from financial stability to graduates' job placement rate.

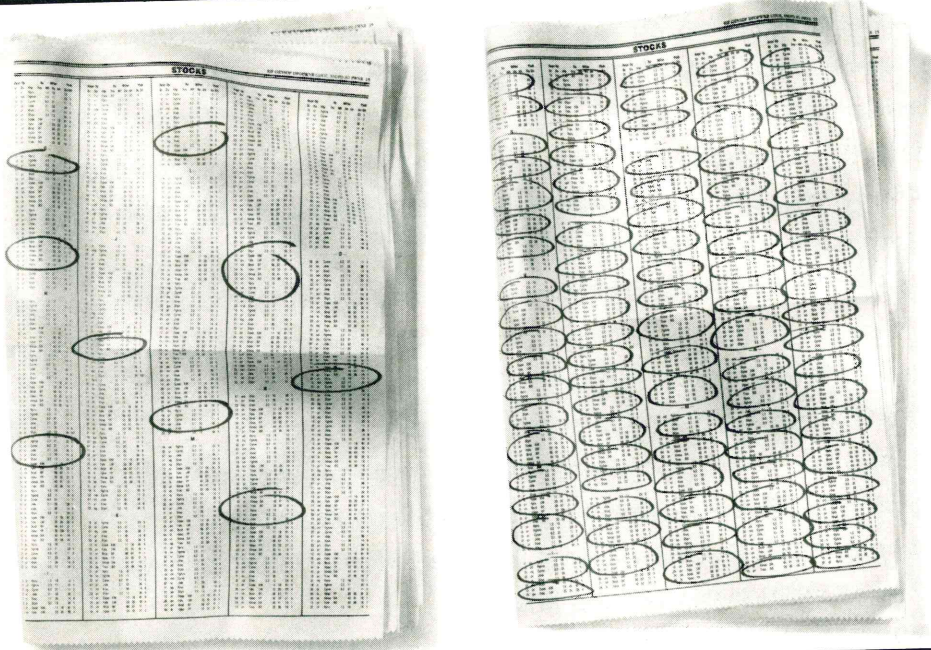
State officials, already dealing with other federal reporting mandates, are wary. Cynthia V. L. Ward, associate commissioner of the Rhode Island Board of Governors of Higher Education, which will serve as the Ocean State's SPRE, says Rhode Island sought to develop the "least onerous" standards possible. "We don't want to see a whole bureaucracy grow up at the institutional level just to deal with the SPRE," Ward explains.

The SPRE regulations are intended to punish institutions which have been accused of enrolling low-income students just to get the federal grants and loans the students qualify for, and then failing to give the students the academic support they need to graduate or the information they need to understand their debt obligations. Most offenders have been proprietary schools. But such schools are rare in New England. Says Ward: "It's a huge program to go after just a few schools."

Cibes Appointed

The Connecticut State University system's nationwide search for a new president ended in Hartford. In June, CSU trustees named former state legislator, educator and budget director William Cibes Jr. to replace retiring President Dallas K. Beal as head of the four-campus system. Cibes has served as Gov. Lowell P. Weicker's state budget director since 1990. Prior to that, he chaired the Connecticut General Assembly's Finance, Bonding and Revenue Committee and was on the faculty of Connecticut College. He also served as a delegate to the New England Board of Higher Education.

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- Average federal taxes paid by New Englanders, 1993: **\$5,318**
- Per-capita federal spending in New England, including grants, wages, direct payments and procurement: **\$5,226**
- Number of members of the U.S. House Committee on Science, Space and Technology: **55**
- Number who are from New England: **2**
- New England's share of research and development expenditures at all U.S. doctorate-granting institutions in fiscal 1992: **8.7%**
- Estimated share of federal research and development budget devoted to defense in fiscal 1994: **59%**
- Estimated share devoted to health: **15%**
- Average hospital bill for treating a child wounded by gunfire, not counting physician's fees and lifetime rehabilitation: **\$14,434**
- Number of hospital expansions among the 25 largest construction projects underway in Massachusetts during summer 1994: **7**
- Percentage of U.S. 13-year-olds who spend four or more hours a week doing math homework: **15%**
- Percentage of 13-year-olds from the former Soviet Union who do: **33%**
- Percentage of U.S. three- to five-year-old children whose parents read to them every day: **53%**
- Percentage among households where parents have less than a high school education: **35%**
- Increase in number of U.S. adults who took the General Educational Development (GED) Tests between 1992 and 1993: **4%**
- Increase in number of GED test-takers in Vermont: **10%**
- Number of New England four-year colleges where students may be admitted without taking Scholastic Assessment Test (SATs) or American College Testing Program (ACT) exams: **14**
- Change in undergraduate enrollment at New England four-year institutions, 1980 to 1992: **-3%**
- Change in enrollment at New England two-year institutions during the same period: **+51%**
- Percentage of full-time faculty at New England's public four-year institutions who are African-American: **2.2%**
- Percentage who are Hispanic: **1.2%**
- Percentage who are Native American: **0.2%**
- Women as a percentage of poor adults in families in Greater Boston: **76%**
- Share of foundation dollars in Greater Boston directed to programs that target women: **6%**
- Percentage of Harvard University's Class of 1993 who planned to go on to graduate school immediately: **32%**
- Percentage of employee suggestions for improving production of cars that are accepted by Toyota Motor Manufacturing: **98%**
- Percentage of U.S. executives who say companies do more to encourage innovative thinking on the job than they did five years earlier: **94%**
- Percentage of U.S. workers who receive some type of employer support for adult education: **30%**
- Percentage of time U.S. executives say they "waste" dealing with company politics: **20%**
- Percentage of small business people who rank "failures of public education" first among reasons businesses have difficulty finding qualified workers: **27%**
- Percentage who rank "insufficient funding of education" first: **6%**
- Number of *Fortune* 500 companies based in New England in 1993: **45**
- Number 10 years earlier: **54**

Sources: 1,2 Northeast Midwest Institute; 3,4 U.S. House Committee on Science, Space and Technology; 5,6,7 National Science Foundation; 8 National Association of Children's Hospitals and Related Institutions; 9 *Boston Business Journal*; 10,11 U.S. Department of Education; 12,13 National Education Goals Panel; 14,15 American Council on Education; 16 National Center for Fair & Open Testing; 17,18 The College Board; 19,20,21 Southern Regional Education Board; 22,23 The Lincoln Filene Center, Tufts University; 24 Harvard University; 25 The Planning Forum; 26 Robert Half International Inc.; 27 National Education Goals Panel; 28 Accountemps; 29,30 *Nation's Business*; 31,32 *Fortune*.

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TOWER OF BABEL OR TOWERING OPPORTUNITY?

JOHN C. HOY

Assessing and responding to the impact of telecommunications and distance learning on higher education is among the most compelling of the New England Board of Higher Education's priorities.

As billions of dollars are invested in how we will entertain, report upon, market, inform, analyze and educate the world, the possibility of a surfeit of educational programming options creates a dilemma. On the one hand, educational programming is clearly preferable to most of the competing uses of the airwaves and the "broadband." On the other hand, faculty and students already must take care to navigate through the flotsam, jetsam and other debris littering the sea of information. The very real prospect of a glut of undifferentiated academic offerings is at hand.

Following a decade of keen interest and a year of study, NEBHE in July 1994 established a Regional Commission on Telecommunications and Distance Learning co-chaired by two pioneers in the field: Vermont State Colleges Chancellor Charles I. Bunting and University of Maine at Augusta President George P. Connick.

The work of the commission is directed by NEBHE Senior Fellow Edmund T. Cranch, the former president of Worcester Polytechnic Institute and one-time engineering dean at Cornell University.

The commission's charge is to clarify the challenges and opportunities this dynamic field presents to New England. More specifically, the commission will grapple with the following issues:

- Leadership in the telecommunications era will require regional insight. As usual, the six New England states — and the region's 250-plus colleges and universities — are tempted to go it alone in resolving the significant regulatory and academic problems constraining educational programming across state lines. The commission will examine ways that New England education, government and business leadership can cooperate to ensure that the *region* leads in telecommunications and distance learning.

- Though rhetoric about telecommunications is ubiquitous, there is a dearth of public information on college-level educational telecommunications programs. New England needs to take inventory. The commission will undertake an assessment of planned and established telecommunications and distance learning operations at New England public and independent colleges and universities, as well as an examination of state-level telecommunications policy.

- Perhaps no recent development in higher education opens the door for interinstitutional cooperation more widely than advances in telecommunications technologies. Here is where New England institutions face the choice of going it alone and creating a Tower of Babel or working together to capitalize on a towering regional opportunity. The commission will ana-

lyze the potential for collaboration among New England colleges and universities within and across state lines. Forms of collaboration may include sharing courses via telecommunications or jointly developing course content.

• New England is known around the world for the excellence of its higher education resources. But the region's thus far spotty involvement in educational telecommunications — combined with unresolved questions about how to evaluate the quality and effectiveness of distance education programs — is cause for concern. The commission will identify those factors that will lead to the emergence of qualitatively superior distance learning programs in New England.

• The role of higher education in creating, keeping and attracting firms on the cutting edge of telecommunications has not been explored. In keeping with NEBHE's longstanding interest in higher education's impact on regional economic development, the commission will evaluate the potential contributions of New England colleges and universities to the development of New England's telecommunications industry.

New England got its first wake-up call on telecommunications more than a decade ago. In 1983, a NEBHE report on the region's telecommunications capacity lamented, "A national assessment of outstanding instructional telecommunications systems in higher education describes 70 programs across the nation. However, not one program cited emanates from New England. There may be no other major aspect of academic endeavor in which this level of New England inadequacy could occur."

The report also noted, however, that while educational telecommunications presents both potential and peril, the potential for new opportunity is vastly more compelling, particularly for a region seemingly well-positioned to deliver knowledge to an increasingly knowledge-intensive regional and world economy.

"The continuing education of adults on campus and particularly at worksites throughout New England will occur rapidly during the balance of this decade," the report predicted. "The potential is immense for reaching new students hitherto ignored by higher education and updating the skills of engineers, physicians, lawyers, teachers and skilled working men and women throughout New England. For the New England Board of Higher Education, committed as it is to

improving the efficient use of New England's academic capabilities and the contribution of higher education to the regional economy, effective six-state telecommunications policy and collaboration must be a prime concern."

The NEBHE report also warned: "Decisions and actions must be informed by concern for the continuing development of individual institutions, mindful of the increasingly collaborative system of (public and private) higher education, which is emerging in the region. The network concept should aim to provide a national model of quality and accessibility for the people of a region whose very economy is intimately dependent upon their educational attainment."

In other words, brainpower was then and is now New England's primary natural resource. Collaboration in distance education programs will be a key tool in harnessing that power.

Moreover, it's useful to recognize the parallels between the promise of educational telecommunications and one of the nation's leading "lower-tech" cooperative programs. Since its establishment in 1957, NEBHE's Regional Student Program (RSP) has provided New England students with major savings on more than 115,000 tuition bills by enabling them to pay significantly reduced tuition at out-of-state public colleges and universities within the six-state region if they pursue certain specialized fields of study not offered by their home state's public institutions. The RSP also allows the states to avoid costly duplication of academic programs.

George Connick noted recently that telecommunications now presents the region with the opportunity to create a regional program exchange — involving both public and independent higher education institutions — to complement the Regional Student Program. NEBHE is encouraged that New England's

chancellors and state commissioners of higher education agree that the RSP should be the model for distance learning pilot programs designed to share academic resources across state boundaries.

In 1983, it was apparently deemed safe to temporarily ignore the warnings about New England's inadequate telecommunications capacity. Another wake-up call is now in order. This time, New England will either take heed or miss the boat.

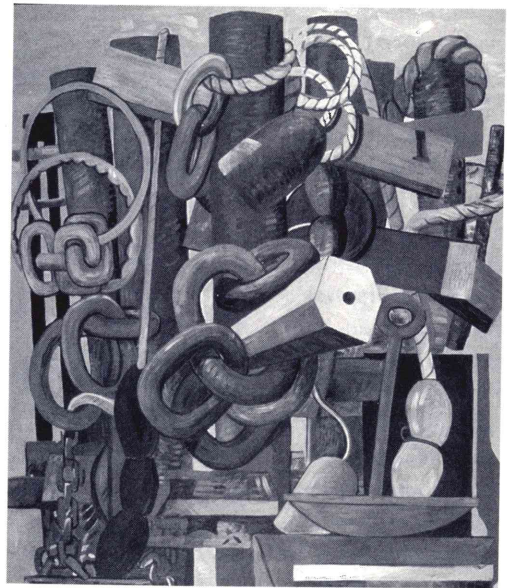
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John C. Hoy is the president of NEBHE and publisher of CONNECTION.

"We are fast approaching a point where the lack of strong New England regional policy focused on educational telecommunications will constitute shirked responsibility as well as lost opportunity. As is so often the case in New England higher education, the very diversity of institutional efforts serves as both the obstacle to regional policy development as well as the unifying force for concerted action."

**— Higher Education
Telecommunications:
A New England
Policy Imperative,
New England Board of
Higher Education,
March 1983**

NEW ENGLAND TELECOMMUNICATIONS



LISTEN UP, LUDDITES! The convergence of telephone, video and computer technologies is changing the world, and New England had better be ready. Digitally switched, broadband telecommunications systems capable of carrying two-way interactive voice, video, text and data will transform the way we work, perhaps the way we spend our leisure time — and certainly the way we teach and learn.

The telecommunications revolution is sufficiently advanced that basic voice communication has earned the humbling acronym, POTS for Plain Old Telephone Service. It's the *new* services — from electronic mail to interactive television — that enable an estimated 8 million Americans to “telecommute” to work and offer the promise of saving lives by providing live hookups between rural doctors and specialists working hundreds of miles away. And it's the new services that will fundamentally change education.

The revolution is good news for that odd grouping of high-tech manufacturers, cable television providers, telephone companies, satellite operators and others who make up New England's telecommunications industry. Though thousands of former phone company employees laid off in the interest of "productivity" would surely disagree, telecommunications is a burgeoning industry — worth about \$10 billion a year in Massachusetts alone, according to a study prepared for Gov. William F. Weld. Small manufacturers of computer networking hardware and videoconferencing equipment dot the regional landscape. In the Bay State, industry leaders have formed a telecommunications council, and Weld has appointed a telecommunications specialist to his administration.

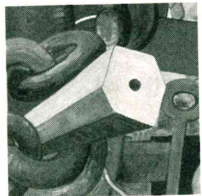


The industry is expected to undergo a metamorphosis as the Clinton administration relaxes 60-year old federal communications regulations in its effort to spur private construction of the National Information Infrastructure (NII) — better known as the Information Superhighway. Already, the traditional business lines are blurring. New England cable television providers are offering customers access to the Internet, the giant computer network usually accessed over phone lines. Phone companies want a piece of the market for movies-on-demand.

The future of telecommunications technologies in education, meanwhile, is filled with promise and fraught with challenges.

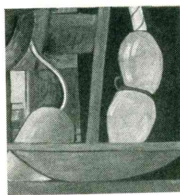
Enchanted by the image of students tapping into the Library of Congress or collaborating on, say, environmental research with Russian tele-penpals, educators and others hail telecommunications as a key to education reform at the K-12 level, even as a great leveler for rich and poor school districts. According to current estimates, however, only one in five U.S. classrooms has a telephone line and fewer still have the modems that permit transfer of data from one computer to another over phone lines. Moreover, some telephone and cable companies have balked at the idea of providing schools with free or inexpensive hookups and low service charges.

At New England's higher education institutions, the telecommunications revolution finds both patriots and loyalists. Many of the region's scholars navigate the Internet with ease. Most major libraries feature on-line catalogs and texts, and administrative functions have been automated to the point where admissions offices may receive applications on specially formatted computer disks. But the chief impact of telecommunications on higher education will be felt in the "classroom."



Since 1993, Northeastern University has awarded 230 complete master's degrees to students who have done all their work via television. The Collaboration for Interactive Visual Distance Learning, which includes Boston University, the Massachusetts Institute of Technology and a variety of other universities and businesses, uses dial-up videoconferencing technology to provide technical pro-

fessionals with engineering education in the workplace. Maine's vaunted Interactive Television system allows islanders to complete associate degree programs without setting foot on the mainland.



But if examples of experimentation with distance learning abound, so do nagging questions: Who regulates out-of-state colleges that beam courses into another state? Who makes sure the product is education, rather than *edutainment*? And what about cost?

Studio production costs of educational programming can reach \$5,000 an hour. And most distance education, by definition, entails long-duration, long-distance "phone calls." Does higher education have the political clout to win preferential telecommunications rates? (Notably, the 30-member U.S. Advisory Council on the National Information Infrastructure appointed by U.S. Commerce Secretary Ronald Brown consists mostly of business officials and only one representative of higher education, Toni Carbo Bearman, dean of the School of Library and Information Science at the University of Pittsburgh.)

There are also questions about New England's level of interest in telecommunications. Former University of Massachusetts President David C. Knapp, for example, worries that distance learning will lack prestige until more faculty at New England's prominent institutions buy into telecommunications technologies.

The resistance Knapp alludes to raises the prospect of New England losing its historical leadership in higher education. It's one thing to be trounced by the University of Miami or Nebraska on the football field. But is New England ready to lose leadership — and tuition dollars — to out-of-state universities with the technological savvy to transmit topnotch distance education programs into the region? And what about entities such as the National Technological University and Mind Extension University, which use New England faculty in some cases to offer degree programs in New England via satellite and cable television? Are they competitors or colleagues?



Finally, if more New England institutions do adopt the technologies, will they do it effectively? As Harry R. Miller, director of marketing with NYNEX-Vermont, recently warned a group of New England college and university administrators: "Most faculty are very used to standing in front of 30, 60, 90, 100 people. And so when you see the first applications of distance learning, it's basically me talking to you just like I would talk to you in my regular classroom, even though I have a hugely powerful television studio that can do all sorts of magical things."

We trust that the following essays on the competitive position of New England's telecommunications industry and the role of telecommunications in education and regional commerce answer some of the tough questions and raise some more.

— John O. Harney

The Great Digital Convergence: Implications for Growth

The coming together of computing, video and telecommunications technologies will create a digital convergence that will alter our economy and our social fabric far more profoundly than anything we have seen in the past 20 years. Consider the sheer magnitude of the industries affected:

- The U.S. telecommunications services industries — local telephone companies, long-distance carriers and cable television companies — are worth just under \$200 billion.
- The computer hardware and software industries are worth more than \$70 billion.
- The media industry, including newspapers, television and radio, is worth another \$70 billion.
- The telecommunications equipment business is worth \$40 billion.

Add another \$24 billion for two of the fastest-growing new industries: \$10 billion for cellular services and \$14 billion for information services. Throw in the movie industry and the emerging multimedia business, and the total tops \$400 billion.

Some have predicted that by the end of the century, these industries will be worth \$3 trillion — half the current U.S. gross national product.

As we think of what the digital convergence will yield, we begin to understand just how exponential the growth in these industries is likely to be. Soon we will live in a world where a customized up-to-the-minute multimedia news summary will be dropped on our digital doorways each morning; where we will be able to work at home or at the beach or on the road, using super-intelligent video-conferencing equipment; where our kids will be able to tap into a world of knowledge available at their fingertips; where our doctors can make housecalls without ever leaving the office; where space and time cease to be deterrents to doing business or earning a degree or even “visiting” loved ones.

The convergence will yield a world so utterly different that it will bring to mind Samuel Morse’s quote when he sent his first telegraph message between Baltimore and Washington in 1844: “What hath God wrought!”

God has wrought an age marked not by the mere existence of a vast storehouse of information — that was the mainframe computer era — but a new age of information empowerment, where individuals have the power to take this great pool of knowledge and shape it themselves. Where we have the power to recreate that information

and add value to it and then ship it quickly and easily over distances great and small.

In such an age, large centralized monopolies are destined to fall and, indeed, the monopolies which have dominated telecommunications are now under siege. The Big Three television networks have yielded not only to another network but to a slew of cable channels; cable companies, in turn, face stiff competition from direct broadcast satellite and telephone companies wielding new video technologies; and the telephone companies struggle to fend off their own new competitors, from the growing cellular industry to the agile fiber-optic companies.

But destiny notwithstanding, monopolies have a way of keeping their power long after technology suggests they should relinquish it, and they are prone to squelching new innovation before it gets out the door in an effort to maintain their positions. That’s where government comes in.

True, there are people who believe the best thing government can do is get out of the way while the market works its magic. But the recent history of telecommunications is rich with examples of government as an active agent for market solutions, as a catalyst for a competitive environment when private interests sought instead to monopolize. It was government, after all, that broke up AT&T. It was Congress that freed up the airwaves to create the cellular industry, and Congress that insisted the regional Bell Companies be kept out of cable television, lest they destroy that industry in its infancy.

More recently, Congress has begun creating a competitive environment unlike any ever seen in the history of the communications industry. The House of Representatives in June passed two bills which together constitute the most significant overhaul of communication policy in 60 years. We put these bills on a fast track because we want to meet the goal set by President Clinton in his State of the Union Address to pass an information superhighway bill by the end of the year. And we *will* meet that goal.

Our bills ensure that at least two wires — a cable company wire and a phone company wire — run down every street in the United States. We will allow, for example,

**By
Edward J.
Markey**

NYNEX to offer video service in Boston in direct competition with Cablevision, the city's cable television provider. Cablevision could, in turn, offer phone service in direct competition with NYNEX. But we will not allow NYNEX to buy cable companies in this region. In Colorado or Alabama, yes, but not in New England or New York, where NYNEX could easily use its current monopoly to run every competitor out of business.

We will also require cable and phone companies to wire all public schools and offer schools preferential rates for services.

We will force NYNEX and other Bell Companies across the country to open their networks to local competitors, so a small fiber-optic company could plug into the local phone network and offer local service. We will gradually introduce new competition in long distance by allowing the Bell Companies to enter the business over the next several years. We will create a whole new generation of wireless technologies when the Federal Communications Commission, acting on separate legislation, auctions off 200 megahertz of the airwaves later this year.

Finally, we will create a new competitive market for "set-top boxes" — computerized television control units resembling cable control boxes — so that any information service entrepreneur with a good idea, whether he be a software designer, a game-maker or a health care provider, can clear the last hurdle to the consumer.

Fifteen years ago, the personal computer didn't exist; today, more than 61 million PCs sit on desktops and in family rooms across the United States. The proliferation of this technology is creating a stupendously fast-growing business in on-line services. For example, the number of subscribers to America Online jumped by 165 per-

cent last year; the number of Internet users has almost doubled in the past two years to more than 20 million. In order to keep this business growing, we will do everything we can to keep the gateway to the home open, whether it be a set-top box or some still unimagined device.

INDUSTRIAL LINK

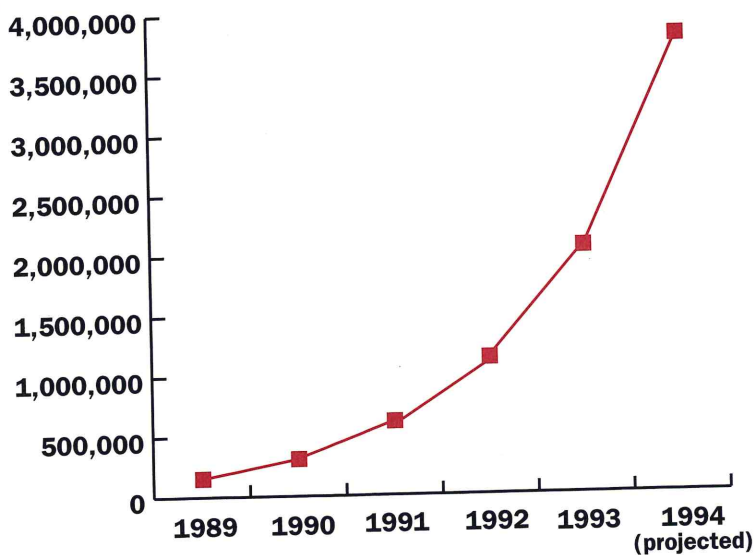
What does all this mean for New England's economy?

First, by setting up a competitive marketplace, we hope to unleash a level of private investment in communications technology unseen in the industry's history. That means exploding demand for products for the cable and telephone networks. AT&T's North Andover, Mass., plant has already been designated as the primary development site for more than \$20 billion in contracts from Bell Companies seeking to upgrade their facilities in preparation for the new competition.

A competitive marketplace means growing demand for links to private networks, for products and services that make it easier and faster to send information from one end of a building to the other or from one end of the country to the other. And if you want to offer a product or service — say an interactive game or voice mail — you no longer have to make a deal with Ma Bell to reach consumers. You can turn to other competitors or simply plug your product into the network, because the Bell Companies will be required to make the network available to all comers.

Right now, no region is better positioned for this competitive marketplace than New England. According to a recent study, more than 70,000 Massachusetts workers alone are employed in telecommunications — more per capita than in any other state in the country. The

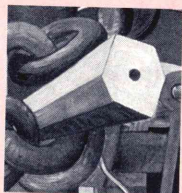
NUMBER OF INTERNET HOST COMPUTERS: 1989-1994



Source: MERIT Network Information Center.

Over the past 25 years, the Internet has evolved from a Defense Department experiment into an international, decentralized "metanetwork." Thousands of smaller networks are tied into the Internet's connection routes, giving users remote access to software, data and text files, as well as powerful network resources. By the end of 1993, 2.2 million time-share computers were acting as Internet hosts, serving an estimated 25 million users — and the numbers were growing by 5 to 10 percent per month. Two-thirds of all host computers are in the United States; 40 percent of these are located at colleges and universities.

INTERNET INSECURITY



There's plenty of anxiety these days on the network of computer networks. In March, Congress

held hearings on Internet security after the Federal Computer Emergency Response Team issued an alert noting that the system may be more vulnerable to deliberate destruction or altering of files than previously thought. Businesses and other organizations also fret about protection of trade secrets and intellectual property rights in the age of interconnection.

All the worry is creating a new market for yet another line of telecommunications products. Witness Massachusetts-based Digital Equipment Corporation's recent release of a package of software and consulting services meant to, in the computer company's words, provide a "protected and programmable firewall" against any unwanted intruders into private networks.



region's software industry remains second to none. And while layoffs at some large New England companies steal the headlines, small telecommunications and software firms like Wellfleet Communications Inc. of Billerica, Mass., Banyan Systems Inc. of Westborough, Mass., and Parametric Technology Corp. of Waltham, Mass., are fueling a steady recovery.

We have one resource that can't be beat: brainpower. No other region of the United States has the concentration of world-class universities, cutting-edge research and highly trained workers that New England has. No place, except lower Manhattan, has the concentration of financial resources found in downtown Boston and at venture capital firms along Route 128 in Massachusetts.

New England's first-rate universities, highly skilled workers, and in Massachusetts, the most attractive research and development tax credit in the nation, give us a leg up in attracting telecommunications firms to the region. But we must channel our resources carefully and efficiently to compete with other regions of the country and the world.

INFO APARTHEID

In our headlong pursuit of profit and growth, we

must also make sure we build a more prosperous society, that we not create information apartheid — a nation of information haves and have-nots.

When I was in grade school, we would gather every Monday in the schoolyard and compare notes about the TV shows we watched the night before: the guests on the Ed Sullivan Show or the adventures of the Cartwrights on Bonanza. Television and the schoolyard were great equalizers, providing common ground for rich and poor, Irish and Italian, and in some places, Black and White.

Already today, we see the broad outlines of the new trend toward information inequality. Some families' homes are wired for cable television, others are not.

Some get Sports Channel or HBO, many do not. More importantly, some kids today can use on-line services at home to tap unlimited sources of information and learn interactively on their own. Most kids, however, are lucky if they have access to a computer at school. A recent Times-Mirror survey found that a college graduate with a family income of at least \$50,000 was five times more likely than a less-educated, lower-income person to own a PC and 10 times more likely to have on-line capability at home.

In the right hands, technology can continue to be a democratizing force and a vehicle for promoting public good, and we have endeavored in our legislation to preserve universal service and promote social uses of the technology. But in the wrong hands, this technology can drive new wedges in our society. It can create an unraveling of society, as television turns up the volume on violence and on-line services promote pornographic games and bulletin boards. Both government and private industry must ensure that the technology is used for some greater good.

Twenty-five years ago, Robert F. Kennedy gave a speech in a burnt-out Detroit ghetto on the importance of a strong economy. He cautioned: "We cannot measure national spirit by the Dow Jones Average, nor national achievement by the gross national product. For the gross national product includes air pollution and advertising for cigarettes and ambulances to clear our highways of carnage. It counts special locks for our doors and jails for the people who break them. The gross national product swells with equipment for the police to put down riots in our cities and though it is not diminished by the damage these riots do, still it goes up as slums are rebuilt on these ashes. And if the gross national product measures all of this, there is much that it does not comprehend. It does not allow for the health of our families, the quality of their education or the joy of their play. The gross national product measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to country. It measures everything, in short, except that which makes life worthwhile. And it can tell us everything about America, except that which makes us proud to be Americans."

In our pursuit of a more competitive economy, we too must be mindful of the inadequacy of measures like the GNP and gigabits-per-second for gauging social progress. For the GNP measures the 67 million handguns circulating in America and the thousands of homes sold after foreclosure in middle-class neighborhoods from Massachusetts to the San Fernando Valley. And gigabits-per-second tell us everything about the sheer brilliance of our engineering without telling us whether those products bring any value to our society.

The communications revolution has the potential to change our society. If we do it right, it has the power to bring rich, new educational and entertainment opportunities to our homes, classrooms and offices. And if we do it right, it can fuel a new economic miracle in New England and around the world.

Edward J. Markey is a Democratic U.S. congressman from Massachusetts. He chairs the Telecommunications and Finance Subcommittee of the House Energy and Commerce Committee.

Higher Education in the Age of Information

At 2:00 on an icy winter afternoon on North Haven Island, 10 miles off the coast of Maine, Belinda Pendleton, site coordinator at the island community school, snaps on the TV in the corner, tucks a tape into the VCR and sets out the portable telephone. Five island women file in from the cold, shed their coats, draw pens and notebooks from their bags and settle heavily into chairs. They talk softly among themselves until the professor, standing at a podium in a broadcast classroom 80 miles away on the mainland, greets them from the monitor.

Since 1989, the people of North Haven have earned college degrees without leaving their beloved island. In the northern forest town of Allagash and downeast in Calais, college courses are available at local schools via interactive television. Thousands of Maine people, excluded from higher education for generations because of geographic isolation engage in new education and training opportunities every day through the Education Network of Maine.

The network, a unit of the University of Maine System, offers 65 courses via interactive television leading to five associate and two master's degrees at more than 100 locations across Maine. Each semester, about 4,000 students enroll in credit courses through the network; an additional 25,000 Maine residents use the network for training or teleconferencing. And this fall, cable television systems will deliver degree programs directly into about 70,000 Maine homes.

The information technologies of the University of Maine System have caused a fundamental shift in the university's relationship to its community. Students don't have to go to college anymore. College goes to them. This transformation in teaching and learning is emerging not only as a result of the availability of these new technologies, but as a deliberate attempt to address the unique challenges facing colleges and universities today.

DYNAMICS OF CHANGE

Higher education's traditional, labor-intensive structure has begun to crack. The strain of increasing numbers of underprepared, widely diverse students, dwindling funds and decaying physical infrastructure has slowly eroded access to higher education and diminished its quality. Built for the young, full-time, residential students who now make up less than 15 percent of the U.S. student population, our colleges and universities scramble to stay viable and competitive. Some of these institutions — realizing that fundamental change can't occur without sweeping reorganization of their Industrial Age structures — have

turned to emerging information technologies to fundamentally redefine the teaching and learning process.

Of course, information technologies have been a part of higher education for years, but they've been used mostly in administration. Their value in improving the learning process and extending the reach of education is only now being recognized, as higher education — the traditional stronghold of critical analysis, tolerance and free expression — finds it must also foster teamwork, flexibility and global thinking and do it more efficiently and equitably than ever before.

PARTNERSHIPS FOR LEARNING

New England is uniquely diverse in educational resources and expertise. Yet our public institutions of higher education have also been fiercely autonomous, often seeing their missions and purposes in local terms only. This narrow outlook may have made sense when education was labor-intensive and limited by the distance students could travel to their local college. In that environment, the aggregation of students, teachers and library holdings presented the most productive use of relatively scarce resources.

But an increasing number of colleges and universities are finding it difficult — and unnecessary — to serve today's students in isolation. Informational and learning networks spanning distances and cultures allow us to bring vast, and rapidly expanding, collections of print and visual materials directly to students. The digitization of information, which has significantly transformed publishing and music, will have an equally profound effect upon the way education is delivered. Liberated from the constraints of real-time delivery, educational programming will offer greater choice in format, design and content to students, whether they come to campus or not. For example, the University of Maine at Augusta recently offered an introductory business course conducted entirely over computer networks. Students participated when they wanted to, where they wanted to.

**By
George P.
Connick
and
Jane A.
Russo**

By creating unique and varied opportunities for continued learning, partnerships among colleges and universities in distance education can prove both economically and socially fruitful for the region. Sharing the collective power and resources of higher education not only extends access to a wider range of programming and services to our students, but engages the institution itself in dialogue with the larger educational community. Partnerships also strengthen our ability to compete with private and public national networks, whose own educational programming will encroach steadily into the homes and workplaces of our students in the coming years. For example, the Colorado-based National Technological University broadcasts training programs to Maine businesses via satellite. And Mind Extension University, also based in Colorado, provides credit courses from participating institutions to Maine students via cable television.

In an era of limited — and shrinking — educational resources, technology will enable higher education to better address the following:

Responding to change. The speed of computer networks allows quick assessment of instructional programming and student satisfaction, which can help us become more responsive to the needs of our students and communities. A renewed and revitalized assessment process will allow faculty to shape relevant curriculum and ensure a higher and more consistent quality of instruction. Most organizations have learned the value of continually updating themselves according to new conditions of contemporary society. Education will use many of the same technological tools to manage quality.

Attending to learning style. Our institutions can't afford to ignore the profound differences in the way people learn. Educators have long realized the importance of recognizing and celebrating essential differences in people's intelligence. But current instructional models, shaped by institutional schedules and the pedagogical styles of instructors, offer little flexibility for teachers or students. By freeing both faculty and student from the constraints of the lecture hall, information technologies allow important opportunities for a variety of self-directed projects that can help individualize learning to an astonishing degree, thereby helping students better understand and capitalize on their own best

approach to learning throughout their lives. One University of Maine instructor developed a laboratory science course, including instructional video, permitting students to dissect a fetal pig at home.

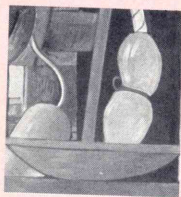
Being accountable. Americans have begun to question the return on public and private investment in higher education — with good reason. Whether shouldered by the students or by state or local governments, the high cost of a degree has become insupportable. And the academy has not produced convincing evidence that the quality of education has risen with the price. State funding for higher education, which has been flat or declining in the New England states since 1988, will remain anemic at best in the coming years, prompting institutions to contain costs by focusing on the efficient use of resources. Funding levels may be determined more by learning *outcomes* than by traditional measures such as the number of Ph.D.s on the faculty, library holdings or full-time enrollment. Economies of scale, such as those realized through distance education networks, can offer real productivity in teaching and learning, gradually slowing growth in college costs. Notably, a major study published in *The American Journal of Distance Education* reveals no essential difference in the quality of learning between distance education and more traditional approaches. Various studies in Maine have echoed those findings.

Promoting partnerships. As colleges and universities become leaner, telecommunications can help bridge programmatic gaps by linking public and private institutions across the United States and abroad in learning partnerships. The Maine Department of Education and the University of Maine System have invited the University of South Carolina, for example, to provide a master's degree in Library Science in Maine, which has no such program of its own. The partnership allows the University System, which has neither the resources or faculty to develop a library science program itself, to offer students a new and challenging curriculum within their own state via telecommunications.

Strengthening teaching and learning. Today, information is so broadly based and the acquisition of knowledge so complex that innovations in pedagogy and course design are essential if students from diverse backgrounds are to be truly engaged in the learning process. Institutions of higher education must encourage faculty participation in the implementation and development of networks and provide professors with the means to forge new alliances with colleagues around the world as they learn to provide structure, support and management for learning. These networks are not replacements for faculty. Instead, they offer alternative approaches to instruction for students whose family and employment commitments, educational background, distance from campus or physical challenges preclude a more traditional learning experience.

Learning collaboratively. Among students, interaction can be broadened and enhanced through interactive networks, creating learning communities that cut across institutional terrain and fan out into the wider world of expertise and experience. These relationships will continue to blur the division between teacher and student, enlarging the number of possible "teachers" and encouraging students to understand the power and effectiveness of sharing their knowledge with others. The burgeoning power of the per-

CATCHING UP FROM A DISTANCE



Despite nationally recognized programs in Vermont and Maine, New England may be well behind the rest

of the nation when it comes to bringing educational services to geographically remote populations. A recent survey by CAUSE, a Colorado-based association that promotes the use and management of information technology in higher education, found 19 percent of New England colleges and universities were "involved in distance education," compared with 48 percent of their counterparts in other regions.



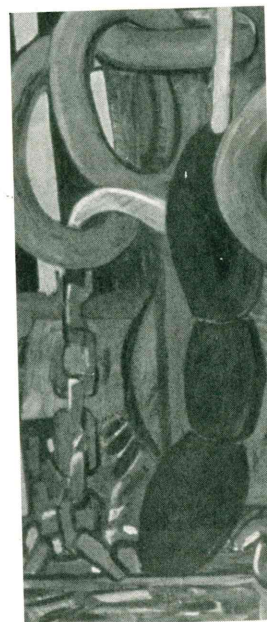
A NATION OF CALLERS

CALLS PER CAPITA *

	Local	Toll Within State	Interstate
Connecticut	1,662	214	274
Maine	926	159	114
Massachusetts	1,729	304	213
New Hampshire	1,285	166	248
Rhode Island	1,438	116	221
Vermont	936	116	184
New England	1,543	234	221
United States	1,693	137	141

* All data are for 1992.

Source: Federal Communications Commission.



sonal computer, the growing influence of multimedia and CD-ROM and the rise of interconnected information networks have shifted the foundations of pedagogy from a teacher-centered model to an increasingly learner-centered model. These technologies can promote apprenticeship experiences at the graduate level or new access to individualized developmental instruction for students taking their first tentative steps into higher education.

While educational changes fueled by the needs of students and society are inevitable, they are still unsettling for many faculty and academic departments faced with a seeming onslaught of new directives, including the incorporation of technology in teaching. Transitions from traditional teaching methods to styles that capitalize on the new technologies can be impossible for some instructors to achieve. Because of their physical distance from the teacher, students must be encouraged to invest more responsibility in the direction and intensity of their own learning; some students — and instructors — may not be ready for this profound shift in the traditional academic relationship. But institutions that choose to embrace the technologies may encourage faculty support by considering the innovative use of technology in tenure and promotion decisions and offering grants and other incentives to instructors who integrate telecommunications in their teaching.

EDUCATIONAL SUPERHIGHWAYS

Despite these and other concerns, colleges throughout the country are beginning to use the powerful technologies that already have transformed industry and much of the rest of our society, not just to manage the campus more efficiently, but to revolutionize the instructional process itself.

These educational prototypes of the coming national information superhighway are positioning themselves to compete in a future where students will learn and communicate in a “virtual classroom” linked to international networks of digitized information and educational resources. Their faculty and staff are redesigning the learning experience itself and, in the process, developing the skills to help students learn to select, synthesize and give meaning to the array of information before them. Still, the competition from for-profit learning corporations, some in league with huge communication conglomerates, will be formidable and will begin to seriously challenge higher education’s monopoly on the provision of learning.

New England’s long tradition of excellence in higher education won’t shelter its institutions from the demands of a rapidly changing world. Strategies that add diversity and direction to higher education and promote substantial increases in productivity are essential if the region’s colleges and universities are to remain strong and viable in the coming years. In any case, we have little choice. Information technologies have already begun to transform higher education. The more our institutions learn to embrace and use these tools to respond to the particular needs of New Englanders and others, the more effective we’ll be at shaping our own future and that of the students we serve.

George P. Connick is the president of the University of Maine at Augusta and the co-chair of NEBHE’s Regional Commission on Telecommunications and Distance Learning. He is currently on leave from the Augusta campus to develop an eighth institution in the University of Maine System, which will become the electronic university of the state of Maine. Jane A. Russo is the executive assistant to the president at the Augusta campus.

Vermont Via the Information Superhighway

Traveling to rural schools across Vermont, I have seen how a satellite downlink can bring a teacher into a classroom hundreds, even thousands of miles away, offering students an advanced course that otherwise would be unavailable in a small school. I have seen students using the telephone, a modem and a computer in a way that just a couple of years ago seemed unthinkable. And I have seen the excitement on the faces of children who, for the first time, are connected electronically through their schools to the rest of the world.

During a visit to Proctor Junior-Senior High School, which has a total enrollment of 180 students, I saw young people attending advanced placement (AP) courses for calculus and statistics with teachers actually 500 miles away in a classroom in Virginia. The students were "handing in" their papers via modem or fax. These challenging AP courses are available in Proctor only because the school invested in satellite downlinking technology, and Proctor is attracting students from other surrounding towns just because of the advantages this technology provides.

It is virtually impossible to underestimate the importance of bringing the electronic information age into the classroom, whether we're talking about the 9,500-student University of Vermont or a two-room schoolhouse in the Northeast Kingdom. A computer and a modem, of course, will never supplant the role of high-caliber teachers who inspire their students to perform at peak levels. These high-tech gadgets are tools, albeit powerful tools, to make more information available to students and teachers alike.

As a parent, an advocate for technologically advanced schools and a governor committed to keeping my state economically vibrant in an increasingly competitive world, I have pledged to bring the electronic superhighway to students in rural Vermont, just as it's available to their counterparts in the cities and suburbs of North Carolina, California and elsewhere.

It is incumbent on government to aid schools in connecting students to the information superhighway. As a first step in this effort in Vermont, we have secured \$300,000 worth of funding in the state's fiscal 1995 budget for equipment that will help link schools through modems, computers and satellites to the distant education opportunities now unavailable to many Vermont children. I am convinced that connecting Vermont's schools to each other, to state libraries and especially to outstanding lecturers and instructors at colleges and univer-

sities across the country will provide the maximum number of curriculum choices and help level the playing field for students as we enter the 21st century.

We must move quickly to ensure access to the electronic information highway for all students. We also need to consider the greater question of electronic access for all citizens, for their personal use and for the economic development of communities and regions. By attracting and growing information-based industries, we encourage private investment in infrastructure and promote a demand for additional capacity as new technologies emerge. Additionally, telecommunications technologies allow residents of rural towns to enjoy New England's beautiful natural environment, the proximity of top-flight colleges and a healthy lifestyle, without suffering from the problem of living hundreds of miles from traditional centers of commerce.

There are many ways we can capitalize on the advantages we already have in our efforts to attract the telecommunications industry. We can provide specific tax incentives, foster a knowledgeable and efficient regulatory process and build partnerships between business, government and higher education to ensure the use of compatible technologies and eliminate costly duplication of capital investment. We have no greater incentive available to us than our workforce — graduates from all levels of schooling whose creative thinking and understanding of the electronic world in which we live make them the most attractive workforce anywhere.

The challenges of integrating telecommunications into our educational system are daunting. During the next few years, we need to adapt methods of instruction. Independent educational certifying authorities must encourage change and redirection. Administrators and teachers should embrace change. Many will fear the evolution from chalkboards, and some changes will be misguided.

**By
Howard
Dean**

Nevertheless, if we want our region to be competitive not just with the rest of the country, but with the rest of the world, we will have to be electronically connected to that world. It is important for us in New England to shape a vision of the future, so all our citizens will have electronic access to databases of every sort around the world.

We will compete educationally, environmentally and economically only if all of our citizens are connected to one another. This electronic revolution will not occur overnight. It will be the result of partnerships and a consensus to move forward forcefully. Next to health care

reform, this will stand as one of this generation's most significant challenges and accomplishments.

While universal electronic access in New England is still a good way down the road, it is a goal we must strive for. I am convinced that grade school kids, college students and workers in Vermont's Green Mountains and across our six-state region will have the potential to be more successful than ever in their endeavors if we provide them, early, with tomorrow's tools.

Howard Dean is the governor of Vermont.

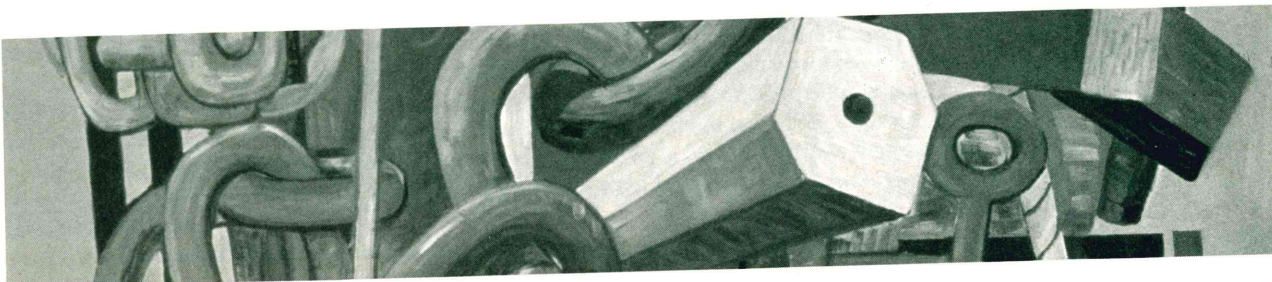
TELECOMMUNICATIONS RESOURCES ON-LINE

Gopher servers allow users to browse through hierarchical menus of stored documents, files and gateways on the Internet. Following are a few gopher servers related to telecommunications and distance learning.

RESOURCE	ADDRESS
Alliance for Public Technology.....	apt.org
Bell Atlantic	ba.com
CAUSE	cause-gopher.colorado.edu
Center for Networked Information.....	gopher.cni.org
Digital Information Infrastructure Guide	farnsworth.mit.edu
EDUCOM	gopher.educom.edu
Federal Communications Commission.....	fcc.gov
Information Infrastructure Task Force	iitf.doc.gov
National Distance Learning Center	ndlc.occ.uky.edu
National Telecommunications and Information Administration.....	gopher.ntia.doc.gov

Listsers function as on-line news sources and discussion groups. A few related to telecommunications:

LIST	DESCRIPTION	ADDRESS
COMMUNET.....	Community networking discussion	listserv@uvmvm.uvm.edu
DISTED	On-line <i>Chronicle of Distance Education</i>	listserv@alpha.acast.nova.edu
EDUPAGE	Abstracts of technology-related news stories.....	listproc@educum.edu
IIAIPO	<i>Information Policy Online</i> newsletter	iiapo-request@his.com
NII_AGENDA	National Information Infrastructure discussion	listserv@civicnet.org
RITIM-L	Telecommunications marketing discussion	listserv@uriacc.uri.edu
TELECOM	Electronic journal of telecommunications policy	telecom-request@eecs.nwu.edu
TELECOMREG	Telecommunications policy discussion	listserver@relay.adp.wisc.edu
VIDNET-L.....	Video technology discussion	listserv@uga.cc.uga.edu



Interactive Television in a Rural State

Vermont is America's most rural state in terms of the scatter of its population and the proportion of residents who live in rural areas. To put it another way, Vermont has lots of small towns and no large cities. Vermont also has the nation's highest share of workers employed by small businesses. These small firms face particular problems in getting access to quality training for their employees.

It is not surprising then that in gauging the potential of telecommunications, Vermont focused initially on using technology to overcome geographic obstacles to education and training programs. Computerized access to library holdings was another early priority.

Vermont shares this emphasis on access with our other northern New England colleagues. Yet Vermont's approach to distance learning has maintained distinctive elements.

In 1984, the IBM computer chip manufacturing plant in Essex Junction provided a small grant to Vermont Technical College (VTC) to explore the feasibility of establishing a two-way, land-based telecommunications link to provide engineering technology courses to IBM employees at the worksite. This feasibility study provided an important impetus for the establishment of the Vermont Interactive Television (VIT) system. Ironically, the VTC-IBM connection was never implemented — the college found that faculty were fully prepared to drive to the IBM plant to provide engineering courses in person, instead of teaching via the interactive video system.

But further encouraged by recommendations of a Governor's Commission on Telecommunications, VTC in January 1988 established an experimental two-way interactive link via T-1 telephone lines between its Randolph campus and the North Country Union High School in Newport, deep in Vermont's Northeast Kingdom. This initial experiment was financed through private grants and donations.

This two-way experimental link proved to be very promising. In fiscal 1989, the fledgling interactive, audio-video system received its first state appropriations of about \$350,000 and expanded to a third community, Springfield. Subsequent developments expanded the system to nine sites, with three more scheduled to go on-line in 1994-95. Beginning with the sixth site, the host communities have each raised \$35,000 from local private sources to match funding drawn from state and federal sources and user fees.

Several key features of the original VIT model remain important aspects of Vermont's still-developing statewide distance learning system:

Partnerships. From the beginning, VIT was designed to serve the distance learning needs of education, business and state government. Consequently, programming over VIT is unusually diverse, ranging from traditional coursework to continuing education for realtors and engineers, to training of state agency employees, to business teleconferencing, to statewide legislative hearings, to national guard training on weekends, to ... well, you get the idea. That VIT is "owned" by no one interest and available to all may be its single most distinguishing characteristic.

Shared governance. The Vermont State Colleges (VSC) manage the VIT system for the state of Vermont, and the VSC board of trustees has final authority for all policies and decisions. But day-to-day oversight is provided by a gubernatorially appointed coordinating council whose membership includes representatives of all three partners in the VIT system: education, business and state government, including legislators.

Operating structure. The VIT director supervises a lean central staff, community site coordinators and studio technicians (all sites both receive and originate programming). Community advisory committees — initially created to raise matching funds from the communities — have been established for every site to provide ongoing assessment and advice on programs and operations.

Coverage. With VIT's pending expansion from nine to 12 sites, virtually all Vermonters now live within about 25 miles of a VIT studio. Last year, VIT delivered education and training programs originated by over 120 institutions and organizations to more than 7,600 Vermonters. These customers were served through 2,800 hours of programming in 1993. The system typically provides programming from 7 a.m. to 10 p.m. on weekdays and, increasingly, on weekends as well.

Program priorities. Demands now far exceed available time on the system, particularly during the "prime time" afternoon and evening hours. Where choices must be made, the priority goes to "programs not otherwise available." Additionally, the director and council have protected some time slots for business conferencing use, since these needs cannot be planned in the same fashion as, for example, semester-long education courses.

By
**Charles I.
Bunting**

Interactivity. Another key characteristic of VIT is that all sites are fully interactive. Pedagogically, this means that the system is well-suited for education and training uses which encourage full engagement of teachers and students. Indeed, it also serves well those non-teaching applications — such as faculty and staff meetings, business teleconferencing and legislative or other public hearings — which rely on dialogue and feedback.

CHALLENGES LOOMING

As we look to the future in Vermont, a statewide, site-based interactive system such as VIT will continue to meet some of the state's pressing education and communications needs. At the same time, the VIT system has been a sort of demonstration project for Vermont — an opportunity to get “hands on” experience with a set of crucial issues, possibilities and promises, all of which the state and its residents would inevitably need to confront and resolve.

Like other states, Vermont is now grappling with a range of future concerns that are very much “on the screen,” in a variety of ways. A recent statewide study commission has tackled the broad question of directions for all forms of educational telecommunications. Both the governor and the Legislature wrestled with several approaches to the very question of how the state should make telecommunications policy. The Vermont Business Roundtable, aware of the integral connection to economic development, has a major study underway on the subject.

If Vermont is to realize the full potential of educational telecommunications, policymakers and educators will need to address the following:

Diversification and proliferation. If once the challenge was to establish a single interactive system, in the not-too-distant future, we will have the advantages — and challenges — of multi-systems. These may include home-based capacity, more private company-based systems, hospital systems, local area education networks and perhaps several networks within different sectors of state government. Additionally, we can expect increased satellite transmission of programs from beyond Vermont, much-expanded use of interactive computer networks and the augmentation of laser discs and CD-ROM technologies. The opportunities for wider access and enriched educational experience are vast and exciting; the challenge to use scarce resources wisely and to connect these diverse systems to better serve the learner is equally awesome.

Strategic planning and policymaking. For a variety of pressing reasons, including the inevitable proliferation of delivery systems, it is essential that Vermont establish effective mechanisms for telecommunications planning and policymaking. Such governing bodies must have “teeth” in their mandates in order to be credible and effective, yet they also need to be broad-based, including the full range of input from education, health, business, government and other sectors. While such broad and diverse representation is absolutely essential, it is equally important that state government, particularly the governor's office, exert leadership on a sustained basis.

Issues in the academy. Higher education has had a somewhat schizophrenic relationship with telecommunications. In some areas, we have fully embraced this

new frontier (note academia's extensive use of the Internet, electronic library and research capacities and the field of engineering's use of satellite technology for coursework). But many of us have been unable or unwilling to see any promise of educational quality in instructional modes that differ from the traditional classroom model, and we have too quickly cast distance learning as a threat to our livelihood rather than an opportunity to expand our circles of learners.

Moreover, there is the matter of the State of New England. Robert Frost's fences notwithstanding, the very nature of this technology renders the borders between the states irrelevant. Particularly in our region, we are aware of the value of sharing educational resources and the interdependence of our economies. Unfortunately, many traditions — and several federal regulatory policies — undercut prospects for interstate cooperation in telecommunications and distance education.

The New England Board of Higher Education is playing a key role in fostering cooperation in educational telecommunications. A recent NEBHE conference on telecommunications held in Woodstock, Vt., provided an excellent start. The conference brought to light a host of educational and policy issues that require action. Additionally, the conference reinforced the perspective of NEBHE's recently formed Regional Commission on Telecommunications and Distance Learning, namely that progress in educational telecommunications will benefit regional economic development.

Charles I. Bunting is the chancellor of the Vermont State Colleges and the co-chair of NEBHE's Regional Commission on Telecommunications and Distance Learning.

MULTIMEDIA AT BENNINGTON



Bennington College is one of 21 U.S. and Canadian colleges chosen as flagship sites for the

New Media Centers Initiative, an effort by a national consortium of computer hardware and software companies to foster multimedia in higher education.

Bennington plans to build an interactive media center on campus to enable students to become “multimedia-literate,” and to extend multimedia services and instruction to local schools, organizations, businesses and individuals.

The Bennington media center will feature CD-ROM authoring stations, advanced desktop publishing and computer-controlled video capture capabilities, as well as software for illustration, image manipulation, video and sound editing and animation. Bennington will use the technology to permit all students to create on CD-ROM a complete text, visual and sound portfolio of their academic and creative work at the college.



Telemedicine: 21st Century Housecalls

New Englanders, like all Americans, have three basic demands when it comes to health care: immediate access, availability of the latest high-tech procedures and affordability. But these three demands have become incompatible. We can usually supply two of them at any one time, but it appears impossible to have all three at once. It may be possible, however, to make part of the health care problem — expensive high-technology medicine — part of the overall solution, while improving the quality of care through “telemedicine.”

Dramatic changes in communications technology have made it possible to link patients and their local doctors with distant medical specialists, an innovation that is particularly important to people who live in rural regions.

Medical experts and patients recognize that one of the most costly shortcomings of the U.S. health care system is our lack of primary care physicians: family doctors, general practitioners, internists and pediatricians. Primary care physicians offer the timely, dependable and compassionate care that most people want, and they keep health care costs down by providing the low-tech care that most people need most of the time. But only 29 percent of American doctors are engaged in primary care practice, compared with more than 50 percent in Canada and most European countries.

The shortage of primary care physicians confronts us at a time when we need them more than ever. The “managed competition” health care plan now being discussed by the Clinton administration is suitable only for the 60 percent of Americans who live in areas of high population density, because the theory of managed competition requires a large population base to foster the competition that is supposed to keep costs in check. Forty percent of Americans — spread across 90 percent of the United States — will still depend on the dwindling number of primary care doctors. And other health care reform plans offered in Congress as alternatives to the Clinton plan include the same dependence on primary care.

Why are so few U.S. doctors attracted to primary care? Some of the reasons are economic. But the difference in income between the specialist physicians and the primary care physicians is just part of the problem. Another problem is esteem within the medical profession. The growing ranks of high-priced specialists tend to look down upon their colleagues who have opted for a career in primary care, treating the primary care doctors like “second-class citizens” in the profession. Perhaps even more discouraging is the way primary care physicians — often practicing medicine in rural America, the inner city or

small hospitals or clinics — feel isolated from the larger world of medicine. Primary care physicians, even though they are often paid the least, are expected to know the most, since they are expected to diagnose and then treat or refer elsewhere, any and every health problem a patient brings into their offices. With medical knowledge expanding every day, no physician can keep up without help.

Now, we can remove the sense of isolation by using high-tech medical communication — high-performance computers, high-resolution television and video and fiberoptic information superhighways. These technologies help us put the entire world of medical science at the fingertips of even the most isolated rural family doctor. A telecommunications health information network allows doctors not only to seek information on a puzzling case before them, but also to pursue lifelong learning.

NEW PERSPECTIVE

A modern health telecommunications system offers as much to patients as it does to their physicians, because it brings patients the best in American medicine at real savings. When your family doctor wants you to have a consultation with a specialist, perhaps in a distant city, interactive television can let you consult that specialist and other experts without leaving your own city or town. That will save time, money and even save lives.

At the Koop Institute at Dartmouth College, a commitment to using communications technology to improve rural primary care is at the top of our agenda this year. We can use telemedicine — a combination of computers, two-way television and interactive video — to link the office of every primary care physician in Maine, New Hampshire and Vermont to the high-tech facilities of medical schools and large medical centers in those states, or for that matter, to any medical library in the United States.

Earlier this year, Dartmouth Medical School offered a dramatic demonstration of this type of long-distance consultation for First Lady Hillary Clinton, who was visiting Dartmouth to discuss health care reform. In the live

By
**C. Everett
Koop**

demonstration, a wounded American soldier in Somalia received triage treatment from a physician tens of thousands of miles away in the United States. A tiny camera on the helmet of the medical corpsman at the side of the soldier transmitted clear, simultaneous pictures back to the doctor stateside, who then instructed the corpsman on how to properly wrap the soldier's badly wounded leg.

The use of information technology in medical consultation can also give the patients a new control over their treatment. The Foundation for Informed Medical Decision Making (FIMDM), a nonprofit organization that promotes the patient's role in medical consultations, has worked with Dartmouth Medical School's Interactive Media Lab to produce interactive videodiscs that offer patients personalized information and treatment options for conditions such as hypertension, back pain, early stage breast cancer or benign prostate enlargement. Using a computer mouse or touch screen, patients can respond to various questions the program puts to them and then receive counsel based on their specific responses. The language is not technical or esoteric medical jargon. If they don't understand something, the patients can replay any part of the program as many times as they like and at the pace they choose. Some of the first patients who used the videodiscs reported that they had more fully, and more calmly, considered all treatment options, thanks to the technology. Only 18 months after becoming available in January 1993, more than 100 copies of the foundation's videodiscs were being used in various medical facilities in the United States and Canada.

These media are also being used in today's medical education and training. Fourth-year students at Dartmouth Medical School are using an FIMDM videodisc in a class on the doctor's role in society. More recently, the school adopted a compelling videodisc on the HIV virus and AIDS, also developed by the school's Interactive Media Lab. The videodisc intersperses real-life interviews of HIV-positive patients and their families with highly sophisticated graphics illustrating the growth of the HIV virus in healthy human cells.

MAKING A NETWORK

A tri-state health communications network being developed under the leadership of the Koop Institute is well underway and has earned the attention of those on the cutting edge of communications technology for the 21st century. Vice President Al Gore has pointed to the initiative as a potential model for the rest of the nation. The vice president is looking to the Koop Institute to organize a private sector telecommunications consortium that will establish public-private "collaboratories" to facilitate the implementation of the health information infrastructure necessary for health care reform.

Of course, the best assistance each of us can provide to our beleaguered health care system is to make fewer demands on it by practicing personal disease prevention and healthy lifestyles. In this area too, high-tech communication can further cut medical costs by encouraging prevention and wellness. A generation of children raised on video games will probably be more attuned to health messages coming from interactive videos than from lectures by the school nurse.

Eventually, personal telemedicine links could provide every home with access to health information 24 hours a day, seven days a week, encouraging personal wellness and prevention, and leading to better informed consumer decisions about health care.

Although we have good reason to view costly high-tech medical gadgetry as a major cause of escalating health care costs, we can make high-tech cut the other way by investing dollars in the kind of medical information technology and information superhighways that will provide better, more accessible health care at a lower cost for all of us.

C. Everett Koop serves as senior scholar at the C. Everett Koop Institute at Dartmouth College. He was the surgeon general of the United States from 1981 to 1989.

COMPUTERIZING HEALTH CARE

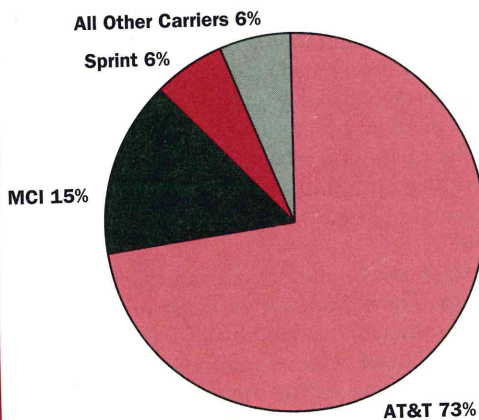


Harvard Medical School researchers at Brigham and Women's Hospital were awarded a three-year, \$1 million grant from the National Library of Medicine and the Department of Defense to help establish a national network for health care information. Collaborating with colleagues from Columbia and Stanford universities, the researchers will create systems to provide teleconferencing and share computerized patient records and research results.



NEW COMPETITION

U.S. SUBSCRIBERS TO LONG-DISTANCE SERVICE BY CARRIER: 1993



Source: Federal Communications Commission.

The Metabolism of Information: A Bigger One-Room School?

Thomas Jefferson observed “all that is necessary for a student is access to a library, and directions in what order the books are to be read.” But Jefferson couldn’t have foreseen how our era of sophisticated telecommunications would alter the definitions of *student*, *access*, *library*, *directions*, *order*, *books* and *read*.

Education is a lifelong activity based in creative conversation and reflection about connections and distinctions. Much of the framework for this creative conversation has been provided by annotated and illustrated texts. Today, the tools for annotating and illustrating text may be extracted from computers that manage time, sound, color, text, graphics, calculation and motion as objects. Media technology and the miniaturization and immediacy of the photoelectric offer an infinite range of control over the constituents of cognitive experience. And we have the opportunity to share media across networks.

In short, new technologies enable the creation of a virtual space in which thought can be shared. A network populated with shareable ideas in all media by scholars of all ages and all disciplines, in turn, can yield a “geography of the imagination,” to borrow a phrase from literary critic Guy Davenport.

Connections among people beget new services by establishing new communities of interest. “User groups” become technology innovators, and developers become efficient imple-“mentors” with new services and features. Thus, the innovation and exploitation of new network technology can be evolutionary and the results for the individual, revolutionary. Used technology is successful technology.

How best do we develop these virtual workshops? Some thoughts:

Schools are for *teaching* and homes are for *learning*. Connections to the home should be established first if the benefits of learning are to be applied where they mean the most to individuals, communities, industry and society. If homes have access to the network, homework clubs can form around lay teachers in many disciplines. People in group homes based around a shared predicament such as AIDS, drug abuse, teenage pregnancy or domestic violence can join new groups where the entry requirement is an active, focused mind, rather than the ability to overcome physical, social, economic and geographic barriers. “Neighborhoods” of peer groups can supplement each other’s capacity for learning. Getting out of the old neigh-

borhood and into a new one should be as easy as pointing with a mouse or speaking into a telephone.

Good teachers are students and good students are teachers. Peer-to-peer communications are a necessary consequence of “master-to-apprentice” dialogues. The idea is to not just export the “star” teacher to disadvantaged students, but to link the star teacher as a colleague to the disadvantaged teacher.

INCREASE LEARNING

Geography is destiny for many scholars. I studied in one-room schools in the mountains that had greater cognitive and conversational connectivity than an elite boarding school I later briefly attended. Access to everything the market has to offer is not necessarily conducive to learning. A law that has been stated for computed neural nets might apply to human learning: “Decrease bandwidth, increase learning.” (Of course, that assumes there is sufficient bandwidth to diminish.)

Broad and deep distribution of access to networks needs to be accomplished quickly for all members of society to participate. The best strategy is to develop virtual broadband schemes that take advantage of existing infrastructure and methods of cost-effective rapid diffusion of information. Many television talk shows and distance learning experiments have used links between telephone and television traffic, well in advance of ubiquitous switched broadband.

People-to-people communications are the first and ultimate priority. The networks of the future must have high fidelity and sufficient bandwidth — bit stream capacity — to convey the full range of human behavior, emotion and expression. Other services should be designed to support and amplify the basic connections between people where their behavior is the interface.

Community-of-interest, logical, shared-cost networks can be reformed and reconfigured to serve individualized cognitive needs on-demand with rates based on usage, but not distance.

Dream a little ...

By
**Nathan
Felde**

Networks will effectively support the development of minds in communities that learn, create, invent, express, instruct, exchange and share knowledge, wisdom and common sense through the efficient interconnection of signals, bit streams, data and information in all media. ...

The virtual university will become a catalog of limitless connections accessible regardless of the physical locations of people.

The ratio of students to teachers could be not just reduced, but reversed. A network with capacity and connections will ultimately result in any learner having hundreds of "teachers," because all learners will be teachers. ...

And what of the preservation of campus life, alma mater, ivy and gown, the playing field, commons, ritual, initiation, dalliance in the fields of learning, the pleasure of company, the life apart?

There is no question that "being there" is the once and future next best thing. Like data, your body is physical and needs to be somewhere most of the time. The geography of the imagination is infinite and can be exploited for all that it is worth to the physiology of the body and the psychology of the group. Sometimes it is the next best thing to "not being there." There will always be the "waterfront" real estate of the fountains of learning. Its price will place it beyond the reach of everyone. But everyone will be somewhere, and new playing fields, commons and library steps will develop around homes and neighborhoods.

ARRAY OF SAVINGS

The capacity of new switched broadband telecommunications infrastructure represents an oil reserve for education that can be exploited indefinitely to achieve significant cost reductions, organizational change, greater connectivity and new educational goals for the individual, family, neighborhood, community, state and society. The refinery on line replaces the disjointed library, classroom and personal checkbook.

Using networks can avoid the costs and obtain the benefits of "being there" in education, business, government and health care and in community, neighborhood and home life. Photoelectric networks can address the following costs:

Transportation. Moving people and paper is the bad cholesterol of the circulation system in education, business, health care and government. In health care, physically moving patients is more expensive than moving diagnoses and treatment. Similarly, moving students carries a high cost that is often buried in the community's and individual's expenses. The cost associated with transportation time — including "hallway" time — for students, faculty and administration personnel can be avoided through telecommunications technologies. My desktop video "NYNEX Shuttle" station links me with my executive assistant around the corner and the vice chairman two states away, with real gains in productivity for all of us.

Replication. The cost of replicating learning experiences is prohibitive. But virtual replication means learning experiences can be stored for later use, altered for better use and made timely and relevant to the individual or the group. This yields savings in common classes, teacher time, best practice and innovations sharing, quality control, library resources and printing and copying. But

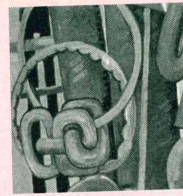
the real opportunity here is the sharing itself. That is the heart of learning, and opportunities to radically increase the level of sharing are effectively increasing the cognitive size of the school exponentially.

Time. Time is the scarcest resource of all, particularly the time of expert teachers. In New England, we are spending about \$2 per minute of school time. Where do we waste time? Can all those minutes become effective teaching minutes? Can we more efficiently deliver those "effective learning moments," the experiences of epiphany and enlightenment that last a lifetime? Yes. Time lost on collateral and digressive activities can be bought back with telecommunications technologies. And we can reduce the occurrence and cost of ineffective teaching minutes and redundancies through an evaluation of individual information metabolism. While we have ample experience testing recall, it is harder to identify the moments of epiphany, especially when "it dawns on me" years after the teaching occurred. We need the time to buy back marginalized disciplines, skills and experiences.

Missed Connections.

Learning is cognitive connectivity. The fabric within which students operate is the sum of connections available and contexts within which connections can be made. Limits on the capacity to access, generate and share connections limit the cognitive "space" in which a school operates. Remote access to observatories, field work and other classrooms

FRENCH FILMS



A Keene State College French professor is developing a multimedia, interactive

video for students of French that makes the old language lab approach look quaint. The video, developed by Professor Thomas J. Durnford, makes the student the subject of the action taking place, offering sequences where the student must choose the proper response.

Durnford, who received a fellowship this summer to study at the Centre National d'Enseignement a Distance (The Center for Long Distance Learning) in Poitiers, France, says he's been struggling to develop a teaching tool "that wouldn't shock my more traditional colleagues but would give my students a sense of what French is really like." Durnford planned to tape some scenes in France and then work with the multimedia staff at Keene State to develop the full video this fall.

Durnford hopes the video will eventually find its way onto The Monadnet, a local area network set up at Keene State to serve the University of New Hampshire and other institutions, community groups and businesses from the towns surrounding Mount Monadnock in southwestern New Hampshire.



MERGING TRAFFIC



Robert Half International, a California-based staffing services firm, asked chief financial officers

at U.S. companies, "On a scale of one to 10 (with 10 being the quickest), how quickly will your company merge onto the information superhighway?" Average response: 3.9.



increase the potential for students to make connections.

Cognitive style. Perceptual media can be multiplexed — separated and recombined — to address the variation of cognitive styles in all learners. Mixed-media communications are composed from disparate resources. The infrastructure for this recombination needs robust networks capable of timely construction of services to yield the proper experience and reduce costs in time devoted to composing subject matter and preparing course-

ware to customize or personalize learning events.

Pace. The needs of society appear to be accelerating, but the rate of learning differs among individuals. Balancing the two requires expert throttling of information transactions among people. We must understand better the role of waste in information systems to understand costs. Multimedia information packages can become the fast food of learning. The "time" gained by speeding up work with media is not always being spent to make the content better, but simply different in texture. Ten minutes of silence presents its own challenge to networks and to learning. Addressable costs are in "time-to-market" of qualified, productive members of society and the loss of skills, subjects and disciplines.

Architecture. Network services that allow separations of time and distance to be effectively ignored eliminate many current investments in buildings that simply house dislocated populations. The costs of meeting rooms, class-

rooms, offices, dormitory and hotel rooms can be avoided. A virtual architecture allows rooms to be used simultaneously and left as they were with the blackboard full of references. A space can be dialed back to a previous state or left in a perpetual state. Content can be retained with context intact, ready for the renewed intent of a learner.

Capacity. A society that embraces learning in all aspects of life throughout life must pursue the goal of increasing access to the learning experience, conversation, instruction and expertise. Since learning needs to take place throughout government, business, health care and home, infrastructure and appliances that support education can be cost-justified by uses in other sectors.

The growing demand for education will not be met by simply expanding the physical-bricks and mortarboards-hydrocarbon-people-and-paper-moving model.

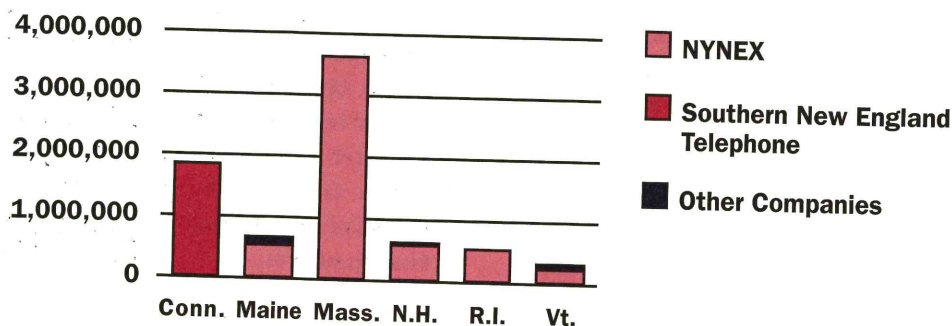
The present renovation of public networks to fiber for utilitarian reasons and consequently higher capacity for advertising and entertainment is an epochal challenge looking for the right design. We are building the wrong network for the wrong reasons, instead of the right network for the wrong reasons. Currently, the dream of high-fidelity, universal access, public-switched networks is stalled figuring out the dilemma of equitable distribution of movies. The simple, direct connection that will support conversation about a richly annotated text with reference to images is on hold — ironically until we "know" more.

If society and governments can accurately state their needs in human and political terms, there is no doubt that the technology can change to fashion a network for learning. We might coincidentally realize a longstanding dream of cutting costs and improving performance in our educational institutions, even as those institutions change their boundaries with one another, with institutions of commerce and government and with the home.

Nathan Felde is the executive director of video information service development at NYNEX Science & Technology.

LOCAL LEADERS

NUMBER OF ACCESS LINES BY LOCAL TELEPHONE COMPANIES: 1993



Source: Federal Communications Commission.



The Approaching Transformation of New England Higher Education

The *means* of education have changed very little in 200 years. For the most part, students of similar age have gathered in groups at specific times, in specific sites, under the tutelage of location-bound teachers. All that is going to change profoundly as a result of advances in electronic materials and circuitry and the expansion of telecommunications networks. Indeed, the impact of information and telecommunications technologies on education is likely to be as transforming as the impact of the automobile on transportation. And this transformation will elevate the importance of cooperation among New England's colleges and universities.

A dominant feature of society today is its technological character. Both the complexity and pace of technological change have accelerated enormously, bringing about a marked change in demands on our workforce. A growing number of jobs now require a substantial level of technical skill and sophistication. Not surprisingly then, the educational requirements of almost all occupations have become greater across all sectors of the economy, with a growing need for specialized professional skills. It is widely recognized that workforce competence — and by extension, regional economic development — requires increased access to cost-effective education and training over the course of one's career.

These changes in workforce requirements, combined with a downturn in the traditional pool of 18-year-old high school graduates, have helped give rise to a sizable new student constituency in higher education: working adults who pursue education on a part-time basis. These and other "nontraditional" students do not typically follow the steady path of the residential student of age 18 or so, but instead move in and out of higher education. Their education is job- or career-motivated. By the year 2000, nontraditional students will account for an estimated 60 percent of the higher education student population, up from 40 percent in 1976.

FREED FROM CONSTRAINTS

As a result of work or family commitments, the new "typical" students are location-bound, lacking the mobility — and the financial wherewithal — of the traditional residential students. They need access to education at their workplaces or homes. And they will have it as a result of modern telecommunications and information technologies.

These technologies have reached the stage where they can free us from the centuries-old constraints on education and, at long last, change the means of education.

For example, advances in digital techniques enable the interactive transmission of voice, video and data among multiple locations. A teacher at an originating studio classroom can be seen and heard by students at multiple remote sites, and the teacher can see and hear the remote-site students. To ask a question, a student raises his hand, the teacher identifies the student, and the question is heard by the participants at all sites. The degree of interactivity comes so close to replicating the actual classroom experience that, in most cases, remote-site students feel they are part of a live classroom discussion. Moreover, pilot tests are underway that bring interactive voice, video and data capabilities directly to the home or workplace. Thus, distance learning has essentially overcome the traditional constraint of *site specificity*.

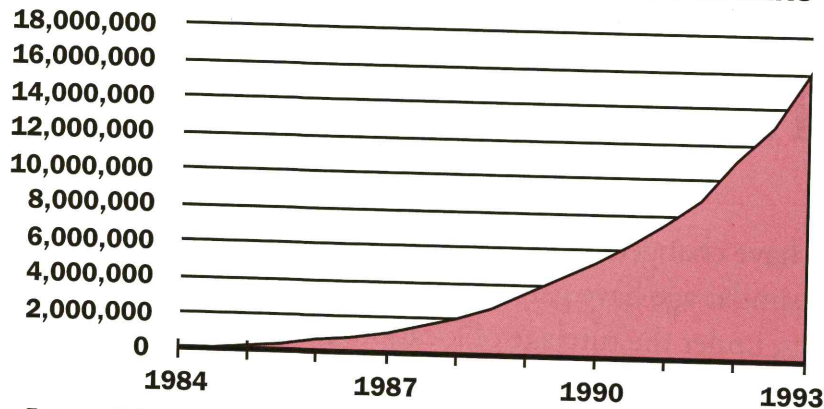
In addition, subject matter or courses can be videotaped and then viewed at a time that best fits the student's schedule, offering considerable freedom from the constraint of *time specificity*. A degree of interactivity can be achieved by scheduling telephone conferences or "network office hours" during which students can ask questions and seek help just as if they were in the teacher's office.

Distance learning technology also permits the involvement of teachers or expert panels at sites far removed from a particular land-based network. A videocamera focuses on the teacher or expert panel at the originating site. The program carried via satellite is then downlinked and fed into a local network, giving students access to a wide range and depth of quality instruction from across the nation or around the globe.

**By
Edmund T.
Cranch**

A C O R D L E S S G E N E R A T I O N

NUMBER OF U.S. CELLULAR TELEPHONE SUBSCRIBERS



Source: Cellular Telecommunications Industry Association.



Such experiments in distance education are already underway in New England. The University of Maine at Augusta's well-developed educational telecommunications network brings college-level programming to almost all parts of the state, and is now being extended into Maine homes via cable television. Vermont Interactive Television's two-way video and audio programming serves business, industry and government as well as education. Northeastern University has joined with the Colorado-based National Technological University (NTU) to deliver master's level courses in engineering and management and noncredit workshops to a nationwide network of worksites. Employees can view the programs live at work or watch them at a more convenient time and place on videotape. NTU faculty are drawn from a variety of U.S. universities where their lectures are "uplinked" to a satellite and transmitted to the worksites.

REGIONAL PATCHWORK

Each New England state has developed its own approach to educational telecommunications, depending on institutional initiatives and goals. The technologies differ from state to state and among institutions. In some areas, the programming emphasis is on grades K-12, while in others the focus is on higher education. In some states, public institutions have taken the initiative; in others, private institutions have been more active. Indeed, regional developments in telecommunications reflect the general state of affairs in New England higher education: Each institution is pursuing its own programs and goals, isolated from others in New England and the nation.

But modern telecommunications and information technologies are certain to challenge traditional thinking. Not since the invention of the printing press half a millennium ago has a technology offered such potential to markedly change the process of teaching and learning. For example, although higher education is largely organized and controlled on a statewide basis, information technologies pay no heed to state boundaries. How will New England states and institutions adjust to

these new developments and their implications for access and equity? How will state education and accreditation agencies adjust to a world in which institutions can import and export electronically mediated educational programming across state lines, transmitting courses not only to other schools, but to workplaces and homes? If New England is to maintain its leadership position in higher education, it will need to anticipate and respond to such questions.

Most notably, two major policy issues must be addressed. First, the transmission rates set by the Federal Communications Commission (FCC) and state public utility commissions are currently too high for the cost-effective transmission of educational programming to a large number of sites. This is especially true for programs transmitted across state boundaries. Interstate access charges established by the FCC are based on traditional commercial telephony. As a result, access to educational programming from out-of-state sources is severely constrained. As Congress considers changes in the national structure of telecommunications regulation, the New England states should seek to remove regulatory and business restrictions on telecommunications carriers for distance learning. Also, these carriers should be offered incentives to develop special pricing for educational applications.

Secondly, traditional educational institutions must modify their go-it-alone mentality and be willing to share programming in a collaborative manner. If the New England states and the region's higher education institutions are to prosper, they will need to use their financial and human resources efficiently. The technology is available to deliver educational programs on a regional basis; what's needed is a spirit of cooperation.

Edmund T. Cranch is a senior fellow at the New England Board of Higher Education and former president of Worcester Polytechnic Institute.

Into the Steamship Age: A New Networking Paradigm

The best uses of new technologies are not always obvious, nor are they immediately employed. The first use of steam power in early 19th-century boats produced “steam sailboats” — conventional sailboats equipped with a steam engine used only to steam out of calm seas. The cutting-edge inventors of the time could not see that steam would lead to larger, all-steel boats that would not need sails. Solving the problem of sailing through the doldrums was useful, but because the solution was limited to the old paradigm of sailboats, it did not make very good use of the steam engine. Eventually, the new paradigm — ships fully powered by steam — rendered the steam sailboat irrelevant to commerce. From the educational perspective, many uses of computer networking are steam sailboats — slightly better ways of doing what educators have always done, but within the old paradigm, in which an authority conveys knowledge and students passively take it in.

On-line encyclopedias and lectures-by-video will certainly be viewed by our successors as the steam sailboats of their day: applications which solve specific problems, like moving through the doldrums, but fail to support the new paradigm, the completely new arrangements that the technology enables, namely *telecollaboration*.

In thinking about educational uses of networking, it is helpful to distinguish between personal communication and communication aimed at a group — “one-way” communication.

We are awash in one-way information relayed by one-way communication. On a normal day, a blizzard of bits come to us uninvited, through the mail at home and at work; the airwaves bathe us in gigabytes from dozens of TV channels and hundreds of radio stations; heaps of newspapers, magazines, newsletters and bulletins arrive every week. This information enters our vicinity more or less passively, without our searching for anything in particular. Should we need specific information, we can easily tap specialized magazines, books, videos, movies and lectures — more vehicles for one-way communication.

The information channels we tap are brimming with gigabytes we never use. Traditional information sources not only select complete stories, news, textbooks and products for us, but they “polish” the information to increase the likelihood that it will enter our consciousness. Sentences are made punchy, rambling text is eliminated, arguments are tightened, special fonts are designed, text is carefully laid out, just the right pictures are selected, expensive color is used, and headlines and blow-up quotes are placed on a publication’s cover and table of contents to entice readers.

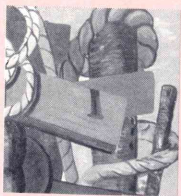
One-way information on computer networks must compete with information from all these sophisticated non-network sources. And if it is to be useful in education, it must offer real advantages over the traditional sources. The problem in using one-way information from the network is there is too much of it, most of it unfiltered and unpolished.

Karl Marx did not appreciate middle-men, because he failed to see that not only laborers, but also financiers, wholesalers, shippers, advertisers, packagers, resellers, traders and speculators all added value to products, smoothing their movement from source to consumer. The huge number of information middle-men — the editors, designers, illustrators, wholesalers, retailers and advertisers — similarly add value to information.

Still, many advocates of networking are InfoMarxists who would eliminate the information middle-men, and use the networks to put us all in direct contact with information producers. That would be a disaster. We, and in particular our students, would drown in information. With only a fraction of the one-way information flow on the digital networks, there is already too much raw and unfiltered information. Imagine the babble when every student puts up his or her writing, every aspiring author in the world electronically publishes half-finished thoughts and unedited essays. Intelligent filters that automatically select information for users will help a bit, but the problem of selecting and polishing information is a uniquely human enterprise that will not be replaced by computers until computers can be taught to deal with *knowledge* rather than *information*.

**By
Robert F.
Tinker**

SPINNING A WEB



Expect to hear more about the World Wide Web, an Internet service that combines video, text and graphics sources and allows users to open other documents by selecting "hypertext" links that appear as highlighted text in the document they're viewing. By some accounts, use of the web is growing at almost twice the rate of the Internet itself. Also growing in popularity: Mosaic, the software developed by the National Center for Supercomputing Applications at the University of Illinois, and made available free of charge to Internet users. Mosaic allows users to browse through the hypertext messages on the web with the click of a computer mouse.

At the University of Massachusetts at Amherst, the Astronomy Department's star models and images of star data are available to scientists around the world free via the web. A graduate course catalog and guide to the work of UMass astronomy professors and doctoral candidates has also been on the web since November 1993. By spring, the department was receiving 3,000 requests for information every month.



on student research. This spring, students at 23 high schools are measuring amphibian populations; their findings will be used as a marker of ozone change over time. Another group in the Global Lab is measuring stratospheric ozone levels with inexpensive photometers. The data the students collect, transmitted to a data consolidation server in Cam-

The important benefit that networking brings to education is not the endless stream of one-way information, but the potential for collaboration: students working together on problems of mutual interest. The following examples illustrate some of the educational potential of telecollaboration:

- Through Global Lab, a program funded by the National Science Foundation, high school and college students use networking to undertake collaborative environmental research. One group of Global Lab students may have uncovered a new environmental hazard. Participants in Russia began measuring nitrate levels in food because they had heard rumors of occasionally high levels related to over-fertilization of crops. Their research, although it revealed no alarming nitrate levels, inspired a Wellesley, Mass., Global Lab team to undertake its own study, which found outrageous levels of nitrate in hydroponic lettuce. They defended their results to some skeptical readers on the network, and have inspired further Global Lab student research which continues at sites around the world.

- Scientists worldwide are investigating change in the earth's ozone level. The Declining Amphibian Populations Task Force, headquartered in Portland, Ore., has helped create a telecollaborative to draw

bridge, Mass., is of real interest to scientists, and will be collected over time to analyze environmental changes. Involvement with real science has immense educational and motivational value for all the students.

- Princeton University is setting up a national network of inexpensive seismic stations in high schools and universities to help students understand geology and physics. Students have access to raw data on seismic traces from around the world and use software that can help them determine the location and strength of major earthquakes anywhere in the world minutes after they happen. The network will yield important data on micro-earthquakes and the detailed structure of the earth.

- In other projects, students are modeling the United Nations, exchanging folk tales across cultures, examining bias in different countries, learning foreign languages, examining pollution across a watershed, tracking the migration of monarch butterflies, measuring acid rain and its effect on trees, solving design problems, measuring indoor air quality and much more.

Collaborating students develop skills and knowledge in the context of investigations. Their classroom suddenly includes students, teachers and scientists from around the world, and their data, analyses and findings have real audiences. These kinds of activities are inherently motivating, interdisciplinary, international and socially important. They are also highly supportive of current trends in educational reform, providing solid substance to the calls for curricula restructuring and systemic reform.

Yet, telecollaboration — in spite of its promise and the decade it has had to mature — remains surprisingly marginal to education at all levels. There are probably a few hundred small, free telecollaborative projects serving a few thousand classrooms, mostly at the precollege level, supported either by grants or individual teachers. But these come and go based on funding and the energy of their organizers. The lesson from these many experiments is that to have a significant impact, telecollaborations need the appropriate technical and organizational infrastructure, including good software, technical support and on-line moderators to facilitate discussion of curricula material.

In addition, technical limitations have restricted the range of telecollaborations. Just as the first steam engines might not have supported large steel boats, the early network technology was only marginally able to support educational telecollaboration. But this is the ideal time to re-examine past assumptions, because the technology is just now maturing to the point where it can support a wider range of telecollaboration. Clearly, the ability to easily create, send and view integrated hypertext multimedia documents over the network will vastly improve communications among learners. Add to this real-time conferencing, software that supports collaboration, the increasing power of computers and explosive growth of the Internet, and all the technical elements for rich implementations in the new paradigm are in place. The resulting collaborative projects will help move education into the network equivalent of the steamship age.

Robert F. Tinker is chief science officer at TERC, a Cambridge, Mass., nonprofit educational research and development organization focusing on improving math and science education.

Telecommunications on Campus: Easing Faculty Fears

Satellites, dark fiber, cable and microwave technologies all make it possible to transform the college environment and the teaching and learning process. Possible. But — so the story goes — faculty have been very slow to adopt these technologies and, as a result, colleges and universities are lagging far behind other organizations in realizing the benefits of the telecommunications age. “Faculty intransigence” is often seen as the primary impediment to fully implementing and realizing the value of technology. And indeed, studies have revealed that many faculty see telecommunications technologies as dehumanizing. But part of what is perceived as faculty resistance to telecommunications results from the technology itself not yet living up to its promise.

Legitimate questions abound about whether current telecommunications technology produces the types of learning that higher education is increasingly expected to provide. For example, many experts such as James Appleberry, the president of the American Association of State Colleges and Universities, have urged colleges to stress the development of oral and written communication skills, critical thinking and collaborative problem-solving in small groups. But much of distance education remains passive: The learner is an observer who may not even have an opportunity to ask questions of the presenter. It is doubtful that large numbers of faculty will move to adopt the new technologies until many of these problems are resolved. Other issues are organizational, social and practical. Fortunately, most of these problems can be overcome.

TECHNOLOGICAL ISSUES

During the past several years, it has become increasingly clear that telecommunications and computing are no longer separate technologies. Computers “speak” to one another over twisted pair-telephone lines. Data, voice and video signals are digitized and transported over the same fiber-optic thread. Satellite signals carry live interactive conferences across oceans, permitting conferees not only to see and hear one another, but also to share the same computer data set.

Similarly, there is a blurring of the traditional line between telecommunications and cable television technologies. In the Virginia suburbs of Washington D.C., Bell Atlantic is experimenting with transmission of television programming across telephone lines. Likewise, sev-

eral cable systems may soon offer telephone service via cable. This trend promises increasing access to information for individual consumers and decreasing segmentation of technology types.

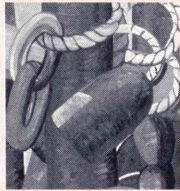
While the potential of the new telecommunications technologies is strong, several significant problems have emerged. First, much of the technology — especially interactive distance technology — still falls into the category of “vaperware.” Its great promise tends to evaporate in production. Consider Time-Warner’s experiment with interactive cable television in the Orlando region of Florida. This technology is based on a computerized television control unit — much like a cable control box — that sits on top of a television set. But as promising as this technology may be, Time-Warner has pushed back the date for adding the first commercial customers, so it can make additional refinements of underlying system software and the set-top terminal.

A second technological issue involves the actual structure of programming. Most colleges and school districts that provide distance education rely on converted television studios for their productions. These studios usually have cameras trained on the instructor and the front of the room. Some more sophisticated studios also have one or more overhead cameras to record desktop experiments, and video may be interspersed in “lectures.” But for the most part, the programs feature talking heads in a quasi-classroom environment; they attempt to reproduce a traditional classroom setting at a distance. Learning is still passive and, even with interactive distance links, question-and-answer sessions are cumbersome.

Another key issue for higher education administrators and faculty is which technology to buy into. Today,

**By
John W.
Bardo**

UNIVERSAL SERVICE



We have become an information-rich society. Almost 100 percent of households have radio and television, and about 94 percent have telephone service. Three-quarters of households contain a videocassette recorder, about 60 percent have cable, and roughly 30 percent have personal computers.

As the information infrastructure expands in breadth and depth, so too will our understanding of the services that are deemed essential. This is not a matter of guaranteeing the right to play video games. It is a matter of guaranteeing access to essential services.

We cannot tolerate — nor, in the long run, can this nation afford — a society in which some children become fully educated and others do not; in which some adults have access to training and lifetime education, and others do not.

— Vice President Al Gore, speaking to the Academy of Television Arts and Sciences about the Clinton administration's proposals to reform the communications marketplace.



international telecommunications programming to Eastern Europe or most of Asia, for example, involves extensive investment in satellite transmission equipment. In the near future, the availability of international fiber and the ability to send full-motion video across the Internet will provide a lower-cost alternative at some sites. But determining which technology to invest in and finding the funds to do so are two of the most difficult decisions facing campuses in New England and nationally. Several states, including Maine and New Hampshire, have made investments in statewide networks. But even these states face “end user” problems involving interactivity and program production. For example, power and transmission failures can cut off a program in progress. Unless “back-up” staff are available to handle students’ questions, either enrollment or the number of questions that can be asked must be limited.

MASS MARKETING

Unfortunately, the experience of college faculty and schoolteachers using telecommunications tends not to match the sales pitch for the products. Because the programs are “live,” there is no way to judge quality in advance. Moreover, distance programs that are sold to educators are aimed at a general audience, with little regard for the specific goals of the instructor. And because the broadcast is scheduled by a producer, the program may not fit well within the context set

out by the faculty member.

For these reasons, most uses of telecommunications programs (with the exception of courses specifically designed as “distance education”) have been in the form of “add-ons” or enrichment programming. For example, Bridgewater State College, along with Woods Hole

Oceanographic Institution, provide the Southeastern Massachusetts home of the Jason Project, in which school children explore topics ranging from whale behavior to tropical reef habitats as seen and relayed by the robot submersible named *Jason*. Bridgewater also regularly receives downlinked programming from the quasi-public Massachusetts Corp. for Educational Telecommunications, teleconference providers and other vendors of distance education. Yet all these programs are *additions* to the curriculum, rather than replacements. Why? Because the programs are of short duration; they are not specifically aimed at any particular course; they are not necessarily available at a time when they would be most useful; and there is normally very little pre-training offered by the vendors of telecommunications programming, public or private, to ensure that even interested faculty members understand how to use the programs.

College professors cherish their academic freedom; they pride themselves on individual initiative and the ability to think, reason and teach independently. Yet most telecommunications productions have been developed and marketed to faculty as if they were a monolithic group. Until the technology becomes more interactive and individualized, there is no reason to believe faculty will move en masse to embrace it.

Faculty also need training if they are to use the technologies effectively. A faculty member from one New England campus recently told me she had agreed to teach a course at a distance, though she had received very little training. Despite this, she was a good sport and was willing to “give it a try.” This situation is not unusual. Faculty, for the most part, have had education and training programs in graduate school through which they developed norms, values and beliefs regarding teaching. Yet, we expect them to go in front of the camera or to create programming appropriate for distance education with little or no training.

It’s a situation where higher education can take a lesson from the marketing textbooks. When a new product is introduced, the manufacturer will often make samples available. Within any group of people, a few risk-takers will give the new product a try. In marketing parlance, these are the “early adopters.” Based on their experience with the product, others who are less adventurous will try it out, and eventually a broad-based market will develop. Why should telecommunications be any different? If we want faculty to warm up to the technology, we need to identify the early adopters and provide them with access to technology, training and time for experimentation.

TRAINING FACULTY

We know that active learning is much better than passive learning for most students. The combination of telecommunications and computing holds tremendous promise to foster cooperative active learning, but not if it attempts to reproduce the old classroom at a distance. We need to know the relationship between specific forms of telecommunications and learning. What techniques are effective for which learners and under what circumstances? Are certain concepts, approaches or theories more readily taught through telecommunications?

At Bridgewater State College, we are implementing

a program in technology innovation and development that will cost in excess of \$11 million for infrastructure alone. This program is structured around the John Joseph Moakley Center for Technological Applications, which is dedicated to the systematic study of telecommunications and computing technologies in teaching and learning and the development of models for other campuses. The college is installing four electronic classrooms, interactive television at approximately 115 sites on campus, a fiber-optic campus spine, networked computers and voice capacity on all faculty desktops and international satellite transmission capabilities. This a major undertaking for a relatively small campus. It became clear very early on that this program would not work if faculty would not support it. To reduce resistance and increase interest, Bridgewater:

- Established a Center for Advancement of Teaching and Research (CART), including networked computers and CD-ROM units to help faculty become familiar with new technologies.
- Assigned two popular and able faculty members to serve as coordinators of CART and help other faculty improve their teaching and uses of technology.
- Started a small grants and summer stipend program to encourage faculty to try out new technologies in their teaching and research.
- Encouraged faculty to apply for sabbaticals that involve projects related to applications of technologies in their disciplines.
- Began training programs to increase faculty interest in applied technologies.
- Identified and developed early adopters. Deans identified several faculty members who were willing to try the new technologies as they were developed. Additionally, the deans have worked with the departments to bring to campus new faculty members who are interested in applying technologies in their disciplines. As a result, there is significant interest in using computing and telecommunications in fields as disparate as chemistry, biology, communications, English, modern languages, elementary education, economics, earth sciences and art.

To be sure, more must be done, but some progress is clear. Two years ago, when we asked faculty members if they wanted a computer on their desks, about 60 of 250 expressed an interest. This year, the college received 150 faculty requests for computers. The key factors appeared to be the increasing use of the Internet by their colleagues, the soon-to-be-completed campus computer network and the availability of training. The early adopters had brought along their colleagues.

ADOPTING TECHNOLOGIES

If we expect faculty at colleges and universities to adopt and adapt to the new technologies, certain critical issues must be addressed. Higher education institutions and technology vendors must:

Provide training. No faculty member can be expected to adopt new modes of educational service delivery without training and assistance.

Show evidence that the technology works. Faculty must be shown real evidence that the technology helps them achieve their teaching and research goals. Unfortunately, the literature on the uses of technologies in teaching offers little reassurance. One 1993 article on the uses of telecommunications in teacher education cited as benefits: 1) the students' experiences with access to "large scale" conferencing systems; 2) exposure to a wide variety of topics; and 3) "students communicated in a professional and scholarly way with students and faculty of other universities." These outcomes might well have been achieved in a conference call at much less expense.

Provide social and organizational support. At Bridgewater, adapting to technology was voluntary. Faculty members were able to find their own ways to applications of technologies that were appropriate to their disciplines. Faculty members now have begun to ask pertinent questions about intellectual property rights, workloads and other issues related to the new technologies. The key to these developments has been the peer support provided by CART and the training provided by the college.

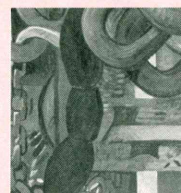
Customize the product. Producers and distributors of technologies must develop their products in ways that will serve the individual goals of faculty members. The more a product can be individualized, the more likely faculty will find a use for it in their teaching.

Establish partnerships and on-site testing. The cost of these technologies, while dropping in unit price, is still high. If the vendors and institutions are to realize a sound return on their investment, vendors must become partners in the development and delivery of programming. Such collaboration receives plenty of lip service, but words must be translated into long-term, broadly based partnerships. In fact, businesses may need to place personnel on campuses to ensure that programs are effective and educationally useful. It is in the long-range interest of telecommunications firms and other businesses to ensure that graduates are able to function in the highly technological, competitive environment that will confront businesses in the next 20 years.

U.S. college and university faculty may be slow to change, but they are not generally opposed to change. Faculty will implement telecommunications technologies only if they get the organizational support and development they need to do it effectively.

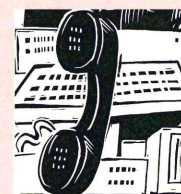
John W. Bardo is the provost and vice president for academic affairs at Bridgewater State College.

LINKING FAIRFIELD



Fairfield University is linking every faculty and staff office and every student residence

with fiber-optic cabling, allowing high-speed data networking and easier access to the university's library and off-campus research institutions, libraries and other networks.



Mass Ed OnLine: Bay State Students on the Technological Track

Because education designed for the bygone industrial age has failed to provide adequate work skills for the information age, society invests *twice* to train most employees. First, taxpayers and parents spend millions of dollars on elementary, secondary and higher education. Then, businesses spend millions more, filling in the knowledge gaps left by an obsolete educational system.

Yet some Massachusetts towns such as Monson, Georgetown and Manchester-by-the-Sea have garnered community support to update their school systems by establishing technologically advanced media centers and networks, integrating technology into curricula, and training teachers and parents in the use of that technology.

Unfortunately, these communities are exceptions. The commonwealth of Massachusetts generally has failed to provide its 850,000 elementary and secondary school students with access to information technologies.

A recent statewide study revealed that Massachusetts offers only one computer for every 13 students, and most of those computers are technological dinosaurs. Less than half the computers have hard drives, and only 27 percent have modems. Sixty percent have no CD-ROM capacity.

Thirty percent lack the power to run even a basic Windows program, while half cannot even be networked. Only 35 percent of our public schools have media or computer specialists, and few use local area networks. A 1992 study showed that while 33 percent of our public schools used some sort of telecommunications application, only 6 percent of our teachers are involved in such efforts.

Furthermore, Massachusetts spends just \$33 per student on technology — about 5 percent of the state's average \$5,500 per-pupil expenditure. Of that \$33, two-thirds is spent on computer hardware. Only 4 percent is spent on teacher training. What training is available comes through 28 technology collaboratives, which are largely underutilized.

Recognizing that these technological shortcomings must be addressed if Massachusetts is to provide equal educational opportunities for all students, state policymakers incorporated technology education into the state's Education Reform Act of 1993. As the legislative initiative developed, educators and economists alike determined that the state's information superhighway must travel beyond elementary and secondary schools and transcend public and private boundaries. The result is Mass Ed Online.

The technological component of the state's education reform agenda, Mass Ed Online is meant to put technology at the service of our public education system and to link schools with higher education institutions and other entities. The initiative is designed to: give students powerful learning tools; provide technical and professional support for teachers; and improve administrative efficiency by reducing paperwork and enhancing accountability.

Mass Ed Online is designed as a partnership between state agencies, local governments, the private sector, parents and educators. Its aim is to facilitate creation of key elements of a telecommunications infrastructure, ensuring availability of needed professional development programs and subsidizing local acquisition of telecommunications hardware and software. These efforts will serve schools' immediate needs and help them comply with the challenging demands of the state's education reform agenda.

Schools that take full advantage of opportunities created by Mass Ed Online will have the world at their fingertips. Teachers may access the best curricular ideas and materials. Administrators' reporting and paperwork burdens will be eased. And parents and policymakers may hold the education system more accountable for its performance.

Mass Ed Online will be financed through a combination of state budgetary and capital funds, federal grants, local resources and private-sector partnerships.

This investment in Mass Ed Online is essential to make the critical connection between education and employability. We expect our young people to work in the information age. It is time we gave them the information they need to do so. Mass Ed Online is the information network through which Massachusetts will ensure both the quality of its human resources and the health of its economy.

**By
Piedad F.
Robertson**

Piedad F. Robertson is the secretary of education in Massachusetts.

New England's Infocommunication Industrial Complex

Remember when movies were shown only in theaters, financial transactions were done in banks, learning occurred in classrooms and television fare consisted of three major networks and a handful of local stations? Inventions from ATMs to VCRs have changed all that. But the biggest changes are yet to come, as new communications technologies provide the means to tap into all of these services and more from the convenience of a home computer/video information "node."

Corporate battles are well underway as companies seek to position themselves for dominance in what is sure to be a multibillion-dollar market. The implications for New England, in terms of business formation, job growth and tax revenue, are enormous. The region boasts a thriving telecommunications industry characterized by technological prowess and high wages.

INFOCOMMUNICATION COMPLEX

The precise evolution of this brave new world defies prediction by even the most insightful technologists. Accurately projecting the future of the industry would require knowledge not only of the development, timing and relative costs of emerging communications technologies, but also of the ways government regulation will shape their use. Still, it is useful to recognize the emergence of an infocommunication complex of four types of organizations: information creators, information packagers, information distributors and information enablers.

The *information creators* are those companies that produce the raw material of the infocommunication industrial complex. The information creators include movie and recording studios, publishers, government agencies, research institutes and schools. New York City and Hollywood are dominant entertainment creation centers, and Washington, D.C., is the premier repository of government-related information. But strength in publishing and academic research gives New England an important stake in information creation. Massachusetts ranks third in the nation in terms of the share of its workforce concentrated in publishing; Vermont ranks fifth, and Connecticut, sixth. The information creation role of New England higher education is supported by the region's disproportionately high number of colleges and universities, concentration of graduate students and total research and development expenditures.

All of these organizations provide information today, but demand for their information products will grow as access to it expands. The impact of the home videocassette recorder is illustrative. As VCRs became common

household appliances in the 1980s, video rental stores began competing with theaters for the viewer's dollar by providing lower cost, convenient access to video entertainment. Since theaters still offered large screens, better sound systems and earlier release dates, rental stores didn't replace them, but they held ticket prices in check and broadened overall access, resulting in increased demand.

The next dimension in the infocommunication complex consists of *information packagers*: radio and TV networks, cable networks and on-line computer services. These information packagers usually add little new to what is produced by the information creators. Rather, their role is to pull together disparate — or related — elements of information so they become more accessible to consumers. So, for example, country music lovers need only find the right radio station to hear their preferred music. Cable channels are increasingly presenting their programming unified around a particular theme, such as sports, news or comedy.

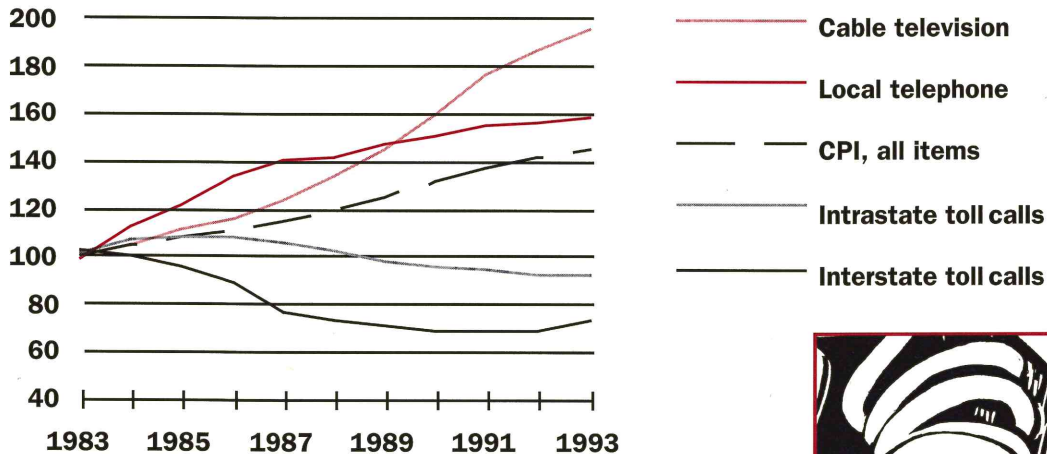
The information packagers tend not to rely directly on their ultimate consumers for revenues, instead selling billions of dollars worth of commercial time to advertisers. This pattern, however, may well change as delivery systems such as home video enable consumers to bypass the packagers — and the advertisers. In fact, this threat of circumventing the information packagers has motivated information packagers to try to buy information creators, many of whom possess copyrights over the use of their products. The \$10 billion takeover battle between information packagers QVC and Viacom for information creator Paramount is one recent example of packagers buying creators. (Viacom ultimately prevailed.) Other examples include the 1990 acquisitions of Columbia Pictures & Entertainment by Sony Inc. and MCA Inc. by Matsushita Inc., which makes Panasonic products.

Still, the most important changes are expected to occur among those companies of the next dimension in the infocommunication complex: *the information distributors*. For most of the 20th century, AT&T was "the" phone

**By
Richard J.
DeKaser**

PAYING THE BILLS

U.S. CONSUMER PRICE INDEX FOR TELEPHONE SERVICE, CABLE TELEVISION AND ALL ITEMS, 1983-1993



Competition in the long-distance telephone market drove the cost of interstate calls down 20 percent from 1983 to 1993. Meanwhile, consumer demand for more programming and clear reception nearly doubled the average cable television bill over the same period.

Source: Federal Communications Commission.



company — a natural monopoly providing universal service. By the late 1960s, however, the telecommunications giant began to lose its monopoly status. In 1968, a court decision allowed a firm named Carterfone to manufacture phone equipment which could be attached to existing phone company lines, effectively opening up the market for “customer premises equipment.” And in 1969, the Federal Communications Commission (FCC) granted an application to a company, now known as MCI, to provide private line service between Chicago and St. Louis.

In 1984, federal Judge Harold Greene set the terms of AT&T’s breakup. Seven independent regional bell operating companies were established, each with domain over local exchange and cellular phone services. These “Baby Bells” were prohibited from providing long-distance service, manufacturing telecommunications equipment or offering on-line information services (though this last restriction was lifted in 1991). AT&T retained ownership of long-distance services, the firm’s research apparatus (Bell Labs) and all manufacturing operations.

The divestiture of AT&T and subsequent deregulation of the phone industry ushered in the competition that has characterized the past decade. Long-distance carriers, forced to pay access fees to local phone companies for connecting to their network, are now attempting to end-run the local carriers by purchasing cellular phone

companies (note AT&T’s proposed purchase of McCaw Cellular) or by building their own local networks (as MCI is doing in Chicago).

The Baby Bells are clamoring to get back into the long-distance market and manufacture their own equipment, much of which is now purchased from competitors. They are also waging war with cable operators, who enjoy the status of a regulated monopoly within their defined service territories. The Baby Bells say they need the revenues from selling video services such as cable television to upgrade their “twisted pair” analog infrastructure to a fiber-optic and coaxial-based digital system capable of delivering high volumes of information.

Until recently, the Baby Bells were prohibited from owning cable companies and vice versa. But in 1992, the FCC began opening up the cable market by allowing the Baby Bells to purchase cable operators outside their own service territories. The first deal came in February 1993, when Southwestern Bell bought two cable operators in suburban Washington, D.C. A subsequent deal, involving Bell Atlantic and Tele-Communications Inc., the nation’s largest cable operator, was nixed after the FCC stepped up its control of prices in the cable industry. Had the merger been consummated, the new entity would have served more than 20 percent of U.S. homes — the broadest such penetration since the breakup of AT&T.

Meanwhile, the FCC is encouraging competition in local phone markets by allowing cable operators to build or acquire private communications networks. Tele-Communications Inc. and Cox Communications made the first such move when they purchased Teleport Communications Group in August 1992.

NEW ENGLAND'S SPECIALTY

Movie studios, phone companies and local TV stations have household names. Manufacturers of satellites, switches, fiber optics and data compression software do not. Indeed, the producers of enabling technologies — *information enablers* — operate in the least visible dimension of the infocommunication complex, but not the least important, particularly in New England.

The equipment segment of this industry alone was worth \$50 billion in 1993 and posted double-digit increases in shipments during each of the past two years. Furthermore, the enabling technologies will figure prominently in the evolution of the entire infocommunication complex. Data compression technology, for example, squeezes large amounts of information into very small packages. Advances in this technology will influence the outcome of the battle between “narrow-band” communication media like phone lines, and broadband media such as coaxial and fiber-optic cable. At the same time, fiber-optic manufacturers are working to develop cheaper synthetics that will also influence the economics of communication.

The enabling technologies industry has become an important part of New England's economic landscape. Massachusetts is second only to California in production of telecommunications equipment and touts a higher concentration of telecommunications equipment workers

than any other state — more than three times the national average. Moreover, their compensation is 40 percent greater than the state average. Massachusetts is also home to more than 120 software firms specializing exclusively in telecommunications applications.

Why do we find such a concentration of telecommunications activity in Massachusetts? The answer is no different than it's been for most of the growth industries that New England has hosted during the latter half of the 20th century. Namely, the region's prestigious institutions of higher education attract some of the nation's most talented students and professors who, in turn, attract huge amounts of federal funding for advanced research and development. Ultimately, the fruits of such labor and investment spill over into the private sector, in the form of new commercial technologies.

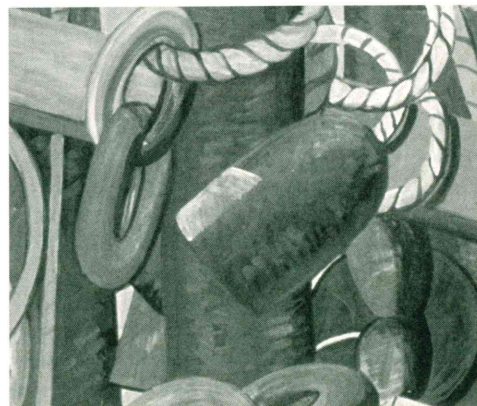
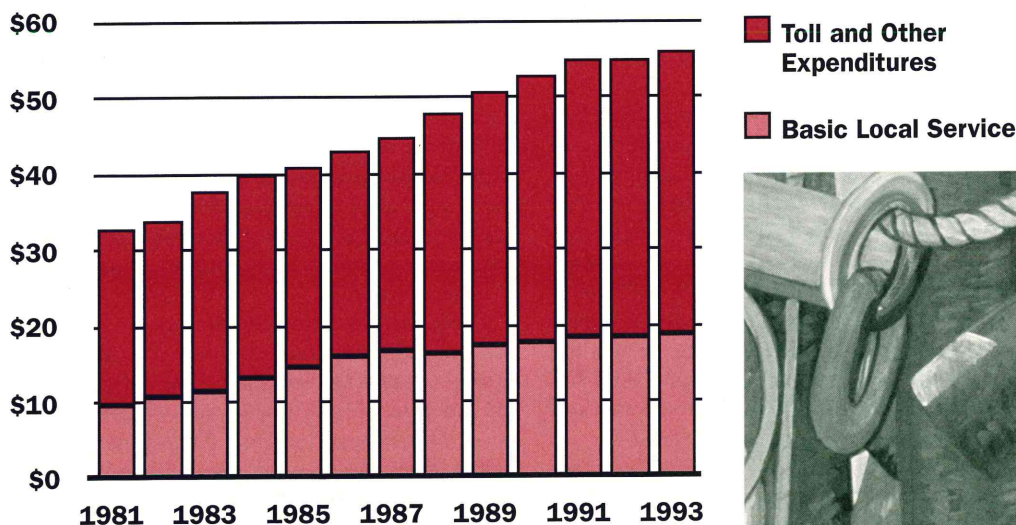
Maintaining this regional lead in telecommunications, however, will require competition of a different type. As other states and regions have recognized the importance of education and research in building a high-wage economy, they have stepped up their own efforts to strengthen their educational systems and successfully fought for a greater share of federal funding.

And while New England is still conferring a disproportionately high number of degrees in the information sciences and engineering, and attracting more than its share of federal R&D grants, its piece of each pie has declined during the past decade. Halting this trend — even better, reversing it — is imperative if New England is to maintain its place in the infocommunication complex and see its economy grow.

Richard J. DeKaser is senior economist at the Bank of Boston and a member of the Massachusetts Telecommunications Council.

DIALING ONE

AVERAGE MONTHLY EXPENDITURES FOR U.S. TELEPHONE SERVICES



Note: Other expenditures include charges for equipment, additional lines, connection, 900 service, and directory listings.

Source: Federal Communications Commission.

Telecommunications: A Public Good?

Competition is making for rapid changes in telecommunications and in our information-dependent society. The days of the paternalistic, soft and fuzzy, local monopoly telephone company are over. Long-distance carriers are providing local service. New and independent companies known as “competitive access providers” have emerged. Alternative pay phones exist. Cellular service has grown faster than expected. Cable television companies want to be allowed to provide local telephone service. New low-frequency, over-the-air technologies are emerging.

Competition in a growing number of business lines has the local telephone companies acting in ways they never have before. The so called “Baby Bells” are striving for efficiencies, reducing the number of employees per access line and lowering costs in other ways. They are also working aggressively to change the regulatory regime under which they operate. The activity in the courts, Congress, the Federal Communications Commission and state utility commissions on the telecommunications front is building to a crescendo this year.

One of the more difficult policy issues under debate relates to how we garner the efficiencies and benefits of a fully competitive free market while maintaining and ensuring compliance with important policy goals. The telephone sector is a heavily legislated and regulated business. If these constraints are lifted, how do we ensure achievement of universal service and ubiquitous deployment of the expensive and capital-intensive digitally switched, broadband telecommunications platform?

The critical issue is the value of telecommunications to the community. Is it similar to education in that we all agree that society as a whole shares the financial burden of educating its people, because the benefits of an educated population outweigh the financial hardship of providing education? Public education is not paid for by user fees but by broad-based taxes, such as property or income taxes. Is advanced telecommunications important enough to dictate that all ratepayers, even those who will be completely satisfied with Plain Old Telephone Service (POTS), pay the cost for services and deployment of new technologies in the network?

Large segments of the population don’t have computers, will never move data and are simply not interested in new broadband telecommunications services. On the other hand, if the cost of advanced telecommunications is not shared, will the telecommunications providers operating in a competitive environment deploy new

technologies only in wealthy neighborhoods and business districts? Will the technology ever reach the majority of Americans? If not, we run the risk of creating a society of information haves and have-nots.

There are numerous other issues being debated, many of which higher education should be watching closely. Included among these is the issue of who will control price and access to the information on the “superhighway.” The telephone industry is contemplating numerous mergers and acquisitions, many of which are geared toward gaining control of the front-end of the business. The industry has come to the conclusion that owning and maintaining the network that transports information is fine, but the real money to be made is in controlling the creative side, the content, the information that rides on the highway. Will information be free and open to the public or will there be a price put on access, even in education settings? The academic community clearly has a stake in this issue and its voice must be heard.

As these issues are sorted out, we must also assess the potential impact this changing environment will have on how we do business. Distance-learning, automated administrative functions, campus networking, recruitment and teleconferencing are some of the potential applications of telecommunications for higher education. Library services and campus layout may also have to be reconsidered.

The higher education community can no longer interpret telecommunications to mean the campus computer system and data processing. The perspective must be expanded to include a new realm of potential applications, all striving to integrate the technical side with the policy issues. To do otherwise will erode the competitive posture, stature and position of our centers of higher education.

James J. Malachowski is the chairman of the Rhode Island Public Utilities Commission.

**By
James J.
Malachowski**



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THE NEW ENGLAND BOARD OF HIGHER EDUCATION ANNOUNCES



THE COMPACT *for* FACULTY **DIVERSITY**

The New England Board of Higher Education has joined the Southern Regional Education Board and the Western Interstate Commission for Higher Education in a national effort to increase the number of African-Americans, Hispanics and Native Americans who teach at U.S. colleges and universities.

The Compact for Faculty Diversity program has received more than \$5 million in state, university and foundation funds (including a \$3.5 million startup grant from The Pew Charitable Trusts and \$500,000 from the Ford Foundation) to recruit minority students for graduate study and provide them with the financial and academic support they need to complete Ph.D.s and enter college teaching.

The program will focus on 36 states that are members of the three participating regional groups. The compact's objective is to prepare 400 new minority faculty members nationwide by the year 2000.

In New England, the initiative will provide five years of financial and academic support for "NEBHE Doctoral Scholars" in science, mathematics and engineering. The program will also provide one year of support to "NEBHE Dissertation Scholars" in the humanities and social sciences who are near completion of their Ph.D.s. Nine New England campuses will participate in the first two years of the program, with others expected to join in 1996.

For more information, write to the New England Board of Higher Education, 45 Temple Place, Boston, MA 02111, or call (617) 357-9620.



Recovering: New England Emerges from Recession

JOSEPH B. WHARTON
YOLANDA K. KODRZYCKI

Twice a year, the New England Economic Project (NEEP), a nonprofit association of economists from New England banks, higher education institutions and other organizations, presents its economic “outlook” for each of the six New England states and the region. Recently, NEEP and the New England Board of Higher Education agreed to publish exclusive periodic reports on the outlook in CONNECTION. NEEP’s current outlook is based on a New England banking forecast by Philip J. Lane, professor of economics at Fairfield University, and state forecasts by the following: Edward J. Deak, chairman of the economics department at Fairfield University in Connecticut; Charles S. Colgan, professor of public policy and management at the University of Southern Maine; Peter P. Kozel, professor of finance at Babson College in Massachusetts; Dennis C. Delay, senior economist at Public Service Co. of New Hampshire; Leonard Lardaro, professor of economics at the University of Rhode Island; and Jeffrey B. Carr, an economic consultant to the state of Vermont.

Revised data reveal that New England’s recession ended in June 1992 – that’s 13 months earlier than previously thought.

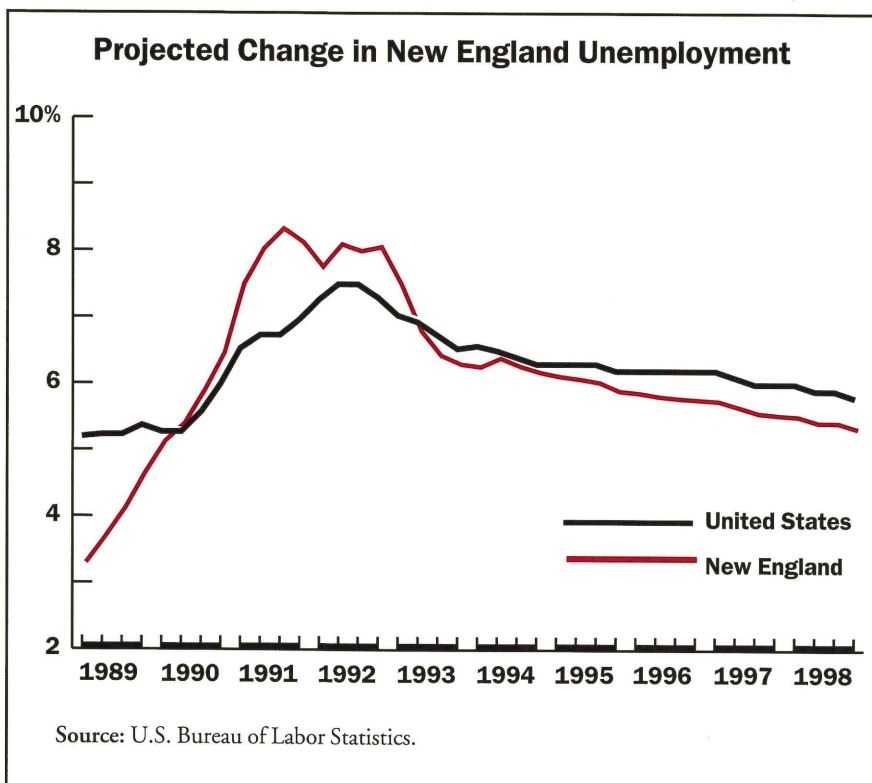
New England is in the midst of a long-awaited economic recovery that will be characterized by rising living standards and falling unemployment rates over the next five years.

Indeed, for the first time since the late 1980s, New England is keeping pace with other regions of the United States in economic growth.

The New England Economic Project forecasts that New England’s total employment will grow by about 2 percent in 1994, while the region’s output of goods and services — gross regional product —

will rise by 3 percent. The growth is projected to continue through 1998, albeit at a slower pace.

The service sector — including business services, health care, education and a variety of other non-manufacturing industries — will be New England’s main economic driver over the next five years, rising to account for 33 percent of the region’s jobs in 1998, up from 27 percent in 1989. This growth in employment share will come at the expense of the manufacturing sector, which will continue its long decline to account for 15 percent of New England



jobs in 1998, down from 20 percent in 1989. Trade will maintain its 24 percent share of the region's jobs, while the category called "other nonmanufacturing," which includes finance, construction, transportation and government, will maintain its 28 percent share.

In the past year alone, employment in New England's service sector has expanded at a rate of close to 5 percent, while jobs in durable manufacturing have continued to disappear at a rate of about 4 percent annually, due largely to shrinking markets for defense, aerospace and minicomputer products.

It should be noted that while the trend toward service jobs and away from manufacturing will be wrenching for some of those involved, it will not prevent real growth in overall income for the region.

Revising the recession

In the first quarter of 1994, the U.S. Bureau of Labor Statistics released revised state and regional employment data. The updated view of recent economic history does not change the fact that New England has suffered a far deeper recession than the rest of the United States. But the new data reveal that the region's recession ended in June 1992 — 13 months earlier than previously thought. Moreover, the New England economy did not subsequently stumble along with fits and starts, but began to

generate real job growth at a rate comparable to the rest of the country.

By April 1994, New England had gained back 195,000 — or 30 percent — of the 650,000 jobs lost since February 1989. During the first four months of 1994 alone, the region added nearly 70,000 jobs. Of the six New England states, only Connecticut had yet to begin a clear upturn (though the revised data reveal that even Connecticut employment is flat, rather than declining).

New England's unemployment rate averaged 6.2 percent in the first quarter of 1994, compared with the U.S. figure of 6.6 percent. Furthermore, NEEP projects that New England job growth will outpace growth in the labor force.

New England's overall population inched up 0.2 percent in 1993, despite continuing population declines in Connecticut and Rhode Island. And by 1995, the region's population will begin growing by at least 0.5 percent per year. Still, the

service sector — particularly the health care and business services industries — will produce jobs faster than the adult population grows. As a result, the New England unemployment rate is projected to fall gradually to 5.4 percent in 1998.

Regional real per-capita income grew by 0.6 percent in 1993 — similar to the national increase. Connecticut continues to boast the nation's highest real per-capita income. NEEP projects a regional increase in real per-capita income of 3.9 percent this year, followed by average annual increases of 2.4 percent through 1998. This growth is driven by higher employment and increasing productivity, which, in turn, is the result of more investment in new capital equipment by the region's employers.

Forecasting growth

The NEEP outlook is based on a macroeconomic forecast prepared in March 1994 by Regional Financial Associates (RFA), a Pennsylvania-based consulting firm. RFA predicts that the national economic expansion that began three years ago will continue throughout the five-year forecast horizon. The fastest growth will occur in 1994, as U.S. gross domestic product rises by 3.7 percent in real terms. The growth should slow in

1995 and beyond to about 2.7 percent, as consumers are unable to sustain their rate of spending growth. U.S. employment is expected to grow by 1.9 percent in 1994, followed by average annual increases of 1.6 percent through 1998.

The prognosis for New England closely resembles the national forecast. Real gross regional product is projected to increase by 3.3 percent in 1994, and by an average of 2.6 percent annually for the remainder of the five-year forecast period. In 1994, New England employment will rise by 2.1 percent, followed by

average annual increases of 1.6 percent from 1995 through 1998. Notably, New England's total employment will not exceed its 1989 peak until the final quar-

The service sector — particularly the health care and business services industries — will produce jobs faster than the adult population grows. As a result, the New England unemployment rate is projected to fall gradually to 5.4 percent in 1998.

ter of 1998 — an indication of the severity of the region's 1989-1992 recession. In contrast, the United States as a whole has already fully recovered from the milder national recession.

The New England outlook differs from the nation's in another key respect: the sector-by-sector composition of growth. New England will experience a relatively greater expansion in services and greater erosion in manufacturing than the United States as a whole.

NEEP forecasts a loss of 85,000 New England manufacturing jobs from 1993 through 1998. Most of the shrinkage will come in defense-dependent durable manufacturing industries — especially electrical and non-electrical machinery and transportation equipment. Nondurable manufacturing industries are projected to add a few thousand jobs in the cyclical upswing of 1994 and 1995. But in the longer term, few New England manufacturing industries are expected to expand their workforces.

New England's nonmanufacturing industries, meanwhile, will increase employment by 2.9 percent in 1994 and by just over 2 percent a year for the remainder of the forecast, for a five-year total increase of more than 600,000 jobs.

More specifically, the health services industry — which employs one in 10 New Englanders — will continue to provide job opportunities. But the restructuring already underway in the hospital sector, along with the impact of some form of national health care reform assumed to begin in 1996, will cut the rate of growth in this, the only industry that continued to expand throughout the late, great recession. About 90,000 net new health services jobs are anticipated over the five-year period. This represents an average annual rate of expansion of about 3 percent, down from the almost 4 percent rate of growth seen during the past five years.

In the past year, employment in business services has soared, in part reflecting corporate policies to use temporary workers and to farm out work that would previously have been performed in-house. NEEP projects a greater than 6 percent rate of growth in business services jobs this year, and the creation of 60,000 new jobs during the 1994-98 period. Another 170,000 new jobs are expected in the miscellaneous service category, encompassing industries from auto repair to engineering, from household help to law.

Trade will be another substantial source of job gain in New England, adding 170,000 jobs over the five-year period — equal to all job losses in trade between 1989 and 1992.

A surge in housing construction and the beginning of a modest recovery in nonresidential building, meanwhile, are expected to result in a 6 percent increase in construction jobs this year, on top of a 4 percent gain in 1993. With long-term interest rates rising and pent-up housing demand largely satisfied, NEEP foresees more modest gains in future years — in the range of 2 to 3 percent. Thus, the New England construction workforce of the late 1990s is likely to be only two-thirds the size it was in the late 1980s.

NEEP also projects that employment in transportation and public utilities, finance-insurance-real estate and the federal government will remain essentially constant. Efforts by banks, insurance companies and utilities to reduce operating costs appear to be offsetting the effects of recent hiring by money management firms. Meanwhile,

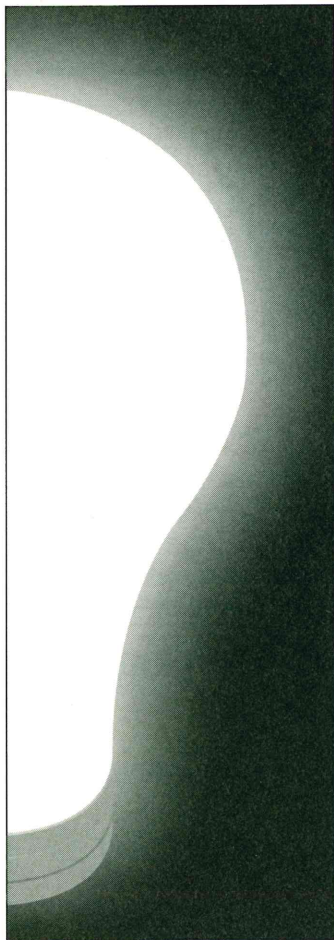
continuing military base closures will help keep federal government employment flat in New England. And though state and local government budgets have grown somewhat, job growth is unlikely to rise above roughly 1 percent a year — far short of historical rates of expansion.

Spurring the economy

The NEEP outlook for the six New England states incorporates the anticipated impact of the states' economic development policies. These policies range from encouraging expansion in the service sector to taking direct action to halt the slide in manufacturing jobs.

For example, Maine's state government has worked with the Department of Defense to bring 750 new finance and accounting jobs to northern Maine communities whose economy would otherwise be devastated by the closure of Loring Air Force Base and the attendant loss of 2,800 military and civilian jobs.

Rhode Island Gov. Bruce Sundlun, meanwhile, has initiated an in-depth look



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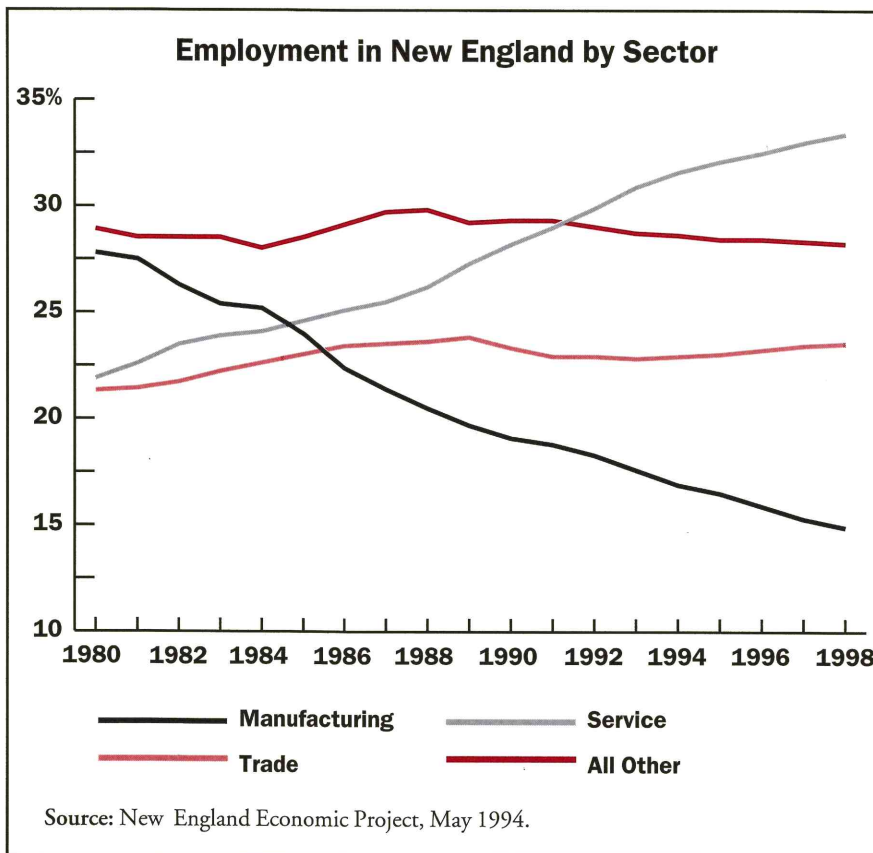
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at the fundamentals of what makes firms locate in a given state. The examination will focus on whether reforms in Rhode Island's worker's compensation and business regulation have gone far enough to attract and keep businesses in the state.

The state of Connecticut has pursued a four-pronged strategy for economic development: reduce business taxes; cut energy and other costs of doing business; aggressively promote the state as an attractive place to do business; and provide companies with direct assistance, including tax breaks. The state Department of Economic Development claims that the direct aid has saved or created about 40,000 jobs, many of them salvaged when state incentives convinced a restless Pratt & Whitney to remain in Connecticut. Notably, however, the Connecticut business community wants to be sure officials in Hartford focus on continued improvement of the state's *general* business climate.

In the longer term, the New England states must find ways to create and sustain high-quality jobs. One common theme undoubtedly will be the importance of education from grade school through graduate school. Telecommunications manufacturers, for example, cite the quality of K-12 and higher education as two of six critical factors in deciding whether to locate plants in Massachusetts, according to a survey conducted by a committee of telecommunication industry leaders, which was convened by Massachusetts Gov. William F. Weld. At the college level, New England continues to benefit from an unparalleled network of major universities and research centers, which regularly spin off ideas, products and startup businesses. If New England is to sustain job growth and regional economic development, the region must harness this creative power. Public and private decision-makers should also consider reducing business costs to a level closer to the national average and encourage promulgation of consistent, clear business regulations. And all this must be done without sacrificing our regional quality of life, which, itself, may be New England's key asset as it strives for continued recovery.

Joseph B. Wharton is the president of the New England Economic Project and assistant to the president and CEO of New England Electric System. Yolanda K. Kodrzycki chairs the forecast committee of the New England Economic Project and is a senior economist at the Federal Reserve Bank of Boston.



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The Ghost of New England's Future

Reversing Declines in Educational Attainment

STEPHEN P. COELEN
DIANE L. SAUNDERS

When New England's economic rebound reaches full force, the region is likely to return to a situation marked by shortages of highly educated people.

Ebenezer Scrooge was very fortunate. He was presented with a vision of what the future would hold if he didn't change his behavior. He was also wise. He didn't ignore the information he was given because ultimately he understood the consequences of doing nothing. He was forced to examine a shocking and accurate picture of the consequences of his greed, of keeping blinders on and ignoring his employees and fellow citizens. New England is in a similar position.

The region recently was provided with a vision of what our future will look like if we do nothing about declining educational attainment. The question is whether we will be as wise as Scrooge and change our behavior now in order to avert a bleak future.

A study released in late 1993 — *Beyond 2000: Demographic Change, Education and the Workforce* — provides a primer on the current state of educational attainment in New England and a prediction of the future based on regional population growth between now and the year 2012. The study, commissioned by Nellie Mae, the nation's largest nonprofit provider of education loans, and conducted by the Massachusetts Institute for Social and Economic Research at the University of Massachusetts at Amherst, warns of dire consequences if New England educators, policymakers and business leaders do not intervene to reverse negative trends in college completion rates.

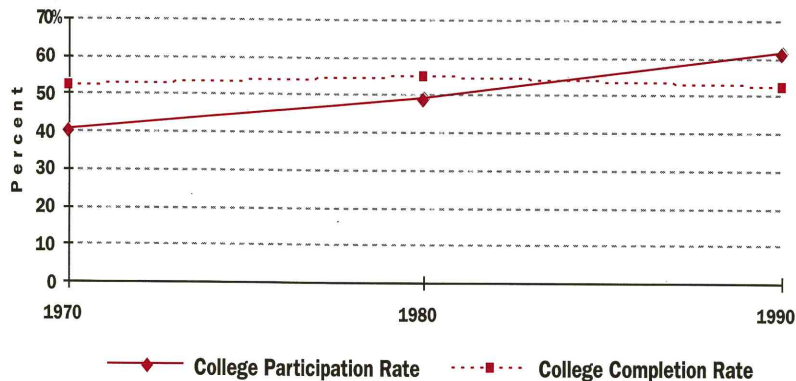
Beyond 2000 provides the snapshot of a region where deficient workforce education levels could stymie economic growth. The report's overriding message: If New England is to solve the problem, the region's colleges and universities must redouble

efforts to "retain" low-income and minority students through to graduation.

To understand the problem, it is important to realize that more students are getting into college these days than 20 years ago, but the rate at which those students complete *four-year* degrees has fallen. Between 1980 and 1990, the rate of college completion declined for *all* New Englanders over age 25. But the decline was most significant among low-income and Hispanic, African-American and Native American populations. In this period, graduation rates for Hispanic, Native American, Eskimo and Aleutian students declined by almost 15 percent. Graduation rates declined by almost 9 percent among African-Americans, almost 5 percent among Whites and about 4 percent among Asian-Americans and Pacific Islanders.

New England, meanwhile, has the fastest-growing minority population in the United States, when measured as a percentage of total population. In the three southern New England states, minorities will account for more than 30 percent of new labor force entrants by the year 2012, up from about 15 per-

COLLEGE PARTICIPATION VS. COMPLETION



Source: Massachusetts Institute for Social and Economic Research.

The *college participation rate* refers to the proportion of people age 25 and over who completed at least some college relative to those who completed at least high school. The *college completion rate* refers to the proportion of people age 25 and over who completed a four-year college degree relative to those who had at least started college. The authors acknowledge the importance of two-year college degrees as either terminal degrees or stepping stones along the way toward more education. Comparable data on the completion of two-year degrees, however, is unavailable for the period 1970 to 1990.

cent today. The minority share of the region's labor force is growing faster than the White, non-Hispanic share for several reasons: 1) the minority population is younger, so a larger percentage of minorities are in their childbearing years; 2) fertility rates are higher among minorities; and 3) minorities are migrating to the region at a higher rate than Whites. For historically homogeneous New England, this is a dramatic change for which very few communities and educational institutions are adequately prepared.

Why low attainment?

Educational attainment is affected by a number of variables alone and in combination with race and ethnicity.

There is some evidence that educational attainment in a community is more a product of income and class than of race and ethnicity. In fact, less than 4 percent of the variation in educational attainment from one community to the next is explained by data on racial and ethnic composition, while 43 percent is explained by income coupled with race and ethnicity.

Language is also an important variable. Most significantly, Hispanic and Asian students who come from homes where adults do not speak English may suffer from what is termed *linguistic isolation*. In New England, an estimated 26 percent of Hispanics and 30 percent of Asians are linguistically isolated.

Another factor widely acknowledged to influence educational attainment is teenage pregnancy and the attendant problems of single motherhood. The total numbers of births to young mothers in New England

are highest in Massachusetts and Connecticut, because of the larger overall populations in those states. But again, race and ethnicity are not the key determinants. The highest rates of pregnancy per 1,000 women between ages 15 and 24 occur in Maine and Vermont — states with comparatively small minority populations.

Most significantly, the 1990 census reveals that in every New England state, more than 25 percent of births to women between ages 15 and 24 are to single women. (The figure is closer to 50 percent in Connecticut and Massachusetts.) Many of these women wrestle with the problems of inadequate child care, poverty and other barriers to continuing their education. In Massachusetts, 30 percent of all unmarried women between ages 20 and 24 who became mothers as teenagers fail to complete high school and do not earn equivalency degrees. In comparison, only 9 percent of unmarried women who were not teenage mothers failed to get high school diplomas or equivalents.

Demographic change

Demographic change in New England goes beyond the increase in young, minority populations. There has been a significant drop in the *total* number of high school seniors, due largely to a declining White, non-Hispanic population, which still makes up the vast majority of the region's total population.

As a result of the overall demographic decline, Connecticut, Massachusetts and Rhode Island each saw high school graduating classes shrink by more than 30 percent from 1980 to 1992. The losses were

less severe in the northern states; high school graduating classes declined by 10 percent in New Hampshire and Vermont and by 20 percent in Maine.

These decreases undoubtedly have exerted pressure on colleges trying to maintain enrollments. Were it not for increasing college *participation rates* among all students — particularly minority and older students — and better recruiting outside the region, college enrollments in New England would have declined at the same rate as high school enrollments. In actuality, the number of New Englanders with *some* college education grew by about 24 percent during the 1980s.

Still, as a result of the demographic shifts, colleges face the dilemma of spreading their considerable fixed costs over fewer student shoulders or opening their doors to more students, many of whom need financial aid, which is subsidized by students who *can* pay. In either case, the result is increasing costs for many students. Indeed, college costs absorb an increasing part of the average family budget, threatening access to college for lower- and middle-income families.

Recent statistics from a Minnesota study have shown as much as a 25 percent decline in the number of students attending college from families with annual incomes of \$30,000 and under in the past 13 years. Although the study looks at one state, these trends can be seen in New England and across the country. This decline coincides with a 200 percent increase in college costs since 1980, the failure of the federal Pell Grant program to keep up with these

increases, and declines in most state scholarship and grant programs for low-income and part-time students.

The support systems that had increased educational opportunity and access in the 1960s and '70s fell prey to rising college costs, decreases in federal and state financial aid support, the economic bust that began in the late 1980s and the strain of a growing population of students who need a broader range of support services.

Economic returns

Economically, it is in each person's interest — and in New England's interest — to strive for a high level of educational attainment. National data from the U.S. Bureau of the Census reveal that the median

income of high school graduates in 1990 was \$12,924, compared with \$5,904 for people without a high school diploma. People with associate degrees earned an average of \$20,000, while bachelor's degree holders earned about \$25,000. Master's degree recipients earned approximately \$33,000 on average, Ph.D.s earned \$46,000, and holders of professional degrees earned \$60,000.

Relative wage shifts among skilled and unskilled workers provide another argument for increasing overall educational attainment. In New England, full-time workers without high school diplomas lost economic ground between 1989 and 1991, as their incomes declined by 6.2 percent in absolute dollars. During the same period,

full-time workers with four-year college degrees saw their median income rise by 3.2 percent in absolute dollars. Those with a high school diploma or some college saw no change in wage and salary income.

Such wide gaps in income growth reveal a dangerous imbalance in the economy. While it is reasonable for those with greater educational attainment to earn more, there is no rationale (other than perhaps marked productivity shifts) for the relative change in wages to vary so dramatically among workers with different levels of education.

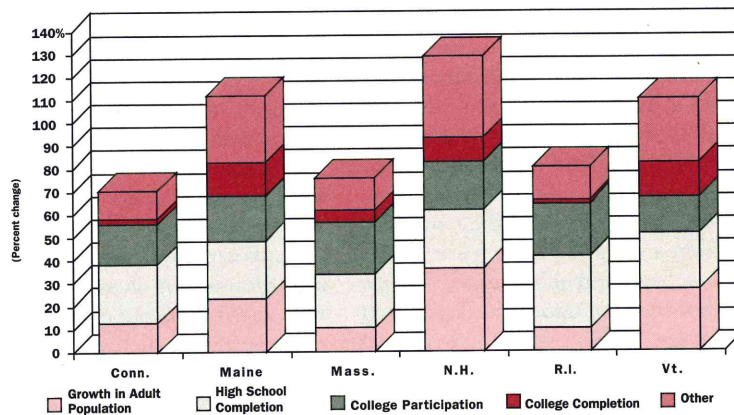
This points to a need to reduce the pool of less-educated workers by increasing educational attainment. Without such a shift, those at the bottom fail to keep pace with increases in the cost of living and

WHY THE NUMBER OF FOUR-YEAR COLLEGE GRADUATES GREW:

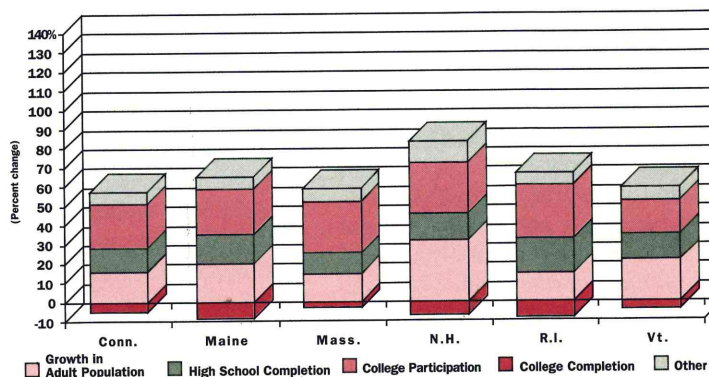
From 1970 to 1990, the population of four-year college graduates in New England rose faster than the region's overall population, as a growing percentage of New Englanders finished high school, attended college and completed college. But while New England's population grew faster in the 1980s than in the 1970s, the '80s produced smaller increases in the number of four-year college graduates. One reason is that four-year college completion rates rose during the 1970s, but declined during the 1980s. Why?

- By the 1980s, greater proportions of students chose to complete an associate degree or take occasional college courses without pursuing a four-year degree program.
- Students increasingly start college later in life and take longer to complete four-year degrees, so by the 1980s, the census data on the population age 25 and over included more people who had not yet completed a four-year college degree, but may in the future.
- In the 1980s, students had more difficulty completing four-year college programs due to factors such as inadequate academic preparation, unmet financial need and, particularly in the case of underrepresented populations, a lack of social support systems on campus.

FAIRLY STEADILY BETWEEN 1970 AND 1980 AND . . .



MORE SLOWLY BETWEEN 1980 AND 1990



Source: Massachusetts Institute for Social and Economic Research.

**CHANGE IN FOUR-YEAR COLLEGE COMPLETION RATES
AMONG RESIDENTS AGE 25 AND OVER: 1980 TO 1990**
(Figures in parentheses show declines)

	Total Population Age 25 and Over	Whites	Blacks	Hispanics	Asian-Americans
Boston, Mass.	0.01%	4.2%	(0.01%)	(15%)	(1.6%)
Lawrence, Mass.	(12.2)	(4.2)	(30.3)	18.1	(27.6)
Manchester, N.H.	(11)	(12)	71.7	47.7	15
Hartford, Conn.	(14.7)	(4.2)	(25.3)	3.1	(25.7)
Providence, R.I.	(4.7)	(1.6)	(7.3)	8.6	(6.9)
Augusta, Maine	(18.5)	(17.6)	N.A.	0	(26.7)
Burlington, Vt.	(3.3)	(3.3)	(1.4)	(2.6)	14.5

Source: Massachusetts Institute for Social and Economic Research.

become more vulnerable, resulting in increased reliance on public assistance. This raises public-sector costs without adding productivity.

Moreover, New England's 1989-1992 recession hid the dangers of declining educational attainment. When the current economic rebound assumes full force, New England is likely to return to a situation marked by shortages of highly educated people. New England employers will be forced to pay higher costs to employ highly educated workers than they would if more of these workers were prepared by the region's colleges and universities. Notably, high labor costs are among the factors that have led New England employers to expand elsewhere or relocate.

Improving success rates

If current birth rate and migration patterns continue, minorities will account for 33 percent of Connecticut's new labor force entrants by 2012, compared with 18 percent in 1985, according to the *Beyond 2000* projections. Similar change will be seen in Massachusetts, with the minority share of new labor force entrants projected to increase from 12 percent to more than 30 percent during the same period. Other New England states are expected to see significant minority population growth, as well.

The most rapidly growing segments of the population have historically attained the lowest levels of education. Therefore, growth in an educated workforce now heavily depends on improving the educational "success rate" of minority populations. New England is not doing particularly well in preparing its currently small minority population for college, nor in helping minorities stay in college and earn degrees. With-

out a concentrated effort to increase long-term minority access and "retention," New England will undoubtedly continue to have an inadequately trained workforce during the next several decades.

Educational institutions, businesses and communities must act in unison to increase the college success rate of low-income and minority students by forging articulation agreements with high schools and providing better support services and financial assistance to students once they enter college. Inadequately prepared high school students cannot support regional economic development in areas forecasting growth, and cannot move out of the underclass and create economic success for themselves and their families.

College and university leaders must continue to explore new strategies and develop detailed plans to increase retention of students on campus. Academic institutions need to improve access and campus climates for all, increase the number of minority faculty to better mirror a campus's student body, and develop cooperative relationships between four-year colleges, community colleges and K-12 to improve student preparedness and success.

The federal financial aid system must also be retooled, so low-income students are not forced to borrow such enormous amounts that the probability of default is greater than the probability of graduation. This requires increases in the Pell Grant and scholarship programs, not increases in the use of income-contingent loan programs that only delay the inevitability of default for some low-income and minority students.

Businesses of all sizes must make wise investments in ensuring access to quality

education in their communities. Whether forming a partnership with a local school, providing financial assistance to an after-school academic program or providing internships for students, each and every business can make a contribution.

State coordinating boards and councils that support K-12 and higher education in New England must develop and implement detailed government relations plans to gain true and consistent support from state and national legislators. These education groups must cross lines and pull in business and community leaders to lobby local and state legislative bodies for systematic change that addresses our evolving regional demography. Among other things, these changes should include increased budgets for need-based scholarships and increased funding of public schools.

Now that we have a clear vision of the future, let us be at least as adaptable as Ebenezer Scrooge and exercise our ability to make a positive change in the course of New England's economic future. The fate of regional economic health and social well-being rests on our ability to act now. New England must develop a new blueprint that will enable it to continue the tradition of educational excellence across the spectrum of a culturally rich and increasingly diverse population.

Stephen P. Coelen is the executive director of the Massachusetts Institute for Social and Economic Research at the University of Massachusetts at Amherst and the primary author of the Beyond 2000 study. Diane L. Saunders is the vice president for communications and public affairs at Nellie Mae.



Reaching Out at Boston College

JOANN MOODY

Of all U.S. college students enrolled full time in bachelor's degree programs during the 1980s, only 54 percent graduated within six years, according to an American Council on Education report released in the spring of 1994. Graduation rates were even lower among some groups of students. For example, just 32 percent of African-American students graduated within six years, 41 percent of Hispanics, and 30 percent of Native Americans. By contrast, 56 percent of White college students and 63 percent of Asian-Americans graduated within the same period.

If African-American, Hispanic, Asian and Native American students are to have mentors, the great majority will by necessity be White.

No wonder "retention" is a hot topic in college administration circles these days. Too few students — particularly students of color — are retained by institutions and earn their degrees; too many drop out.

Boston College is one campus where retention efforts are producing results. The graduation rate for students of color at BC stands at about 85 percent. For a group of academically underprepared but highly motivated students who receive support through BC's "Options Through Education" program, the rate is even higher — about 92 percent over the past four years.

These underprepared students of color (almost half are African-American) persist in their studies and graduate because of their own hard work and the academic services provided by BC's Office of AHANA Student Programs. *AHANA* is an acronym originated at BC and adopted widely to designate African-Americans, Hispanics, Asians and Native Americans.

AHANA students made up 16 percent of BC's 1993-94 undergraduate enrollment of 8,807. Each year, 60 AHANA freshmen, mostly from inner-city schools, are accepted into the college's Options program and receive BC scholarships to meet their typically acute financial need. Because their academic

preparation is limited compared with that of students from more affluent public and private schools, they face a formidable task of catching up. But the students accepted into the special program demonstrate critically important traits: a positive self-concept; an understanding of racism and an ability to deal with it; a commitment to set and pursue long-term goals; demonstrated leadership experience; and attraction to volunteer work and community service. These measures of experience prove to be far more reliable than standardized test scores or even high grades in predicting who is likely to work hard and ultimately succeed in college.

Prior to their first year of study, Options students must complete intensive summer workshops focusing on writing, reading, math, time-management and study skills. During their years at BC, these students benefit from academic advising, tutoring, monitoring of their academic performance, and counseling services aimed at helping them navigate their way to graduation and satisfying careers. As Nancy Joseph, a junior in Nursing, notes: "The program has helped me recognize my strengths and work on my weaknesses." More than 50 percent of

Options students go on to graduate school before joining the workforce; many make it a point to help younger students who, like themselves, show great promise and need encouragement.

Donald Brown, who has directed the AHANA Office for more than a decade, attributes much of the program's success to the sense of community among students and staff. "The constant reassurance we offer our students that they can make it has made the difference," says Brown. "We let them know we care and we provide them with someone to talk to."

Developing mentors

The Benjamin Mays Mentoring Institute is another exemplary program at BC. The institute, named after the African-American scholar and former president of Morehouse College in Atlanta, was established in 1989 through the leadership of BC History Professor Andrew Buni and the AHANA Office, and funded by private foundations and the college.

At the Institute, White BC faculty members, together with a few doctoral graduate

students, volunteer for a three-day, mentor-development program. After graduation, each faculty member is assigned one to three freshman AHANA students to coach and mentor during the upcoming academic year. The mentors act as attentive nurturers and friends to the younger students over the long term.

Why White faculty as mentors? The answer lies in the continuing underrepresentation of AHANA professors at BC, and for that matter, at any other New England college. Of the 575 faculty members at BC, only 17 are African-American, Hispanic, Asian or Native American. If AHANA students are to have mentors, the great majority will by necessity be White.

Participating faculty take part in various training exercises, such as "prejudice-reduction" discussions to help recognize and then overcome the negative attitudes they may have about people different from themselves. Mentoring experts — such as Harvard University Professor Charles Willie and University of Massachusetts at Boston Professor Emeritus James Blackwell — also consult with faculty mem-

bers. Through panel discussions and interactions with AHANA students and college alumni, the mentors-in-training hear candid accounts of the students' psychological pressures and frequent isolation on a predominantly White campus — a process one professor called "the most important experience I've had at BC in 15 years." And during the academic year, mentors participate in "cluster meetings," in which they give other faculty members progress reports on their mentoring and get advice and encouragement from other mentors. The students involved are also periodically interviewed.

By the end of summer 1994, Brown says, "the Institute will have helped 100 faculty members develop key communication skills and bridge the cultural divide that often separates them from AHANA students."

Faculty give the Mays Institute high marks for helping them interact more confidently and competently with AHANA students. "I see faculty revitalized and turned around," observes Buni. "And I see older students who have been mentored reaching out and mentoring college freshmen and sophomores and kids at their former high schools."

More campuses should routinely organize forums where faculty can participate in frank dialogues with their students. And it appears that more campuses will.

BC's mentoring program is being studied by other campuses. Mount Holyoke College, for example, is planning to start its own mentoring workshops in the fall of 1994.

Harvard's Willie says that more should be done, noting: "Colleges and universities have not undertaken the training and development of faculty which would free them of their fears and reservations about being mentors to students unlike themselves in racial, ethnic, and socioeconomic characteristics." With BC leading the way, campuses now have a prototype to consider and adapt for their own faculty and students.

JoAnn Moody is vice president of the New England Board of Higher Education and director of NEBHE's Equity and Pluralism Action Program. NEBHE recently helped launch the "Compact for Faculty Diversity," a national fellowship and faculty recruitment program aimed at increasing the number of graduate students of color who earn doctorates and then teach at New England's colleges and universities. Andy Breen, a recent graduate of the University of Massachusetts at Boston, assisted with this article.

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Illustration by Lauren Scheuer.



Trustee Tasks: Setting the Agenda

A select group of volunteers will guide higher education through a thicket of demographic pressures, rising costs and ethical dilemmas. Fewer than 10,000 individuals serve as trustees of the nation's roughly 900 public colleges and universities, which enroll 11 million students, according to the Association of Governing Boards of Universities and Colleges. About 40,000 trustees serve the more than 1,600 independent institutions, which enroll about 3 million students. Though their charges and challenges differ, accountability will be the watchword for trustees of both public and private institutions. Observes Massachusetts Chancellor of Higher Education Stanley Z. Koplik: "The public's microscope will zoom in intensely on all higher education institutions." Following are two views of priorities for boards of trustees of public and private institutions, respectively.

A presidential candidate who has not alienated some constituencies may not have what it takes for bold, effective leadership.

Under the Microscope: Priorities for Trustees of Public Institutions

**STANLEY Z. KOPLIK
JOHN F. WELSH**

1. **Refine institutional missions.** Public higher education trustees must re-examine their institution's fundamental purposes, emphases and clientele and sharpen institutional mission statements to maintain a balance between available resources, the

needs of the institution's clientele and the institution's strengths.

2. **Look at the compass.** Public trustees must be vigilant in their scrutiny of attempted intrusions into curricula, whether these intrusions be legislatively inspired or offered as politically correct. Proposed programs and curricula must meet the tests of academic substance and relevance to institutional mission before being adopted. Biotechnology, environmental engineering and allied health, for example, are hot fields. But programs in these areas are not for every institution.

3. **Redefine the relationship between trustees and presidents.** Even as public trustees involve themselves more directly in the academic and administrative life of institutions, fundamental

change will continue to hinge on the vision of a strong president. Boards should hire reform-minded presidents who have demonstrated that they can conceive, implement and defend unpopular but necessary changes. Indeed, trustees should remember in their fact finding and reference checking that a presidential candidate who has failed to alienate some constituencies may not have what it takes for bold, effective leadership.

4. Share resources among institutions. As public institutions are expected to conduct more and different tasks with fewer or, at best, modestly increased resources, trustees should encourage the development of consortia among higher education institutions to ease transfer of credits, share library resources and permit the reciprocal exchange of students and faculty.

5. Enhance diversity and multiculturalism. If the United States is to recapture its competitiveness in the global marketplace, higher education must extend its resources to ensure that underserved and underrepresented populations have the opportunity to succeed in rigorous, high-quality educational experiences. The nation's complexion is changing much more rapidly than higher education. Trustees take heed.

6. Encourage school-college collaboration. Higher education has been quick to criticize the preparation of applicants, but slow to support reform movements in elementary and secondary education. Public higher education boards must ensure that the colleges they govern work to improve teacher education and educational administration programs. For example, trustees could push their institutions to create summer institutes for prospective freshmen, thus capitalizing on idle campus buildings and stimulating idle teenage minds.

7. Incorporate new learning technologies. Employers will continue to demand that colleges and universities produce graduates with technological skills. On campus, meanwhile, information management and telecommunications technologies will improve the delivery of instruction and administrative and student services. But technological change requires sizable investments in equipment and training. Trustees should enlist the support of the business community to determine the appropriate technological investments.

8. Improve faculty performance. Public trustees must respond to increasingly prevalent questions about faculty workload

and productivity; the proper balance of teaching, research and service; the use of graduate teaching assistants; and predicted faculty shortages. Boards should direct their institutions to develop clear processes to evaluate faculty, offer merit-based rewards for outstanding faculty and ensure that the best teachers are available not only to upper division and graduate students, but to freshmen and sophomores.

9. Reinvent accreditation. Institutions have been forced to shift resources solely to meet the requirements of agencies that offer accreditation for specialized programs. By taking part in self-studies required by accrediting agencies and serving as members of teams considering the accreditation of other institutions, trustees could learn more about their own institutions and revitalize an accreditation system that is in disarray.

10. Demonstrate effectiveness. Public colleges and universities need to demonstrate the effectiveness of higher education

in terms that are convincing and understandable to the public. But higher education institutions have had difficulty recognizing what their various clients need from higher education and what kinds of evidence the clients believe is significant. Boards can play a critical role in this process by helping campuses define critical audiences, identifying what institutions are accountable for, and prescribing such measures of progress as "report cards," detailing changes in faculty productivity, student graduation rates and job placement of graduates. Having demonstrated the effectiveness of their institutions, public trustees may go to legislators with a critical appeal: "Give us a little more and we'll give you a lot more."

Stanley Z. Koplik is the chancellor of higher education in Massachusetts. John F. Welsh is the associate director of academic affairs for the Kansas Board of Regents.

Shaping a Vision: Priorities for Trustees of Private Institutions

**JAMES MARTIN
JAMES E. SAMELS**

1. Shape a proactive vision for the year 2000. Trustees of independent colleges and universities must demonstrate a new accountability and commitment to the educational aspirations of students and expectations of employers. The foremost challenge for trustees is to commit to the mission of their institutions and not simply *approve*, but passionately *shape* an overall vision for the year 2000 in a context of shifting demographics, declining resources and rising expectations.

2. Define and direct through presidential choice. Selecting the president and implementing a model to assess his or her effectiveness is the most important decision a board member ever makes. Having made these decisions, trustees should provide an arms-length perspective to guide and inform executive policymaking.

3. Separate policy and management. Trustees should set an overall policy framework that reflects strategic objectives and careful positioning, rather than issuing a

patchwork of resolutions which threaten to micromanage specific programs.

4. Demonstrate due diligence and integrity. Often imbued with only a general notion of public trust, private college trustees must exercise due diligence and good ethical sense in guiding institutional growth. They should challenge the stereotype that trustees who don't have enough to do will cause "mischief." There is enough to accomplish on most campuses that weeks, even months, of concentrated effort would still leave unfinished the greater portion of policymaking, resource allocation and strategic planning.

5. Establish an ethics committee. Although operating outside state conflict-of-interest statutes, independent college trustees must deal squarely with ethical issues. In the Spring/Summer 1994 issue of CONNECTION, Bryant College President Emeritus William O'Hara urges boards to establish standing committees on ethics and to require presidents to

address the campus community annually on an institution's commitment to appropriate policies and behaviors. Around the same time, the Massachusetts attorney general issued a new *Guide for Members of Charitable Organizations*. Title of the longest chapter: "Beware of Conflicts of Interest."

6. Give, get or get off. Flat corporate giving to higher education puts new pressures on the trustees of independent institutions both to develop innovative programs to raise board giving levels overall and to lead by example with their own philanthropy. In the new world of board philanthropy, "give, get or get off" means everyone gives and only judges are excused from asking.

7. Consider consumer culture. Gone are the days when trustees were insulated from consumer complaints from parents and students. Students demand lower costs, higher quality and a mix of offerings. Increasingly, applicants with learning disabilities and special needs demand customized educational programs and services and sometimes hold board members specif-

ically accountable if delivery does not occur. Senior board members must stop denying the consumer culture that is shaping their institutions.

8. Conserve compensation. Examples of excess continue to abound in large corporations, sports and, yes, in higher education. Independent college and university trustees must confront this growing concern over executive compensation packages when setting presidential pay. Special compensation committees should be established to examine comparative salary ranges, and every member of the board should expect to review what the chief executive is to be paid, with the final figure subject to the approval of the full board.

9. Encourage alliances and affiliations. Between 1960 and 1990, 323 U.S. colleges and universities closed their doors. Mergers, affiliations and resource-sharing consortia would not have saved every one of these colleges, but complementary plans to consolidate faculties, libraries, laboratories and recreational facilities could have preserved some of them. Private, tuition-dependent institutions must now consider joining with

both private and public institutions to achieve economies of scale and reduce duplication of effort.

10. Standardize self-evaluation. Some observers have noted that when it comes time for the independent college board to evaluate itself, the process is often of questionable objectivity and validity. The boards of independent colleges and universities in New England should take the lead in implementing and standardizing objective self-evaluation processes to test commitment and raise accountability. This evaluation should focus on one central question: What constitutes effective leadership behavior for those on a volunteer governing board?

*James Martin, vice president for academic affairs at Mount Ida College, and James E. Samels, a higher education attorney, are partners in the Samels Group, a higher education consulting firm based in Natick, Mass. Their book, *Merging Colleges for Mutual Growth*, was recently published by The Johns Hopkins University Press.*

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Misconduct Follies

The following is excerpted from "The Misconduct Follies: Wow, What a Conference!," which appeared in the June 15, 1994 issue of Science & Government Report, a biweekly newsletter published in Washington, D.C. Since 1971, SGR has provided scientists and research administrators with an insider look at federal science policy, peppered with the wry observations of Editor and Publisher Daniel S. Greenberg, a former news editor at Science magazine.

Conferences frequently inspire mutterings of disappointment. But rarely in *SGR*'s long experience has a major gathering evoked such low, even contemptuous ratings, as the solemnly titled Convocation on Scientific Conduct, sponsored by and held at the National Academy of Sciences (NAS) on June 6 and 7.

For bashing the obvious, paucity of content and irrelevance to the issue of the moment — ongoing erosion of public confidence in the integrity of science — this one could retire the cup. ...

Normally, low-yield meetings of scientists and associated onlookers are too frequent to warrant attention. But this show was an all-too-familiar symptom of the science establishment's underlying skepticism about the seriousness of the misconduct issue. The leadership now accepts that politicians and the public must be persuaded that science is determined to police itself. But the basic feeling in the senior ranks is that the issue has been pumped up by opportunistic Congressmen and muddled journalists. And from that perception, the ensuing interest tends more toward public relations than policing.

Given the influential sponsorship of the proceedings, it is understandable that none of the attendees queried by *SGR* would comment for the record. But the confided assessments were uniformly dismal, with ... one journalist on a major scientific weekly plaintively asking, as he walked out early, "Why are they doing this?" ...

The assemblage was strongly exhorted to educate the coming generation of scientists in ethical purity, the rationale being that contemporary science is bigger and more competitive and impersonal than in prior days, when, according to NAS President Bruce Alberts, ethical understanding was acquired by "osmosis." Left unnoted was that today's most brazen miscreants are senior and high-ranking.

This was pointed out during a question-and-answer period by Heidi Weissmann, a physician who was once a rising star in nuclear medicine. Weissmann won a court ruling in 1989 against copyright infringement by a former mentor and colleague and recently a \$900,000 settlement in her employment discrimination suit against Yeshiva University's Albert Einstein Medical School. Weissmann

noted that she lost her job while her officially certified oppressor got a promotion. "The students get the message," Weissmann said, "that misconduct is OK if you're high up enough."

The Convocation, of course, should have mined her long and painful hands-on experiences with the misconduct system in action, but she was merely a member of the audience, not a scheduled speaker. Weissmann's comments seemed to embarrass the assemblage, which quickly passed on to other matters. ...

The fundamental problem was that the Convocation did not proceed from the conviction that science faces a gruesome problem of public and political skepticism about its integrity. Doubters should ponder a public opinion survey, sponsored by the Chicago Academy of Sciences and reported in *Science & Engineering Indicators 1993*, published by the National Science Board.

Survey statement: "Many scientists make up or falsify research results to advance their careers." In agreement, 52 percent of all adults surveyed.

Business and Liberal Arts

The following is adapted from an address by Shirley Strum Kenny as part of the University of New Hampshire's Centennial Summit Lecture Series. Kenny, president of Queens College of the City University of New York and a noted scholar of 18th century drama, spoke on "The Liberal Arts: Survival Tactics for the '90s."

It was at a dinner recently in which five university presidents met with five editors of major newspapers, magazines and TV shows. The very first question fired at us was: Corporations have successfully downsized, why can't you? The presidents gave the usual answers: *We must continue research to keep society going. The government insists we count more and more things and that takes more people.* ... Clearly the answers, none unfamiliar, weren't making an impact on the editors. Did it really make sense that faculty spend only a few hours a week in the classroom? Couldn't computers, distance learning and other telecommunications approaches cut costs by reducing the number of teachers? Did we need to teach courses in Old Norse that enroll only four students? Did we even need to study Old Norse? We elaborated on our usually defensive answers. They prodded, but we resisted.

What we never said was that there are four choices to achieve economies: heavier teaching loads; reduced offerings; larger classes; or more computerized and canned courses. We just gave the reasons we couldn't downsize and they

weren't very convincing to these editors.

By and large, academics do a terrible job in answering such questions. We do not recognize or accept the notion that non-academics eye universities as a business, or at least accountable to the same economic constraints. We do not answer from a business perspective. ... The new suspicion that universities don't give good value offends us massively. We are used to being the good guys. But parents do not understand why they pay more for their children to come to college and do not get exactly what they want. Many of them don't understand why their children should study Shakespeare or French or world history when they want to get a degree in computers or be statisticians or doctors: "Waste of time," say these parents. "Teach them what they need to get a job." ...

We will have to make some changes to survive in the '90s and beyond and I think one of those changes is greater attention to teaching. Increasingly, faculty at major institutions have a two- or three-day teaching week, although they explain that they do research on the other days and really work a 70-hour week. Our editors questioned whether the research was worth the cost (remember their question about Old Norse). Medical research, yes. But restoration theatre? Very questionable in their minds. Why should the state be paying for me to take time to do scholarly editions of 18th century plays? ...

Those of us in liberal arts probably should feel a little paranoid. Yes, we are in greater danger of the ax than engineering or life sciences. Which is one reason it's important for people to understand our role in job training. ...

I believe that the strongest job skills anybody will ever have, regardless of profession, are communication skills, both written and oral, research skills, problem-solving skills and decision-making ability. New York corporate leaders agree. They also agree that the best undergraduate education to hone those skills is liberal arts. But as we know, human resources professionals do not necessarily hire our students, and I think that is because we have not successfully sold those skills. Our solution at Queens College, one of many possible approaches, was to create a minor called Business and the Liberal Arts, a minor that students can combine with any liberal arts major. ... Every course was especially designed by faculty interacting with corporate executives on a corporate advisory board, and every course emphasizes writing, speaking and a different computer application. Because the design involved executives, it was much more liberal arts focused than we would have dared on our own ... The resulting job offers have been numerous, and employers tell me again and again that it is the speaking and writing and language skills that get students permanent job offers when they are selected over many other students, mostly coming from Ivy League institutions. ...

My first recommendation then is to capitalize on the fact that we own the most important job skills of all — com-

munication, research and problem-solving. We should remind ourselves that we are not sullied by teaching these skills within professional context. The Business and Liberal Arts program started as a gimmick to protect the liberal arts, and it worked.

Whose Woods These Are

The following is excerpted from Finding Common Ground: The Draft Recommendations of the Northern Forest Lands Council, which was released in March. The council was created in 1990 by the U.S. Congress and the governors of Maine, New Hampshire, New York and Vermont, in response to increasing private sales of land and the threat of unrestricted development in the 26-million-acre stretch of forest that runs through the four states. Council membership consists of four gubernatorial appointees — representing landowners, environmental interests, state conservation agencies and local communities — from each of the four states and one U.S. Forest Service representative. Although real estate speculation in the Northern Forest has cooled, state and federal officials worry about the potential impact of future land deals on forest-related industries, ranging from tourism to manufacturing. The council was expected to issue a final report in September.

It is essential to recognize and understand the fears of those who live within and care about the Northern Forest. Landowners worry that the value they hold in their land, their equity, their privacy, their long-standing connections with their property will be taken from them by forces of change and without fair compensation. Residents are upset that their way of life, their culture, their heritage, their jobs in the mills and the woods may be lost. Hunters and anglers, hikers and canoeists are troubled with the thought that the forest, their place of escape from the cares of everyday life, will be closed off to them. Many people fear that plant and animal species will be damaged or destroyed, and fear that this large area of mostly undeveloped land will be lost forever to economic forces beyond their control or to pressures of people coming to the forest in increasing numbers. Measures to conserve the land must address these worries. They must also involve people in decisions affecting their future. ...

While the initial crisis and cycle of land development of the 1980s has passed, and while a council-commissioned study of land conversions during the period did not reveal wholesale loss of Northern Forest, the council, through its research, discovered that the ingredients of future undesired change are still present. Rising property taxes and high land valuations and estate tax rates make passing of land

intact from one generation to the next very difficult. Many forest-product markets, especially pulp and paper, experience continuing weakness. National and global competition puts pressure on regional forest product industries. The 70 million people who live within a day's drive of the Northern Forest look for places to acquire along a lake or near the mountains, and want to use and enjoy the forest.

We must view human and biological relationships to the land with equal regard. For many generations, residents of the Northern Forest have earned their livings directly or indirectly from the land. These connections are just as irreplaceable as those of plants and animals of the forest to soils and waterways. Those living outside and perhaps unfamiliar with the way of life here must understand that it is entirely possible to conserve the forest and sustain towns and villages within its boundaries in ways that damage neither its human nor its plant and animal communities.

The forest must be viewed as a whole, made of and deriving its values from both private and public lands. The history of the region has shown that the values we are concerned about can be maintained through predominantly privately owned forest land. Proposals to conserve values of the forest must include a wide range of measures to encourage the careful long-term stewardship of private land. Such stewardship can and should include sound management for harvest of trees. It should be clear, however, that acquisition of property or interest in property by the public has been and should continue to be an appropriate way to conserve land with exceptional biological, scenic and recreational values. Nonetheless, acquisitions should take place in accordance with plans developed with full participation of affected landowners, including residents. ...

Traditionally, Maine, New Hampshire, New York and Vermont have worked with landowners and nonprofit organizations to conserve the Northern Forest. While federal assistance can be important to the future of the region, the states, working with local communities, should continue this lead role. The Northern Forest states have different histories, traditions and citizen views. These all must be respected. But these forests provide great benefits to many within and outside the region. So, all users have an obligation to share the true costs of proper management of public lands and to assist private landowners and communities that steward public values.

The Northern Forest has been and can continue to be a powerful force for long-term economic well-being for its residents and the Northeast region in general. In a world of growing human population and diminishing forest resources, a properly managed forest can provide a needed source of wood and fiber to support jobs in the forest and in mills and woodworking shops. The wood products industries of the four states had an annual economic value of \$18 billion in 1987. Similarly, in a world where the opportunities for escape to a natural surrounding are also dimin-

ishing, the forest, if it remains a forest, can always provide a place for compatible tourism and recreation. But these long-term economic values will be lost if the integrity of the forest is sacrificed for short-term gain. ...

Some view finding common ground as defeat, as their failure to achieve a vision of what should be. The Northern Forest Lands Council does not share this view. We believe, rather, that all interests must work together to achieve cooperative and informed long-term stewardship of public and private land. ...

In addition to our specific proposals, we believe that we have demonstrated something about the process for achieving a desirable future. We believe we have shown that people of different perspectives can work together, can gather information, consult experts, discuss emotional and important issues with a broad spectrum of the public and then proceed in a rational way to accomplish common goals. This can be done without individuals or groups giving up their own points of view, but rather by finding those things they can agree upon and those things they are willing to accept to accomplish a rational and deliberate agreement on overall issues. ...

Objection!

The following is from a news release disseminated by the Massachusetts School of Law in June.

As part of their efforts to falsely portray the Massachusetts School of Law (MSL), American Bar Association (ABA) accrediting personnel distorted and attacked [the school's] bar passage rates, deliberately ignoring the fact that those rates have sometimes exceeded rates of ABA-accredited schools. The latest bar passage results again [illustrated] that the bar passage rates of the new, non-accredited MSL exceed those of some long-established ABA-accredited schools. MSL's passage rate of more than 69 percent for first-time takers on the February 1994 bar examination exceeded the rates of two of the ABA schools located in Massachusetts, exceeding one by a large margin and the other by a medium-sized margin. This was achieved by MSL students [whom] the ABA accreditors attacked as unfit to be law students and to whom ABA schools denied admission on the ground that they lacked sufficient capacity to be law students and lawyers.

The latest bar results confirm once again what MSL has long maintained — that capable persons from less privileged backgrounds, who are long on industriousness and motivated by a desire to better themselves and their families' future prospects, will succeed if given the opportunity which the ABA accreditors deliberately deny them and which the ABA schools likewise deny them.

If I Were a Text

*The following is adapted from an address delivered in June by Bowdoin College President Robert H. Edwards at a campus symposium celebrating the college's bicentennial. Edwards examined change in American higher education since 1945, when a group of Harvard University faculty assembled by President James Conant issued the groundbreaking report, *General Education in a Free Society*, also known as the *Redbook*. The report saw higher education's role changing from nurturing a privileged few to "cultivating" democratic ideals among a diverse mix of students.*

It is not an exaggeration to say that in almost every respect the Harvard committee would be unthinkable today. In its white maleness, its bereftness of students, its failure to mention the world beyond the Western tradition, its blindness to the Black population and only slightly greater awareness of women, but especially in its audacity in setting forth confidently a unitary social and educational theory, the *Redbook*, written brilliantly in our lifetime, seems quaint and even illegitimate today. What happened? Why did we in higher education for the past generation begin to shrink from defining the educational needs of the "common good," or a "free society," for fear the attempt would leave us in common shreds rather than renewed unity?

What happened is that the social forces foreseen by Harvard's scholars, and many of those they did not see, burst apart their elegant theory of general education practically as it was being written. The immediate cause was the specialization of knowledge, so powerful within Harvard that the responsibilities for general education were soon delegated to a helotry of graduate students and second-class academic citizens, while the student and faculty elite pursued the excitement of new scientific and other learning.

But much more was going on than a knowledge explosion. Conant's assumption that the goal of educated men was to build and sustain a society and a legal order was stood on its head. As the 1960s rolled in, it began to be argued that civil society was, in fact, a structure of exclusion and injustice. The neglected rights of peoples excluded from the "common good" — notably Blacks — justified the selective overruling of the formal laws of society. This same higher morality justified civil disobedience to demand an end to the Vietnam War and later to assert the rights of women. ...

Polls during this period show that faith in government leadership fell to half its previous level; public confidence in higher education leadership fell by 30 percent in the 1960s — almost the same as the decline of trust in the military establishment. ... The campuses were in tumult. Takeovers of buildings by Black and anti-war protesters; the abolition of curricular requirements — Bowdoin dropped its distri-

bution requirements in 1967; suppression of government speakers, Kent State, the "Harvard bust" and pictures of besieged administrators all left much of American society wishing that the generation gap were even wider than it was.

Perhaps most striking and lasting of all, the rhetoric shifted in college catalogues and addresses of presidents. The objective of education ceased to be the building of a more cohesive and orderly society, or the advancement of a "common good." Its goal became the "empowering" of the individual student. ... The quality of the individual academic experience, not participation in a common intellectual molding, became the measure of how colleges serve society.

The expressions of democracy, the extensive participation of individual faculty and students in college and university affairs did not cease in the 1980s, but took on a new dimension. Given the collapse of the old orthodoxes, individuals turned not to a redefinition of society as a whole, but to new strength and identity for its subgroups: initially for Blacks, then for women, for Hispanics, for gays and lesbians and for the disabled. ...

The irreducible truth the academy must protect — having moved from a social definition of its purpose, to a focus on the individual and then to a focus on groups of individuals — is the fact of the individual as a responsible human being.

There are in the academy, anomalously enough, certain theories that could diminish the individual as a responsible and accountable person, which is the assumption upon which all trust is ultimately based. A "postmodern" theorist might argue that President Conant's group of Harvard faculty were not, in fact, really motivated by the desire to create a just society — but were seeking, knowingly or not, to perpetuate the power of White males through their manipulation of inherited structures of knowledge. This is the doctrine derived from a literary theory that says, in effect, that a "text" conveys not its surface, ostensible meaning but, if properly "deconstructed," conveys the deep-seated prejudices, attitudes and psychological conditions of its author.

There is a not-unwise skepticism here. But carried comprehensively into practical life, these doctrines can undermine the basis of trust between human beings. If I, as Bowdoin's president, am a text to be deconstructed, whatever I say must be understood as the witting or unwitting distortion of an unknowable reality purveyed by a White, heterosexual male of 58 years — not by a responsible human being, influenced by his past, but also by an independently functioning mind. But the academy cannot exist without responsible human beings. Truth, honor and fairness cannot be explained away as existing only in the mind of the beholder. Their standards must be constantly re-examined; but they are the principles of academic life, of our lives as human beings, and ultimately of our academic contract with society.

MACHIAS, MAINE — The University of Maine at Machias was awarded \$77,000 by the National Marine Fisheries Service to study a decline in the clam population along parts of the Maine coast. Researchers will compare environmental and biological findings from Cumberland County, where clam flats are productive, with findings from Washington County, where a 90 percent reduction in clam harvests has battered the coastal economy.

PROVIDENCE, R.I. — Brown University announced it would offer a worksite master's degree program in biology to laboratory workers at Pfizer Inc. in Groton, Conn., beginning in fall 1994. As many as 50 Pfizer research employees are expected to enroll in the program each semester, with the health care company picking up the tab for tuition.

AMHERST, MASS. — Computer science researchers at the University of Massachusetts at Amherst were awarded \$9 million under the federal Technology Reinvestment Program to design and build computer systems to help robots see. A consortium of computer manufacturers and the commonwealth of Massachusetts are expected to put up another \$9 million toward the project. The partners will create a new company to build commercial computer systems which could have uses ranging from medical diagnosis to automobile collision avoidance. In a separate development, the Department of Defense awarded \$3 million to the UMass Center for Intelligent Information Retrieval to develop computer technology to automate labor-intensive hospital administrative procedures.

BURLINGTON, VT. — The University of Vermont's five-year-old

Substance Abuse Treatment Center was awarded \$2.3 million by the National Institute on Drug Abuse to continue research and treatment programs aimed at curbing cocaine abuse and related public health problems.

DURHAM, N.H. — The Institute on Disability at the University of New Hampshire formed a partnership with the state to provide computer-based Braille transcription services at the New Hampshire State Library in Concord. The institute's system — which can receive input through a scanner, computer disk, keyboard or modem and produce materials in Braille or large print — will be provided to the state on long-term loan.

FAIRFIELD, CONN. — The Charles E. Culpeper Foundation awarded \$186,800 to Fairfield University for a new language resource center, including technology that will allow students to downlink video programs from overseas and access computer networks around the world.

NORTH ANDOVER, MASS. — The National Microscale Chemistry Center at Merrimack College snared a Governor's Award for Toxics Use Reduction, an honor usually reserved for businesses. Microscale chemistry uses very small amounts of chemicals in research, thereby cutting costs for researchers, reducing the risk of toxic contamination or accidents in laboratories and minimizing waste.

NARRAGANSETT, R.I. — The University of Rhode Island was awarded \$468,478 under the National Sea Grant College Program to grow anti-tumor compounds found in marine environments. The three-year grant is the largest marine biotechnology

research award in the national program this year. Researchers will develop special culture systems for marine organisms, known as dinoflagellates, which the scientists believe could fight cancer in humans. No single, effective drug has yet been developed, in part because the supply of the marine compounds has been inadequate. Researchers hope that growing their own compounds in laboratories will solve the supply problem and lead to rapid development of anti-cancer drugs.

MIDDLEBURY, VT. — Middlebury College donated \$1 million to the town of Middlebury to compensate Middlebury taxpayers for the various town services enjoyed by the college and otherwise continue "the cordial relationship" between the town and college. The contribution grew out of discussions begun two years ago about the college's role in the community.

NEW HAVEN, CONN. — Yale University announced it earned a record \$1.7 million in patent royalties in 1992-93, up 130 percent from the previous year. Yale officials attributed much of the increase to licensing agreements in which the university gave various companies exclusive rights to turn biotechnology discoveries into products. Yale earned \$6.4 million in royalties from 1982 through 1993 from patents and nonpatented inventions.

BOSTON, MASS. — Boston University's School of Management was awarded \$60,500 from the General Electric Foundation to support a team-learning program for full-time MBA students. The program is part of an effort to reformulate the MBA curriculum to reflect contemporary organizational needs. The grant will sup-

port faculty development and the creation of new curricular materials for the program.

MANCHESTER, N.H. — The U.S. Department of Housing and Urban Development awarded \$1 million to New Hampshire College to develop a high-technology business information center in the college's Shapiro Library. The center, to be open to the public, will house 56 networked personal computers. Dial-up access will allow students, faculty and others to access the center's resources from their homes or offices.

NORWICH, CONN. — Three Rivers Community-Technical College was awarded the 1993 Innovation in Education Award from the Accreditation Board for Engineering and Technology, a federation of 27 engineering professional technical societies representing 1.8 million engineers nationwide. The award recognizes the college's Nuclear Engineering Technology Program for its partnership with Northeast Utilities and the state of Connecticut. Three Rivers offers the nation's only accredited associate degree program in nuclear engineering technology.

BOSTON, MASS. — Tufts University School of Medicine and the Tufts Associated Health Plan established a program to train practicing physicians, residents and medical students for work in health maintenance organizations, preferred provider organizations and other managed care organizations, which are expected to dominate health care delivery in coming years.

PROVIDENCE, R.I. — Media mogul Ted Turner donated \$25 million to Brown University as part of a \$75 million gift to edu-

cation. The Turner Broadcasting System president holds a bachelor's degree from Brown and is active in the university's current \$450 million fundraising campaign. Turner made similar donations to The Citadel in South Carolina and The McCallie School in Tennessee.

AMHERST, MASS. — The University of Massachusetts at Amherst launched a new Office of Economic Development to broaden the university's cooperation with industry in the state and region.

DURHAM, N.H. — The New Hampshire Charitable Foundation awarded \$6,000 to the Action Learning Center at the University of New Hampshire. The money will help nonprofit groups and state agencies participate in the center's programs aimed at building teamwork in organizations.

BOSTON, MASS. — The Department of Defense awarded a three-year, \$592,000 grant to Boston University's Department of Manufacturing Engineering to help practicing engineers and displaced defense industry engineers enroll in the department's Executive Master's of Science program. Sponsor companies whose employees participate in the program will provide matching funds. The 16-month master's degree program — launched in 1992 as an alternative to the traditional MBA — emphasizes manufacturing technology and product and process design.

BEDFORD, MASS. — Middlesex Community College received a \$24,630 grant from the Metropolitan Life Foundation to launch a program to aid Lowell ninth-graders who are at risk

academically. The initiative, also supported by the TRC Environmental Corp. of Lowell, will provide 100 students with counseling, career exploration, peer mentoring and school support services. Meanwhile, the college's five-year old Lowell Early Awareness Program, which encourages seventh- and eighth-graders to stay in school, received a \$5,000 grant from the Shawmut Bank Corp.

BOSTON, MASS. — Tufts University School of Medicine and Emerson College launched a joint master's degree program in health communication. Courses covering topics such as political communication, public relations, advertising and global and community health will be offered at both institutions, beginning in fall 1994.

NORTHFIELD, VT. — Norwich University and the U.S. Army Research Development and Engineering Center in Natick, Mass., reached an agreement establishing joint research projects between Norwich faculty and Army researchers and providing for field-testing of Army equipment by Norwich students.

WORCESTER, MASS. — The Arthur Vining Davis Foundations awarded a \$100,000 grant to the College of the Holy Cross toward development of a modern language resource center with state-of-the-art audio, video and computer equipment. The center, expected to cost \$505,000, has also received support from the Charles E. Culppeper Foundation and IBM Corp.

BRISTOL, R.I. — Roger Williams University received \$50,000 from The Champlin Foundations to complete the purchase of new computer equip-

ment for the university's Academic Computing Center.

SOUTH HADLEY, MASS. — Mount Holyoke College was awarded a five-year, \$500,000 grant from the Sherman Fairchild Foundation to buy a new transmission electron microscope and other state-of-the-art equipment for the college's science laboratories. About 25 percent of the 2,000 students at the women's college major in the sciences — almost three times the percentage of female science majors at coeducational institutions nationwide.

WEST HARTFORD, CONN. — Saint Joseph College established a scholarship fund to support graduates of high schools sponsored by the Sisters of Mercy, the order which founded the college over 60 years ago. The \$6,500 scholarships will go to two high school graduates each year who show strength in academics and commitment to community service.

DURHAM, N.H. — The National Aeronautics and Space Administration awarded \$4.5 million to the University of New Hampshire to build an instrument to detect and measure ions produced by the sun. The instrument, which NASA plans to launch into space in August 1997, will help researchers calculate the acceleration rates of ions — electrically charged atoms — as they travel through space. Researchers also hope to understand how the sun's activity affects the production and composition of ions.

BOSTON, MASS. — Berklee College of Music and the Boston Conservatory of Music announced a joint master's degree program in Jazz Studies, beginning in September 1994. Study will focus on performance, com-

position and pedagogy. The degree will be awarded by the Conservatory, but classes will also be taught at Berklee.

FAIRFIELD, CONN. — The Laerdal Medical Corp. donated five life-sized mannequins and a measuring device to Fairfield University's nursing program to help train student nurses in cardiac life support and CPR. The mannequins are connected to a special monitor that teaches students timing and the correct amount of effort for compression and breaths during mouth-to-mouth resuscitation.

WESTON, MASS. — Regis College received a \$50,000 gift from the George I. Alden Trust of Worcester toward a \$200,000 scholarship endowment. Regis also received \$50,000 from the Thomas Anthony Pappas Charitable Foundation of Belmont, Mass., to support the college's new fine arts center.

PROVIDENCE, R.I. — Brown University's Institute for Secondary Education and the Roger Williams Park Zoo were awarded \$692,411 from the National Science Foundation to train area science teachers in laboratory work. As part of the three-year collaborative project called "ZooScope: Focus on Middle School Training," middle school science teachers from Rhode Island and southeastern Massachusetts work with research scientists at the zoo, then incorporate their research experience into laboratory work plans for students in grades 6 through 9.

CAMBRIDGE, MASS. — The Josiah Macy Jr. Foundation awarded a three-year, \$1.5 million grant to Harvard University's Medical School and Graduate School of Education to jointly develop programs that will help

medical schools in the United States and abroad reform medical education.

NORTON, MASS. — Wheaton College was awarded a \$50,000 grant from the George I. Alden Trust to purchase scientific equipment.

AMHERST, MASS. — Instron Corp., a Canton, Mass., manufacturer of materials testing equipment, donated \$236,000 worth of equipment and software to the University of Massachusetts at Amherst for use in teaching laboratories. Some of the equipment will be used in the university's new \$56 million polymer science research center. UMass also received \$133,625 worth of high-precision scientific tools from The Millipore Foundation of Bedford, Mass., for use in the university's polymer science and engineering department and the food science department.

FAIRFIELD, CONN. — Fairfield University received a \$200,000 federal grant from the Technology Reinvestment Project to establish a new Center for Global Competitiveness. The center is intended to encourage exporting among small- and medium-sized Connecticut businesses that have been dependent on defense spending.

BRUNSWICK, MAINE — Bowdoin College received \$14 million from alumnus Stanley F. Druckenmiller to build a new facility housing the college's biology and geology departments, as well as a portion of the environmental studies program. The gift from Druckenmiller, a managing partner at Soros Fund Management in New York, is the largest in Bowdoin's 200-year history.

HARTFORD, CONN. — The Community-Technical Colleges of Connecticut approved four new technical fields of study. An associate degree program will be offered in Industrial Management Technology at Asnuntuck Community-Technical College in Enfield; certificate programs will be launched in Building and Grounds Technicians and Broadcast Technicians at Middlesex Community-Technical College in Middletown; and a certificate program in Basic Microcomputer Networks will be offered at Capital Community-Technical College in Hartford. Meanwhile, Three Rivers Community-Technical College in Norwalk introduced the state's first associate degree program in environmental engineering technology. The program will prepare students to properly handle hazardous materials and interpret national, state and local environmental laws.

DURHAM, N.H. — The New Hampshire Industrial Research Center, a cooperative initiative of the University of New Hampshire, Dartmouth College and the state Department of Resources and Economic Development, awarded \$100,000 in design and technical problem-solving support services to Manchester-based Poly-Vac, a firm that produces plastic sterilization containers for the medical industry. The IRC was established in 1991 to offer local companies state-subsidized technical assistance from academic experts. The IRC also awarded \$50,000 to Milford-based Saphikon Inc., which produces sapphire plates, tubes and fibers for various optical and structural applications. With help from UNH faculty, Saphikon will explore applications of sapphire technology in advanced materials markets.

NEW HAVEN, CONN. — The Yale Child Study Center and the Consultation Center, both associated with Yale University's School of Medicine, were awarded \$65,000 by the Community Foundation for Greater New Haven to provide critical mental health services for public schools in New Haven, North Haven, West Haven and East Haven. The program is designed to help schools better respond to crisis situations stemming from violence, accidents, fires and other events.

MANCHESTER, N.H. — Notre Dame College announced it would begin offering \$1,000 scholarships to students from Catholic high schools who graduate in the top 25 percent of their class and are active in community service. The scholarships will be renewable at Notre Dame every year if the student maintains a 3.0 grade point average.

CAMBRIDGE, MASS. — The Massachusetts Institute of Technology and Amgen, a California biotechnology company, agreed to a long-term research collaboration. Under the agreement, Amgen will receive certain patent and technology licensing rights to scientific developments stemming from the collaboration, while MIT researchers will receive support up to \$3 million a year for as many as 10 years. Amgen scientists may also serve as visiting scientists at MIT.

BAR HARBOR, MAINE — The Davis Family Foundation awarded \$25,000 to the College of the Atlantic for scholarships to be reserved for Maine students, who make up more than 23 percent of the college's student body. In addition, the King and Jean Cummings Charitable Trust awarded \$5,000 to the col-

lege to establish a scholarship for students from Maine, particularly those from the western mountain region of the state. The late King Cummings was a trustee of the college.

BRADFORD, MASS. — Bradford College and Sacred Heart University of Fairfield, Conn., were awarded \$22,000 grants from the Council of Independent Colleges to participate in the nationwide Learning and Service Alliance, which encourages college students to provide community service.

STORRS, CONN. — A team of University of Connecticut engineers and two New England industrial machine manufacturers received a \$3.3 million grant from the Department of Defense to develop a highly productive industrial grinding machine. The high-speed bearing grinding machines, designed with a grinding wheel that rotates at three-fourths the speed of sound, are expected to give the United States a competitive edge in manufacturing aerospace and automotive components, cutting tools and surgical instruments.

AMHERST, MASS. — The University of Massachusetts at Amherst won approval from the state's Higher Education Coordinating Council to offer a doctoral program in nursing, beginning in fall 1994. The program will draw on the resources of the university's medical center in Worcester.

STAMFORD, CONN. — The University of Connecticut was awarded \$1.3 million by General Reinsurance Corp. to support development of a university campus in downtown Stamford, where General Reinsurance is based. In March, UConn bought a 240,000-square-foot former

Bloomington's department store as the anchor of the future campus.

COLCHESTER, VT. — Saint Michael's College was awarded a \$65,322 grant from the U.S. Department of Education toward the establishment of a minor in international business studies at the college. The minor will combine international business courses with French and Spanish language courses. The grant will fund new bilingual internships in U.S. businesses, as well as the introduction of new economics, political science and history courses bringing together international and U.S. students.

SOUTH HADLEY, MASS. — Mount Holyoke College and the Latino Scholarship Fund were awarded \$25,000 by the College/Community Partnership Program, a national initiative to encourage cooperative efforts by private colleges and community groups to increase academic and financial support of at-risk students. The initiative, a joint program of Citizens' Scholarship Foundation of America Inc. and a unit of the Council of Independent Colleges, is funded by a \$1.05 million grant from the DeWitt Wallace-Reader's Digest Fund. Mount Holyoke's program will create a high school Latino Scholars Club in the local community to provide tutoring, mentoring and college preparatory services to students.

HANOVER, N.H. — Dartmouth College upgraded its women's softball and volleyball teams to varsity level, starting with the 1995-96 season. The changes come after the women's softball team lodged a formal Title IX complaint last summer with the federal Office for Civil Rights, charging that Dartmouth failed to

support equal opportunities for its female students. Dartmouth officials estimate the changes — along with other gender-equity initiatives — will cost \$300,000 annually.

NEW HAVEN, CONN. — Yale University School of Medicine unveiled a major initiative on women's and children's health in Saudi Arabia. Yale doctors and scientists will work with Saudi colleagues to develop biomedical research programs and enrich physician training in areas related to maternal and child health.

NORTH ANDOVER, MASS. — Merrimack College was awarded a \$100,000 grant from The Stevens Foundations of North Andover to turn the basement of one of its classroom buildings into a 2,278-square-foot auditorium/lecture hall.

KINGSTON, R.I. — Cherry Semiconductor Corp., an East Greenwich, R.I., manufacturer of integrated circuits, pledged \$120,000 to the University of Rhode Island's capital campaign to support scholarships for engineering students. The \$1,000 scholarships will be awarded to students who have high grades and demonstrate financial need, with preference given to Rhode Island residents.

FAIRFIELD, CONN. — Trustees of the Bridgeport Engineering Institute and Fairfield University approved a merger of the two institutions, effective August 1994. Under the plan, the engineering institute operates as a separate school within the university, with students earning Fairfield University degrees in mechanical engineering, electrical engineering, information systems engineering and manufacturing engineering. The

institute's new name: the BEI School of Engineering of Fairfield University.

AMHERST, MASS. — The University of Massachusetts at Amherst Writing Program was awarded a \$63,000 grant from the publisher Houghton Mifflin to develop a multimedia resource package for the program's teachers. The package will use print, video, audio and interactive computer technologies to help teachers plan their courses and better understand their students' needs and perspectives.

NORWALK, CONN. — The Nursing Program at Norwalk Community-Technical College was awarded a \$36,000 grant from the Helene Fuld Health Trust to develop a computer laboratory for nursing instruction. The lab will help students prepare for the Connecticut nursing license examination, which is administered by computer.

MEDFORD, MASS. — Tufts University launched a new master's degree program in food supply and distribution. The program is offered through the Tufts Center on Agriculture, Food and the Environment. Faculty from the schools of Nutrition and Veterinary Medicine, the Department of Urban and Environmental Policy and the Fletcher School of Law and Diplomacy will teach courses on human nutrition, epidemiology, U.S. food policy, malnutrition and socioeconomic issues, insect physiology and pest management.

BIDDEFORD, MAINE — The University of New England entered an agreement with the Bigelow Laboratory for Ocean Sciences, providing UNE students with internships at the inde-

pendent research laboratory in West Boothbay Harbor, Maine, and calling for one course per semester to be taught by a Bigelow Lab researcher.

CAMBRIDGE, MASS. — Harvard University's chemistry department received a \$1 million gift from an alumnus to establish graduate fellowships in organic and bioorganic chemistry for students from the Czech Republic.

WEST HARTFORD, CONN. — The University of Hartford began offering a new master of science program in nursing and organizational behavior. The program, the first of its kind in Connecticut, trains nurse executives to direct patient care services in hospitals, long-term care facilities and community agencies.

CAMBRIDGE, MASS. — The Massachusetts Institute of Technology's Sea Grant College Program was awarded \$1.8 million from the National Oceanic and Atmospheric Administration to support university-based marine research, education and advisory services. Congress each year provides funds to Sea Grant programs; every \$2 in federal funds must be matched with \$1 from non-federal sources. MIT estimates that it will receive matching funds of approximately \$1.5 million from industry, the commonwealth of Massachusetts and other institutions. MIT Sea Grant Program research focuses on autonomous mobile instrumentation platforms, marine biotechnology, ocean and coastal processes, ocean engineering and technology development and management.

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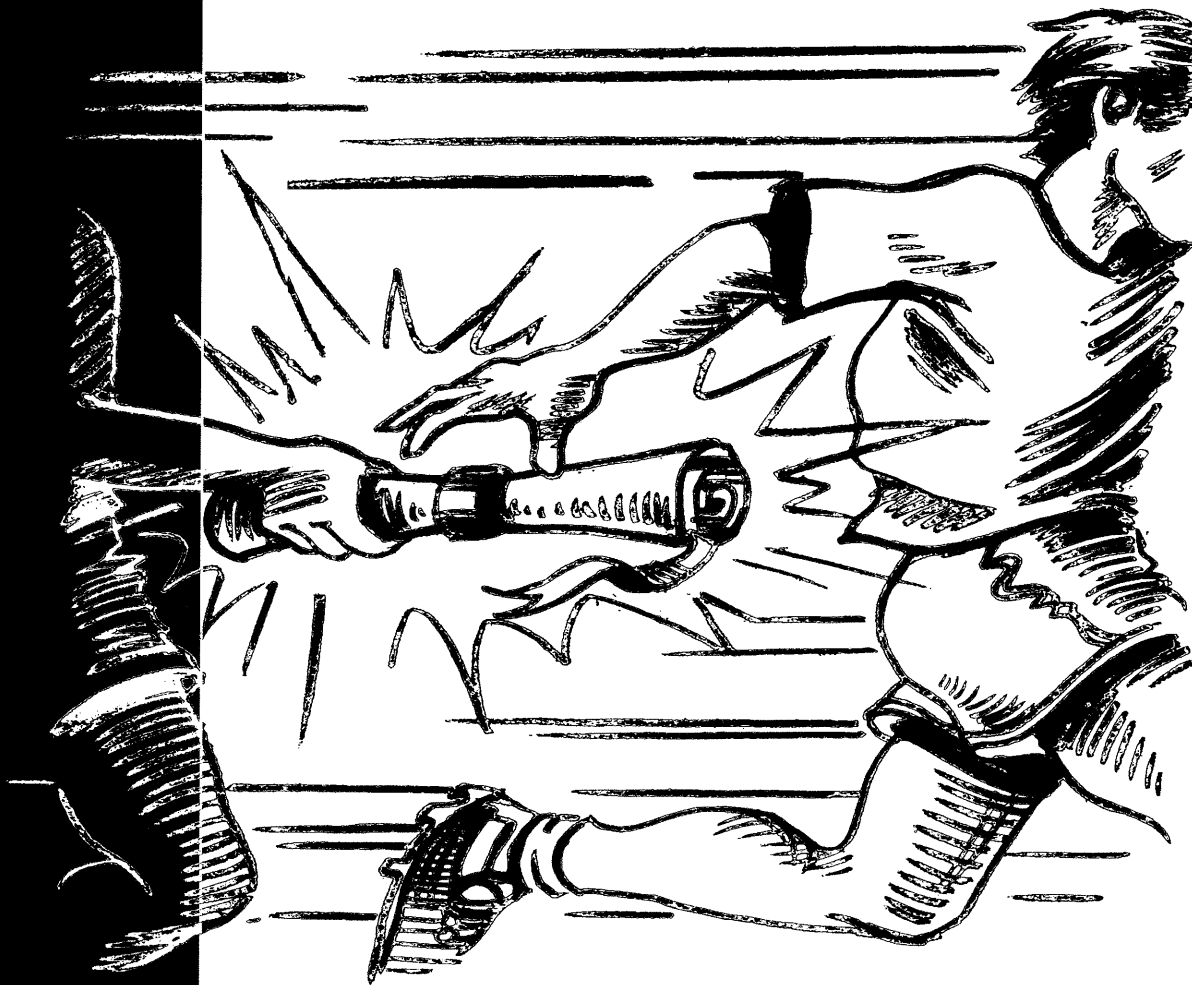
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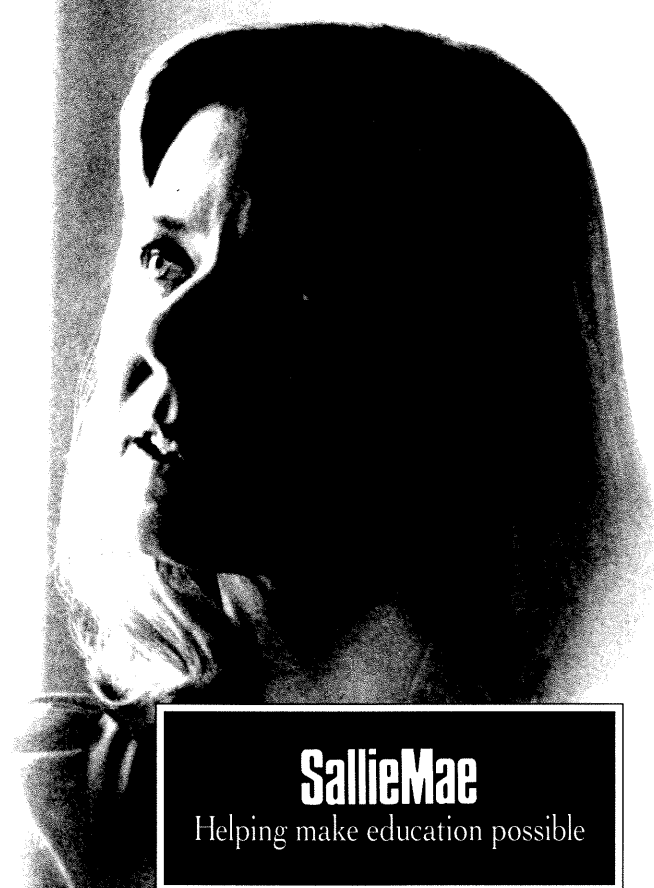
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