

TECHNOLOGY & LEARNING

Part Two of a Three-Part Series



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Publisher: Jo-Ann McDevitt jmcdevitt@cmp.com

EDITORIAL

Editor in Chief: Susan McLester smclester@cmp.com
Associate Publisher/Executive Editor: Amy Poflak apoflak@cmp.com
Art Director: Janet Phares jphares@cmp.com
Copy Editor: Sheetal Singh
Consulting Editor: Judy Salpeter
Contributing Editors: Jeffrey Branzburg,
Susan Brooks-Young, Gwen Solomon

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TECHLEARNING.COM

Director: Gwen Solomon gwenso1@earthlink.net
Web Production: Minnick Web Services

ADVERTISING SALES

National Sales Manager: Simon Tschinkel
stschinkel@cmp.com; (212) 600-3094; Fax: (212) 600-3122
Western Regional Sales Manager: Allison Knapp
aknapp@cmp.com; (415) 947-6151; Fax: (415) 947-6041
Account Manager: Patrick Rife
prife@cmp.com; (415) 947-6267; Fax: (415) 947-6041

MARKETING

Marketing & Sales Coordinator: Adrienne Robillard
arobillard@cmp.com
Ad Production Coordinator: John Cunningham
jcunningham@cmp.com
Circulation Director: Kevin P. Regan kregan@cmp.com
Circulation Coordinator: Jessica Ward jward@cmp.com

Conference & Events Manager:
Diana Milbert dmilbert@cmp.com
Reprints: Terry Wilmot
twilmot@cmp.com; (516) 562-7081

EDITORIAL AND ADVERTISING OFFICES

600 Harrison Street, San Francisco, CA 94107
Phone: (415) 947-6746 Fax: (415) 947-6041
For general editorial correspondence: techlearning_editors@cmp.com

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Let's Teach Students to Innovate

It's very likely that history will prove the last 25 years a mere prelude to an age of unparalleled innovation.

What creative, untamed minds paired with technology have made possible today was simply inconceivable to most of us a decade ago. The pace has indeed been dizzying. And the growing pains have been there from the start.

In the pioneering days of technology in education—the late 70's and early 80's—we argued about frills: was color on a computer extravagant? Was sound frivolous and distracting? A major issue of debate in 1982 was whether word processing would help or hinder education. And in those days, we also weren't talking much about different learning modalities. In an interview, psychologist B.F. Skinner states, "Computer graphics and animations aren't really necessary...When you refrain from jazzing up a program to give students false interests, you're actually letting them discover they can learn something."

In 1987 the battle raged around operating systems, with Tandy ads urging schools to "move up to the MS-DOS standard." And conversations were heating up around

school-business partnership issues, with Chris Whittle's Channel One classroom TV program setting off a storm of controversy about airing advertisements in the classroom. In 1993, "edutainment" was hot, but we didn't use that word around most educators—school was school, games were games, and never the twain shall meet. Today, Harvard, MIT and others have labs devoted entirely to the development of learning simulation games, and even the U.S. military is employing them to train soldiers for active duty.

We can chuckle a bit in hindsight over what might feel like quaint sentiments and concerns of the early days of technology in schools. At the same time, looking back serves only to re-emphasize how rapid the rate of change has been

and how challenging a task it is to innovate for an unknown future.

For the past 25 years, it's been difficult not to focus as much on the new technologies—computers, multimedia, the Internet—as on the education of our children. We have been understandably wowed by the capabilities of all the new gadgets at our fingertips, and creative educators have found ways to enhance teaching and learning, streamline tasks and do much more with their assistance.

But, as more educators, parents and employers are asking today, are we serving our students when we have them using technology to complete the same tasks that their parents did with pencil and paper? Are we training them for a real world where invention, discovery and the ability to think will be necessary skills for success?



At the core of innovation is the capacity to imagine the unimaginable. And as we move deeper into the 21st century where exponential leaps in technology may be the only predictable thing, let's be sure our children are empowered with both the tools and the courage to step up and shape the innovations that will drive not only their own futures, but the future of their fellow citizens of the planet. ■

Susan McLester
Editor in Chief

With thanks to the following who made this Special Report possible: Apple, AOL@School, Atomic Learning, CDW-G, Compass Learning, Olympus, PBS, Pearson Education.



25 That Made Their Mark

We are proud to present 25 innovative people, products and initiatives that have shaped the landscape of education technology over the past generation.

The educators, leaders and innovations we've selected to profile here mark 25 of those who've been most successful at meeting the challenge of envisioning and preparing for an unknown future. They were chosen by *T&L* editors from a mixture of readership studies, advice from advisors and other experts in the field, and also from the pages of *Technology & Learning* over the years. We're honored to salute these influencers, models and benchmarks, as tangible demonstrations of the magic that can occur when people take their dreams and work to make them reality.

Of course, it was a tough call to whittle down to 25 the many excellent choices from which we had to select. And by no means do the innovations we showcase here tell the complete story. Far from it. The amazing educators, exciting products, cutting edge schools and groundbreaking initiatives we've covered over the years and continue to see on a

daily basis are ongoing evidence of the dedication and inspired ideas that continue to drive key changes in education.

5 Who Led the Way

The following leaders represent a broad range of accomplishments in the world of education and technology. What they share, however, are the qualities of vision, courage, confidence, character and energy required to make a difference.

1 The name **Seymour Papert** might historically and accurately be more closely associated with the word "revolution" than anything else. The MIT professor and Piagetian psychology-trained Papert was a pioneer in his theory that learning in school ought to be as child centered and natural as learning in the real world. As early as the sixties, Papert was conducting research with kids and computers in his MIT lab, convinced that computers could be "instruments

for learning and for enhancing creativity." The Logo programming language was created in this lab, as well as a variety of children's electronic toys. In 1980, Papert authored "Mindstorms: Children, Computing and Powerful Ideas," long before the Internet had been established or word processing or even the Apple IIe was to be found in most schools. The publication espoused the idea that computers can help children "learn how to learn," and used the development of Logo as a "case study and prime example." (see Logo, page 7).

The official launch of Logo as a marketed software program that same year was to quickly inspire a nationwide "logomania" among educators, with a near cult-like profusion of books and articles following, including such titles as "Logo Fever," "Apple Logo in the Classroom," "Logo: Not Just for Kids," "Logophile," and hundreds of others. But Papert's eye remained doggedly on the prize. In interviews he warned that it would be "stupidly complacent to think the computer has come and that it's going to solve our problems in education."

In a 1983, *Classroom Computer News* (*T&L*'s former name) Special Logo Issue, editor Peter Kelman laments the fact that Papert's Logo software program designed as an open-ended "object to think with" was being squeezed back into the familiar mold of "school" with the



"The official launch of Logo inspired a nationwide "logomania" among educators."

electronics "hacker" and 21-year-old Steve Jobs were to begin a collaboration leading to the creation of the Apple Computer Company. With the Apple I micro-computer a trial run, the pair then hit the jackpot with the Apple II, which was to win the hearts and minds, and long-term loyalty of schools. In a 2000 interview with *Business Week*, Jobs described

the process which would eventually catapult Apple to the position of number one supplier of computers to schools:

"We at Apple sold the first computers [to schools] back in the '70s, but we were very frustrated, because at that time people didn't understand how technology could help. So we started a program called "The Kids Can't Wait" and helped author a bill in Congress [in the late '70s to give tax breaks for donations of computers to schools]. I went back to Washington for three weeks and walked the halls of Congress myself. The bill passed the House with a huge margin, but in the Senate, [former Senator] Bob Dole refused to bring it to a vote and it died.... The next year, California thought it was such a great idea that they passed their own law. Apple then gave a computer to every school [in California],

2 **Steve Jobs and Steve Wozniak.** It was at the Homebrew Computer club in Palo Alto that 27-year-old Steve Wozniak, an HP employee and dedicated digital elec-

and we got the software developers to do the same thing. This was the first mass deployment of computers in schools ever—and it was very exciting."

Jobs' encore invention, the Mac, with its GUI interface, has had a dramatic impact on the entire computing world.

Apple continues today its strong representation in the school market, with a range of classroom-friendly digital media tools and discounted software for education.

3 **Bill Gates.** Controversial though he may be, Bill Gates had done much to drive reform in K-12 education over the past 25 years. Beginning with his development of the BASIC programming language for the Altair 8080 at age 19 back in 1975, Gates has displayed his genius for marketing and business in many a niche of the broader realm of technology.

Growing up in the shadow of Apple when it came to operating systems in schools, Microsoft's DOS-based system was primarily seen as a "serious" business-based application accessible only to the more techie students with a motivation and love for "under the hood" programming. But with Microsoft's controversial adoption of the Mac-emulating graphical user interface, especially in its later Windows 95 iteration, the PC became as broadly accessible to students and educators as the Macintosh.

With a base in schools to rival Apple's, Microsoft began creat-



“Kathy Schrock has touched more in-the-classroom educators than any other person with her practical technology-related resources.”

ing high quality education software, such as the Encarta multimedia reference product, and offering them with site licenses at consistent and significant discounts to schools. Since then, Gates has demonstrated his dedication to helping schools get up to speed with technology via several additional initiatives targeting parents, libraries, educators, and districts seeking funding for technology. Among these programs have been summer institutes for teachers, school PTSA technology nights, online lesson communities and networks, the Gates Library Initiative, Connected Learning Community grants, a kids Stay Safe Online guide and much more.

Microsoft's coining of the term “anytime, anywhere learning,” in the mid-90s effectively helped to focus attention on the importance

of mobile computing and 1:1 learning in schools.

Perhaps most significant in recent years has been the Bill and Melinda Gates Foundation's efforts on behalf of small school reform. In a demonstration of the power of committed philanthropy to spearhead real change, the past four years have seen the Foundation award more than \$475 million to schools serving low-income and minority students across the country. The initiative continues to make “Reinvention Grants” to individual states and local urban reform efforts, and to use the high profile Gates name to generate the publicity necessary to keep the effort alive and in the public eye. The program's goal is to be a major driving force in innovative education practices and to ensure that minorities and other traditionally disenfranchised students graduate with the

same “ready for college” education as their more fortunate counterparts.

4 Senators Rockefeller and Snowe. In 1996, Senators Jay Rockefeller (D-W.V.) and Olympia Snowe (R-ME) transcended party lines to collaborate on an initiative that would prove a powerful first step toward bridging the digital divide in America. The Snowe-Rockefeller Amendment to the Telecommunications Act of 1996, commonly known as the E-rate, created deep discounts of 20 to 90 percent off

the cost of Internet access for schools and libraries nationwide, making it possible for schools and communities in remote areas to connect to the online world for the first time. With the changing of the guard from the Clinton to the Bush administration, a decreased emphasis on the importance of technology in schools, and a few well publicized allegations of corruption and misuse, the E-rate program has come under fire and even now continues to have its livelihood threatened. Senator Snowe has kept up the fight for the E-rate, appealing to former Secretary of Education Rod Paige to maintain the program's independence from the larger education block grants which would require schools and libraries to apply through state education agencies rather than local agencies.

5 Kathy Schrock. A former librarian and current administrator for technology for the Nauset Public Schools in Cape Cod, Mass., Kathy Schrock has perhaps touched more in-the-classroom educators than any other single person with her comprehensive, high quality and thoroughly practical technology-related resources. Celebrating its 10th year, Schrock's online Guide for Educators (now

under the discoveryschool.com banner) originated in a card file box of categorized Gopher sites and was launched online when dial up came to Cape Cod in 1995. The energetic educator taught herself HTML in a week, “mounted up the pages,” and the rest is history.

Maintaining the site from 5-6 a.m. and 9-10 p.m. daily, the educator features more than 20 of her own books on topics from developing a Web page to writing and research on the computer to building a technology-enabled media center. She also posts full content for more than 15 slide shows from her ongoing workshops on such topics as handheld technologies, information literacy, and using the Internet in lessons. In addition she has created templates for Web evaluation, assessment rubrics for digital projects, TeacherQuests, and supplies links to tens of online bulletin boards to encourage educator communities of practice.

But Schrock doesn't stop there. She also tackles hardware and “gadgets,” aggregating information from other sites on digital cameras, flash drives, videoconferencing, GPS, tablets, wireless and much more. In all she keeps an astounding 2500+ links current and is constantly reading and locating new sites of interest to educators.

It is difficult to imagine how there are enough hours in a week for this dedicated educator to perform her tech administrator job, while continuing to author books and articles and respond in a timely manner to all who e-mail Schrock from her Guide for Educators site.

15 Breakthrough Products

The following eclectic mix of hardware, software and emerging technologies were culled from polls of reader favorites over the years and from current surveys of educators and other experts in the field. Presented here in

chronological order; each of them remains a benchmark in the journey through the last generation of technology in education.

6 The Oregon Trail (1971) Long before the “personal computer” made educational games popular in most schools, folks at the Minnesota Educational Computing Consortium and elsewhere were building simulation games. Oregon Trail, created in 1971 as a senior project by Don Rawitsch and two other education students at Carleton College, took students on an authentic pioneering journey, asking them to make choices and solve “real world” problems such as finding food, hauling loaded wagons across rivers, and identifying dangers that ultimately determined their destiny in the wilderness. Originally, choices were made via teletype and the machine printed out the responses that came back over the phone line. Shooting was accomplished by asking the user to type “BANG” as fast as possible. Later, MECC created Apple II versions of Oregon Trail and succeeding versions, published by The Learning Company, and now Riverdeep, have withstood the test of time, evolving with the advancing technologies over the years. Oregon Trail is currently in its 5th iteration.

7 Apple II (1977) Introduced in 1977 at the West Coast Computer Fair, the Apple II was the first pre-assembled “micro.” Breakthrough features of the \$1,298 machine that spurred its popularity in schools included its “printed circuit motherboard, switching power supply, keyboard, case assembly, manual, game paddles, A/C power cord, and cassette tape with the computer game ‘Breakout,’” according to the Computer History Museum. Competitors followed but by 1979, when Minnesota adopted Apple IIs for the entire state, it was clear that Apple had moved into the No. 1 slot.

8 Logo (1980) The Logo programming language, created by Seymour Papert and his team at MIT, was based in the constructivist learning philosophy and designed to truly tap in to kids' ability to think critically (see page 4). The program's primary features—interactivity, modularity, extensibility and flexibility—were designed to inspire self-directed learning. The following description is from the Logo Foundation Web site: “For most people, learning Logo is not an end in itself, and programming is always about something. Logo programming activities are in mathematics, language, music, robotics, telecommunications, and science. It is used to develop simulations, and to create multimedia presentations. Logo is designed to have a ‘low threshold and no ceiling’: It is accessible to novices, including young children, and also supports complex explorations and sophisticated projects by experienced users.

The most popular Logo environments have involved the Turtle, originally a robotic creature that sat on the floor and could be directed to move around by typing commands at the computer. Soon the Turtle migrated to the computer graphics screen where it is used to draw shapes, designs, and pictures.”

9 Laptop Computers (1981) Anyone remember the Osborne 1? Developed by Adam Osborne of Osborne Computer in 1981, it is considered the very first portable computer for the masses. Weighing a considerable 24.5 pounds but small enough to fit under an airline seat (with a screen that was only five inches), the \$1,795 wundermachine flew off the shelves at a reported rate of 10,000 units per month. Throughout the decade Epson, Radio Shack, IBM, Compaq, NEC, Apple, and Zenith Data Systems followed suit with their own portable models.



Today, laptop—or one-to-one computing—programs abound in school districts and even across states such as Maine and Michigan. Powerful results, now borne out in research, show students in laptop programs collaborate more, write more, and apply critical thinking skills more readily than other students. Teachers, too, are affected—adopting new roles as learners and facilitators.

Before the concept of laptop learning reached widespread adoption in the United States, however, it was being pioneered Down Under. In the late 1980s, long before “anytime, anywhere learning” was even a gleam in Microsoft’s eye, a group of Australian educators had a prescient thought: how would education change if every child had a notebook computer?

In 1989, David Loader, then principal of the Methodist Ladies’ College, a private girls’ school in Melbourne, and his colleagues launched the first-known laptop program. They began with one class, then expanded to include an entire grade level, and finally all classes and grades in the school. By 1990, each fifth-grade girl was toting a Toshiba T1000SE and using LogoWriter to create multimedia presentations across the curriculum.

Following their lead, several private schools launched laptop programs. This movement spread to public schools in the mid-1990s.

The laptop revolution in Australia made big news, drawing attention from curious educators around the world, including a team of Americans who came in 1996 to observe what was happening. And the rest, as they say, is history.

10 The IBM Personal Computer (1981)

In contrast to Apple’s proprietary technology, the IBM Model 5150 offered an open architecture that allowed it to work with third party

“FrEdMail was a God-send. This marvel allowed two-way communication, free and at almost the same pace as the postal service.”

add-ons from a range of vendors. Also, its comparatively simple design made it easy for others to clone. The idea was that the more IBM imitations on the market, the more likely it was that IBM-type systems and the software that runs on them would become the business standard. This strategy spurred the development of thousands of brands of IBM clones, which lowered the price of computers in general and made them more accessible to schools.

Launched in the now-classic series of ads featuring Charlie Chaplin, the PC was followed two years later by the PCjr, designed especially for schools.

11 Bank Street Writer (1982)

The Bank Street Writer represented a groundbreaking change in the way people young and old used computers to write and edit. Developed with the help of the ahead-of-its-time Bank Street College of Education in New York, and sold through Scholastic, the accessible, user-friendly application became a common sight in schools across the country and went on to sell over 1 million copies. The April 1983 issue of *Computer Classroom News* (*T&L*’s old name) reported The Bank Street Writer “allows users to correct spelling or grammar, revise or insert sentences, move paragraphs, and then print out a draft or final copy of their work with just a few simple commands” all for \$95.

12 FrEdMail (1984)

The original idea of the Free Educational Mail Network was simple: to help students become better writers. Founded by enterprising San Diego teachers Al Rogers and Yvonne Andres in 1984, FrEdMail was an Apple II-based networking application that let educators and students from different parts of the country collaborate on projects and share resources. “FrEdMail was a God-send,” said Harold M. Brewer, superintendent of Montgomery County Schools in Maryland. “Just as I was learning the use of the computer and some Internet, here was this marvel that allowed two-way communication, free and at almost the same pace as the postal service. It would take two to three days for a message to get a turnaround, but, it was the best thing going...” In 1993, FrEdMail Foundation became the Global SchoolNet Foundation, which has continued the vision of connecting a global electronic community through its award-winning Global Schoolhouse project and its Doors to Diplomacy student Web design contest.

13 Macintosh (1984)

In 1984 Apple introduced the Macintosh with much fanfare. Wrote former *T&L* editor Holly Brady of the unveiling: “After building up much anticipation about the new machine’s architecture, [Steve] Jobs dramatically con-



nected a long cable to the back of a 128K Mac sitting alone on stage. The little Mac came to life and greeted the huge crowd in its robotic voice. ‘Hello,’ it said. People went wild!”

Besides its “speaking” ability, the Macintosh wowed educators with its groundbreaking mouse-driven graphical user interface. During the next year, the Atari ST and Commodore Amiga were built around the same chip (the Motorola 68000). But the Mac was the only machine that made true inroads in the general market—in spite of its lack of color.

14 Multidisciplinary Programs (1984–)

Products that took advantage of media to integrate instruction across a variety of disciplines offered students the new dimension of a “real world” context for learning.

One of the earliest of these, *Voyage of the Mimi*, developed by Bank Street College of Education was described by the company this way: [it] “brings the world of whales to the classroom in 26 15-minute video segments, four computer learning modules, and extensive print materials.” The program integrated math, science, language arts, and social studies.

With the advent of the Internet, such multidisciplinary projects gained the added advantage of becoming real-time adventures. The science-centered JASON Project was one of the earliest of these. A 1999 description from techlearning.com captures the excitement of the experience: “The

JASON Project uses a telecommunications technology known as ‘telepresence’ to take millions of students along on a research expedition using a live satellite feed. Currently, this telepresence is allowing students at primary interactive network sites (PINS) throughout North America and the United Kingdom and Mexico to watch an expedition to the Amazon River basin live. Viewers can interact with scientists and control live-feed video cameras in real time.”

Also popular were the later *MayaQuest*, *AfricaQuest*, and other quests in the series first published

by MECC and later Classroom Connect. A 1996 *MayaQuest* newsletter describes the experience: “In the spring of 1995, a team of five explorers, led by Dan Buettner, bicycled to ruins in Mexico and Central America, met with on-site archaeologists, and attempted to unlock one of the most perplexing mysteries: the collapse of the ancient Maya civilization. But the team wasn’t alone: over 1 million kids, teachers and others from around the globe helped to lead the expedition by way of the Internet.

Armed with hi-tech team equipment, the explorers linked to classrooms and computers around the world. The online interactive experience let followers lead the team, chat with other kids and educators, view images from the journey, and learn about the ancient Maya and contemporary Central America.”

15 HyperCard and HyperStudio (1987-1992)

In the early 1990s the education world was buzzing with multimedia talk. On the do-it-yourself front, HyperCard (1987) and HyperStudio (1989) were being used enthusiastically by students and educators to author their own multimedia projects and presentations. With the easy to use, groundbreaking HyperStudio, presentations could move beyond the realm of being strictly text-based, allowing users to experiment with backgrounds, graphics, sounds, and animations that made their work come alive and brought new energy to classrooms. Reminiscing about the impact of the product, creator Roger Wagner says it best: “Students didn’t just ‘do a project’ with HyperStudio, they became engaged in an open-ended process of researching, exploring and internalizing concepts, and then delighting in the ways that their new knowledge could be expressed and shared with others.

One insight into the special appeal of HyperStudio could be summarized



by the words 'community' and 'commitment.' The software became the by-word of a community of motivated and enthusiastic educators with a shared vision of how the classroom experience could be qualitatively different. Educators greeting each other at a conference or meeting that shared the fact that they were using HyperStudio instantly understood that they were among similarly-minded pioneers with an exciting mission."

16 The World Wide Web (1993)

Until 1993, the World Wide Web was simply a project in the Swiss research lab CERN. But with the

much more. And we have just scratched the surface of this technology—with the Internet2 promising new immersive environments and virtual reality experiences from museum tours and field trips, to 3-D visualization and virtual classrooms comprising students and experts from around the world.

17 Encyclopedia Britannica Online (1994)

This well-known company broke new ground in education when they became the first commonly used reference to take advantage of the Internet to offer a subscription-based product that provided regular

"WebQuests were the perfect way to pair the World Wide Web with higher-order thinking skills."

advent of Marc Andreessen's graphics-friendly Mosaic browser, the Web took the shape we recognize today. With the Internet as its backbone, the Web soon became the primary avenue for presenting information on networks, and the rest is history.

For education, it has brought with it a host of possibilities. This point was first driven home to *T&L* editors one afternoon in '93 when they observed a live online chat between then Vice President Al Gore, and a high school student around the topic of technology. (At one point, the student announced he had to get offline because his mother was calling him to do homework.) This kind of accessibility was a new frontier indeed.

Since then, of course, we've come to rely heavily on the Web for timely news and references, for collaborative projects and document sharing, for e-learning opportunities, Web-delivered curriculum and

updates and a host of school-friendly tools. This marked the beginning of a slow but steady shift of educational content from CD-ROM to Web format.

18 WebQuests (1995)

Originated by Bernie Dodge and Tom March, WebQuests captured the imagination of educators as the perfect way to pair use of the World Wide Web with higher order thinking skills. Dodge describes the Quests as "inquiry-based activities designed to use learners' time well, to focus on using information rather than looking for it." Each WebQuest is built around a task, which provides a context and motivating goal for student work. Examples include: "King Tutankhamun: Was it Murder?" and "Searching for China," which has students reading about and debating different perspectives to achieve consensus.

These projects enrich the curriculum while teaching students to analyze and synthesize information they find online and elsewhere.

19 PDAs (1996)

[The following are excerpts from a *T&L* article, "A Report Card on Handheld Computing."] "Ed tech 'old timers' will remember the mid-1980s Apple Newton, the much ballyhooed but far from perfect first-generation personal digital assistant that fit in the palm and was the first to employ the special stylus and handwriting recognition software still in use in today's models. Although the Newton's glitches kept it from catching on in a widespread way, Apple was on the right track with the idea of a lightweight handheld personal technology.

With Palm's 1996 introduction of the Pilot 1000 and Pilot 5000—with their small, pocket-friendly size, increased memory, and most significantly, ability to run mini-applications called applets—handhelds took the first steps toward coming into their own for the education market. Third-party developers were soon creating a variety of useful programs—from basic office suite software to foreign language dictionaries—and the device began to stand on its own as more than simply a calendar and address book tool. In addition to Palm's platform, the Pocket PC operating system built by Microsoft also emerged to define the handheld computing category. With an optional modem or wireless networking hardware, both Palm OS and Pocket PC devices can also be used for e-mail, Internet access, and instant messaging."

20 Wireless Networking (1997)

Way back in the early 70's the University of Hawaii was using the first wireless LAN to connect their seven computers across four different islands via packet-based

radio. But wireless was not widely useful and accessible until the IEEE 802.11 standard emerged in 1997, paving the way for the proliferation of WLANs in offices, homes and schools. For schools in particular it offered a practical solution to many common problems. One was the challenge of installing cable in older buildings or those with concrete walls and low floors. Another was the problem of wiring in portable classrooms that had sprouted up in so many venues due to overcrowding. But the main advantage to wireless was its liberating effect on education. Students and educators were no longer tied to desks and labs when online, but could move throughout the school and grounds.

Today, new wireless standards are evolving, and though issues of security remain major concerns, a ubiquitous wireless environment is undoubtedly in our future.

5 Initiatives that Changed History

Among the highlights of the past 25 years are the following programs that addressed major educational technology challenges, creating broad ripple effects and heightening the national consciousness around technology issues.

21 Technology Innovation Challenge Grants and PT3

Perhaps no efforts have had as much of an impact on the state of K–12 education as the now-defunct Technology Innovation Challenge Grants and the Preparing Tomorrow's Teachers to use Technology grant program. Launched in 1995 under President Bill Clinton, the TICG initiative marked the first time that an administration put technology in schools on its agenda, and raised the importance of educational technology to

the national level. It also was the first time a presidential administration took steps to ensure America stayed ahead of other nations in terms of technology in schools.

The TICG program stemmed from the Improving America's Schools Act in 1994, which pledged \$2 billion over a five-year period to help states and communities integrate technology into schools. The section of this law known as the Technology for Education Act created the TICG program, and the program was set up to dole out \$5 to \$10 million grants. In its heyday, the program supported partnerships among educators, business and industry, and other community organizations to develop innovative applications of technology and plans for fully integrating technology into schools. The program also targeted the underprivileged, providing competitive five-year awards to consortia that included at least one local educational agency with a high percentage or number of children living in poverty.

Although the program was K–12 in focus, its consortium requirement opened doors to collaboration between K–12 schools and higher education. As a result, between 1995 and 1997, 62 TICG projects were funded nationwide. From 1998 to 2000, the government funded 38. The program doled out its last grants in 2001.

In 1999, as TICG was winding down, the Department of Education responded with a slightly different take on rewarding technological innovation in the classroom: the Preparing Tomorrow's Teachers to use Technology, or PT3, grant program. While TICG focused on equipping schools with technology, PT3 recognized the importance of getting educators up to speed on it. In its first year, PT3 awarded \$75 million in competitive grants to education consortia to help address the challenge of teaching teachers how

Other Pioneers

BREAKTHROUGH PRODUCTS

Assistive Technology Devices Kurzweil, Intellitools, and others developed technology accessibility tools, such as joy sticks, touch screens, special keyboards and voice-to-text software that have opened up a new world to physically-challenged students and educators.
CD-ROM Technology Multimedia blossomed with this new technology, spawning such school favorites as multimedia encyclopedias with animations and music, and CD-ROM storybooks like the popular interactive *Just Grandma and Me* from Broderbund.
Microsoft Office This first suite of productivity applications streamlined the tasks in businesses and schools and paved the way for tools such as spreadsheets and PowerPoint to become commonly integrated into classrooms.
Information Management Systems Chancery's WinSchool was one of the first systems designed to manage student data—everything from class schedules to progress reports, to health and family data. Now, national assessment and reporting requirements have created a burgeoning market for these programs.

INITIATIVES AND PROJECTS

National Standards (including ISTE NETS standards)-CEO Forum and the Partnership for 21st Century Skills These organizations identified the level of technology readiness, preparation and literacy necessary for students to meet the challenges of the new millennium.
U.S. D.O.E. Education Regional Labs From high-stakes testing to public engagement, these labs offer outstanding resources on school accountability. Education institutions can measure school and student performance and how to work with schools that want to improve.
Americas with Disabilities Act Enacted in 1990, the ADA prohibits discrimination and ensures equal opportunity for persons with disabilities in employment, State and local government services, public accommodations, commercial facilities, and transportation. It required schools to offer equal access to technology and learning materials for all students.
Schools Interoperability Framework (SIF) This initiative has established common standards for software and hardware technologies so that schools across the nation and the world can work together.
ThinkQuest This program, still going strong and now owned by Oracle, pioneered student-centered learning by challenging youngsters to research, design and create their own Web sites that instruct other students.
Generation Why Pairs businesses and students to "Cutting-Edge Insight, Perspectives, and Strategies for Educating and Employing the Next Generation."
I-Earn Online global network that invites young people to use the Internet and other new technologies to engage in collaborative educational projects that both enhance learning and make a difference in the world.
Tapped-In Set the stage for later online communities where educators, students and researchers come to learn, collaborate, share, and support one another.



to use the technology their district provides. These grants include projects designed to transform teaching and learning through faculty development, course restructuring, online teacher preparation, and more.

Overall, the PT3 program has awarded grants to more than 400 consortia composed of higher education institutions, state agencies, K–12 school districts, nonprofit organizations and more. The program continues today.

22 E-Rate

When President Clinton signed the Telecommunications Act of 1996, he presided over the first comprehensive revision of the country's communications laws in more than 60 years. By establishing a universal fee for all phone users across the country, the law set out to help schools and libraries obtain access to state-of-the-art services and technologies at discounted rates. Using this fee, the E-rate program was established to dole out \$2.25 billion a year to help poor schools connect to the Internet. The program also provides schools and libraries with discounts of 20 to 90 percent on telecommunications, Internet and internal connections equipment.

From the very beginning, an overwhelming majority of the districts that qualified for participation in the E-rate program were in rural or poor urban areas. But that hasn't stopped just about every other district in the nation from applying as well. A 2000 study by the Education Department and the Urban Institute found that 75 percent of all public school districts and individual schools had applied for E-Rate funds, and that nearly 84 percent of the money has gone to public schools. About half of all public libraries and 15 percent of private schools have applied for the funds, and the program has huge advocates within K–12 education.



“Intel’s Teach to the Future helps educators create assessment tools and align lessons with learning goals and standards.”

E-Rate has also given a leg up to many ed tech industry vendors, whose online curriculum and other resource materials are now accessible to a much broader audience.

This year, the E-Rate is up for reauthorization, which has reopened old claims of misuse and

corruption and brought out new ones as well. A report issued in March by the Federal Communications Commission said that 42 criminal investigations relating to the program were underway. If the valuable E-Rate program is to survive, educators and the

American public in general will have to be active evangelists for this program that has done so much to help bridge the digital divide.

23 Intel Teach to the Future

Giving a huge boost to educator professional development on a national level was Intel's Teach to the Future program. Launched in 2000, the program is a worldwide effort to help experienced and pre-service educators integrate technology into instruction to develop students' higher-level thinking skills and enhance learning. Through the program, educators take advantage of collaborative Web-based “communities of practice” to learn from colleagues about best practices in harnessing technology to enhance the education experience and drive reform. In addition, they experience new approaches to creating assessment tools and aligning lessons to learning goals and standards.

The Intel Teach to the Future program began in the U.S. but has since welcomed teachers from more than 30 countries including: Argentina, China, India, South Africa, Russia and the United Kingdom, to name a few. When international educators get involved, Intel often collaborates with ministries of education or other government entities to adapt the curriculum for each location. So far, the program has trained more than 1.5 million educators; by 2006, Intel expects the program to train more than 2.5 million worldwide.

24 NetDay

Much like the E-rate, NetDay was designed as a comprehensive effort to bridge the digital divide. The initiative began in 1995 as a year-round grassroots volunteer program by companies, educators, families and communities to wire the nation's classrooms for Internet access. Between 1996 and 2001, more than 500,000 volunteers affli-

ated with NetDay wired more than 75,000 classrooms in 40 states. Today, NetDay is an effort spearheaded by an eponymous nonprofit organization that works with other national organizations to help schools and communities incorporate technology into instruction and school management. Officials credit the organization with bringing Internet access to almost 99 percent of K–12 schools across the country.

Specifically, NetDay community initiatives provide direct service to more than 25,000 students in 25 schools in five different underserved communities. Through the NetDay Technology Enhances Student Success program, the organization provides direct mentoring and coaching to help teachers learn how to use technology to improve student achievement in Mississippi. Through the NetDay AmeriCorps bridge, NetDay recruits AmeriCorps volunteers to dedicate a year of service to help bridge the digital divide for schools in underserved communities around the country.

25 Virtual School Initiatives

Since the 1996 pioneering efforts of The Concord Consortium's Virtual High School and the Florida Virtual Online High School, now the Florida Virtual School, e-learning has been growing at an exponential rate. Instituted as a problem-based solution, the virtual schools grew from a variety of needs. Overcrowded schools in

swiftly growing districts, enrollment demands in high need courses, such as Algebra, the need for Honors and AP courses to be available to students in remote and rural areas, keeping job holding students from dropping out—all these were and are addressed by the flexibility of the online course. The Florida Virtual High School, whose motto is “anytime, any place, any path, any pace” has become a national model for a statewide initiative. In 2000, the Florida State Legislature established FLVS in state law as an independent educational entity with a gubernatorial appointed governing board. Today, FLVS develops and provides curriculum for schools all across the nation, specializing in grades 6 to 12, as well as adults seeking GED alternatives. Enrollment for the 2003-2004 School Year exceeded 21,000 students.

The school offers more than 80 courses—everything from GED to honors to Advanced Placement courses. It is accredited by the Southern Association of Colleges and Schools, and all of its courses are accepted for credit and transferable. Courses are delivered over the Internet, and teachers communicate with students and parents on a regular basis by phone, e-mail, instant messaging, and discussion forums. The school employs more than 200 teachers, all of whom hold a valid Florida teaching certificate. At last check, 21 of these teachers were nationally certified, as well. ■

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Celebrating 25 Years With Technology & Learning

As *Technology & Learning* magazine moves through its 25th year of publication, we are happy to be bringing readers a three-part series of Special Anniversary Reports. In its entirety, the series is designed to showcase the greater impact of digital technologies on education over the last generation. In this second report, "Saluting Innovation" we celebrate the leaders, ideas, schools, solutions,

and initiatives that have been major influencers in shaping the vision and practice of technology in education.

Our first report, "Celebrating Students," delved into the personal stories of nine children whose lives have been profoundly touched by today's technologies. These inspiring narratives serve

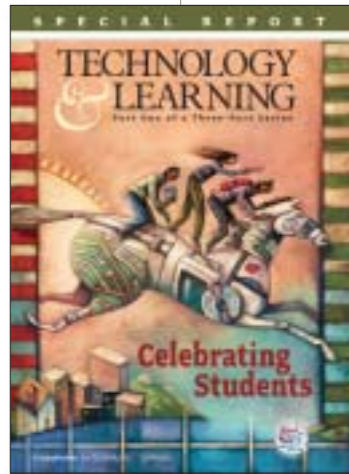
to illustrate the power of technology to motivate, to challenge, to lift and ultimately to impact forever the destiny of an individual.

Here are highlights from a few of our student stories:

■ Seventeen-year-old Prum, the seventh of 10 children born to Cambodian immigrants, went from skipping school and feeling isolated from his parents to gaining newfound self-confidence and direction through his exposure to digital photography and documentary film production. Prum's work in the dig-

ital arts earned him a position as a production assistant in a documentary project on Culture Clash, a trip to American Samoa to teach middle and high school age students, and most importantly, the understanding and respect of his parents.

■ Spurred on by her teacher, Neme Alperstein, 10-year-old Alyssa crafted an incredibly rich and comprehensive resource on how she had lived with epilepsy since age six.



Alyssa's Web site explains what epilepsy is, talks about how it's treated, includes a movie on her visit to her neurologist, invites input from similarly afflicted youngsters and also features her own (heartbreaking) graphical pictorial depiction of a young girl with probes attached to her forehead.

■ Ali, who immigrated to America from Pakistan at age 10, was lost in the large urban environment of the New York City public schools. He was unmotivated and uninterested in learning more than just the minimum required for graduation. But the MOUSE program changed all that. MOUSE (Making Opportunities for Upgrading Schools and Education) is a New York City-based non-profit dedicated to empowering students. Ali's experiences in the MOUSE Squad allowed him to have an outlet for

his nascent interest in computers. He has been able to exercise his interest in graphic design and digital art. He's also learned about technological terminology, networking, servers, and troubleshooting.

■ In 2003, four high school students from the Tashkent International School in the country of Uzbekistan confronted the issue of their nation's human rights problems head on by researching the topic and publishing their findings on the Web. The site, "Uzbekistan: Opaque Reality," was created as an entry for the non-profit Global SchoolNet's Doors to Diplomacy student competition.

Other highlights from our first issue include student "Dear Mr. President" letters collected in an online survey by the non-profit NetDay. The heartfelt letters showcase the crucial role that technology plays in the lives of students today.

You can read the complete stories and hear the first person voices of these remarkable students in the "Celebrating Students" special report on our Web site at:

<http://i.cmpnet.com/techlearning/pdf/25years/25thAnnivReport1.pdf>

Don't miss our final 25th Anniversary Special Report: "Envisioning the Future" Stay tuned for our next special report due out in November 2005. In "Envisioning the Future," *Technology & Learning* editors, futurists, and those on the cutting edge of science and technology will take an in-depth look at how technological innovations are likely to change the landscape of tomorrow. ■

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NOVEMBER 2005 *T&L*: ENVISIONING THE FUTURE

In 25 years, technology has changed our lives profoundly. Experts' predictions about the innovations to come will explore how future technologies will change teaching, training, and managing well into the future.