THE POWER OF THE INTERNET FOR LEARNING

The Internet is perhaps the most transformative technology in history, reshaping business, media, entertainment, and society in astonishing ways. But for all its power, it is just now being tapped to transform education.

The good news is that the Internet is bringing us closer than we ever thought possible to make learning—of all kinds, at all levels, any time, any place, any pace—a practical reality for every man, woman, and child.

The bad news? Millions still cannot access the Internet and do not understand how to use it to harness the global web of knowledge.

They do not know how to deal in information, the basic currency of the knowledge economy. They do not know how to find information, how to handle it, how to trade in it, how to invest it for their futures.

These individuals, already at risk, will become increasingly marginal in the emerging knowledge economy—unless we change current law, current regulations, and current practices.

The World Wide Web is a tool that empowers society to school the illiterate, bring job training to the unskilled, open a universe of wondrous images and knowledge to all students, and enrich the understanding of the lifelong learner.

The opportunity is at hand. The power and the promise are here. It is now time to move from promise to practice.

There is no going back. The traditional classroom has been transformed.

(e-Testimony to the Web-based Education Commission)

- **Growing enrollments.**
  The baby boom echo, the 25% increase in the nation's birthrate that began in the mid-1970s and peaked in 1990, and rising immigration have increased school enrollment.[5] Public elementary and secondary school enrollment is projected to reach over 47 million in 2000, and to increase further in subsequent years.[6]

- **Critical need for teachers.**
  Schools across the nation will need to hire between 1.7 and 2.7 million additional teachers over the next decade to meet the demand of rising enrollments and replace a large pool of retiring teachers.[7]

- **Overcrowded schools and outdated buildings.**
  $127 billion in spending is needed to repair, renovate, and modernize school buildings. The average public school in America is 42 years old.[8]

Age-Old Dreams, Down-to-Earth Problems

Amidst all of the hype about the Internet is the reality of its inevitability. Forged by the competitive struggles of the private sector, it will soon surpass today's expectations like a Ferrari overtaking the Model-T.

Web-based education is just beginning, with something of far greater promise emerging in the middle distance. Yet technology, even in its current stage of development, can already allow us to realistically dream of achieving age-old **goals in education**—

To center learning around the student instead of the classroom

To focus on the strengths and needs of individual learners

To make lifelong learning a reality

Blazing Trails

The bipartisan, congressional Web-based Education Commission set out to discover how the Internet is being used to enhance learning opportunity, and to identify ways that Congress and the President can help local schools, state education agencies, and postsecondary institutions overcome barriers.

Our work began with face-to-face hearings across America and in virtual hearings on the Web. The Commission listened to hundreds of people eager to show how the Internet and learning are coming together to meet the needs of their communities and schools. From the Head Start teacher on an Indian reservation, to the governor of South Dakota, to the superintendent of a challenged inner-city school district, to the Secretary of the U.S. Army, they gave us a vision of the tremendous promise of the Internet, and they demonstrated its power.[1]

And we listened to those who are concerned about preserving the most valuable elements of traditional education delivery as we move ahead in developing web-based courses and models.

What did they tell us? They told us that the Internet offers education in places where there is none and extends resources where few exist. They told us that the Internet connects people, communities, and resources to support learning. They told us that it extends the learning day and the learning place. They showed us how it adds graphics, sound, video, and interaction to give teachers and learners multiple paths for understanding. And they told us the Web is a media today's kids expect to use for expression and communication—the world into which they were born.

We also learned that the most important ingredient is not money. It is the presence of a local hero or heroes with the vision, courage, and stamina to challenge the status quo. Absent this ingredient, more money will be of little benefit.

The Commission listened to people facing problems as varied as all of America. The solutions they created were no less diverse. Every person who testified before us had one thing in common: each was an Internet trailblazer who heard the cries of need in their communities, and responded—crafting solutions that best fit local outlooks and expectations.

Each saw an opportunity and took it. Each accepted risk. Each embraced a challenge. For these reasons, we believe these Internet trailblazers are among the new heroes of education.

K-12

- **Increasingly diverse student population.**

  35% of U.S. children are members of minority groups, a figure that is expected to climb more than 50% by 2040. One in five comes from a household headed by an immigrant. And nearly one-fifth live in poverty.[9]

- **Intense focus on higher standards and increased accountability.**

  In 1992, only 14 states had designed and adopted academic standards. Today, 49 states have developed content standards and 48 have assessments to measure student progress in core academic subjects, including high stakes testing.[10]

- **More alternatives to public education.**

  As of fall 1999, 350,000 students were enrolled in more than 1,600 charter schools across the United States. Thirty-six states and the District of Columbia have passed charter schools legislation.[11] Home schooling is growing. The number of home schooled 6-17 year olds in 1994 was 345,000, growing to 636,000 by 1996.[12] This figure is now estimated to be between 700,000 and 1.5 million.[13]

  * Note to Readers: Throughout this report we use the term K-12 to refer to the traditional U.S. elementary, middle, and secondary school structure. Much of the data cited was collected at the kindergarten through grade 12 level. However, we acknowledge that web-based technologies have value for young children at the pre-kindergarten level as well (i.e., ages 3 and 4) and occasionally, we use the term preK-12.

CURRENT CONTEXT FOR POST-SECONDARY EDUCATION

POST SECONDARY

- **Growing enrollments.**
  Total college enrollment has been increasing in recent years, projected to hit a record 15.1 million in fall 2000. Between 1998 and 2010, full-time enrollment is projected to increase by 22% as large numbers of high school graduates enter college. Part-time enrollment is projected to increase by 16%.[14] About 67% of all 1997 high school graduates went directly on to college.[15]

- **Increased levels of education are required for our knowledge-based economy.**
  Higher levels of skills and knowledge are required for an economy based on information. 85% of current jobs require education beyond high schools, up from 65% in 1991.[16]

- **Changing demographics.**
  Large numbers of older persons, working adults, and part-time students attended college in 1999. The adult age cohort is the fastest growing segment of students in postsecondary education: 77 million adults are estimated to be taking postsecondary courses. Despite rising enrollments noted above, just 16% of college students fit the traditional 18-22 year old profile, attend full-time, and live on campus.[17]

A Call to Action

These leaders identified distinct barriers to web-based education, and urged us to remove them. They told us the promise of the Internet could not be fully realized unless there is:

- **Greater access to broadband connectivity**

- **Guidance in the best uses of the Web for learning**

- **Understanding of how people learn differently with the Internet**

- **Content that leverages the powerful capabilities of the Web**

We also heard their frustrations. They informed us that yesterday's regulations stymie innovation. They warned us that the Internet is still uncharted territory and urged us to assure that appropriate protections are put in place. And they emphasized that without new sources of funding the promise of the Internet for learning may not be met.

Above all, they asked us to issue a national call to action to remove these barriers.

What Are We Waiting For?

Against this backdrop of opportunity, there are some that have called on us to hold back. In essence, they seek a moratorium on the educational use of digital technologies, including the Internet, until clear evidence of their effectiveness and shortcomings are better understood.

We believe that this call, if heeded, would squander a momentous opportunity in education. This Commission believes that we have sufficient evidence to know that the Internet—if used wisely—enhances education.

We know it works. It is an empirical success in schools, and an empirical success in the private sector.

Imagine what would have happened if the nation's corporate leaders had imposed a similar moratorium in 1990, before they were able to measure objectively any positive impact of technology investment in productivity. It took years for these technological investments to bear fruit. Fortunately, business made these investments in technology. As vast as those investments were, they are dwarfed by their results— a one-third increase in real U.S. economic growth.[2]

We live in a global market, one in which a strained U.S. labor market has to import brainpower and high-skilled workers, or rent it over the Internet from people living in Dublin or Mumbai. In such a rapidly changing environment, standing still is not an option.

Those in the educational sector who would have us wait fail to grasp what has been obvious to the private sector for half-a-decade. The Internet is not a fad. It is not just another in a long line of technologies that have promised a "quick fix" for education. Its reach and impact on all aspects of society are unprecedented. The interactivity of this new technology makes it different from anything that came before. It elicits participation, not passive interest. It gives learners a place for communication, not isolation.

It is not a new form of television. It is the beginning of a new way of learning.

In one sense, however, those who urge education to hold back have nothing to worry about. A *de facto* moratorium already exists in most American schools. On average, U.S. firms spend between $3,500 and $5,500 per worker in technology and technological support each year,[3] compared to per student spending on technology that rarely exceeds a couple hundred dollars in the best of circumstances.[4]
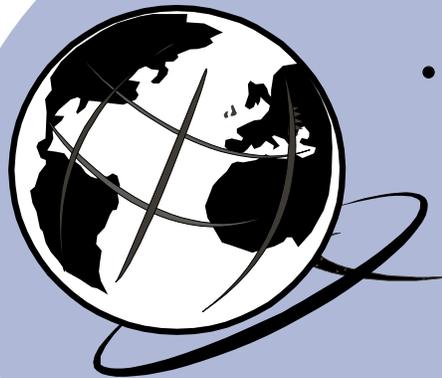
POST SECONDARY

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- **Rising costs of higher education.**
  College costs have risen at both public and private institutions. In the last decade, average tuition and fees at public colleges have risen 44%, and the average at private colleges shows a 40% increase after adjusting for inflation.[18]

- **New technologies are transforming postsecondary institutions.**
  Students enrolled in distance education as a percentage of total postsecondary enrollments are projected to triple to almost 15% in 2002 from just 5% in 1998.[19] The number of distance courses offered by postsecondary institutions and the number of enrollments nearly doubled between 1994-95 and 1997-98.[20]

- **Privatization in higher education.**
  The profit-making sector sees education as an investment opportunity. A growing number of for-profit institutions are emerging and providing students with alternatives to public education.

- **Globalization.**
  The demand for U.S. higher education by students abroad is huge. Close to 500,000 foreign students currently study in the U.S.. Global demand for higher education is forecast to reach 160 million students in 2025.[21]

At the beginning of the 21st Century, the most cutting edge tool to be found in many American classrooms—including our institutions of higher education—is still an overhead projector.

No Turning Back

The Commission has found:

The need for a new design in learning is there. Today's education is built on an agrarian model that worked in the years when we were a nation of farmers, foresters, and fishermen. Schooling changed to take on elements of the industrial revolution (factory-line classes, assembly-line curriculum, and teacher-foremen) that worked for the needs of the Industrial Age. New designs are needed to create the "knowledge workers" who will define the Information Age.

The market is there. Business is poised to support education with powerful Internet solutions. We know that education itself can be a strong market that drives the innovation of continuing products, tools, and applications to benefit learners across the spectrum.

The global economy is there. If this era of globalization has proven anything, it is that a growing world economy can create a strong and lasting demand for skilled knowledge workers and a technologically savvy workforce.

But we haven't made the connection to education. We must seize the opportunities and complete these connections—technological and human.

And we must advance with constant assessment and reflection. There is still much about learning and the impact of technology we do not know. We must continue to research what is not known, analyze what is proposed or underway, and then examine the results. We also must combine our belief in the great value of these advances with appreciation for the difficulties that we face: the inequality of access and the lack of teacher preparedness for web-based learning.

To make the most of learning with the Internet, we will have to address serious issues. Many of these issues are not new. They have been facing education for decades, and some are reaching a crisis point.

We cannot talk about effective use of the Internet in education without understanding the parts of the system that are already strained: teacher shortages and

MEDIA AND INFORMATION: THE WORLD OF TODAY'S STUDENTS

- **Data smog: explosion of information and sources. Kids need information literacy.**

- **Media sensitization and expectations: kids expect content to be as exciting as their latest video game. How can schools compete?**

- **Information architecture: information can be structured in new ways to support effective searching, use, and understanding.[22] How do students learn this?**

TECHNOLOGY TRENDS

Moving from:

- **narrowband**
- **plain, single mode (e.g., text or speech)**
- **tethered (wired) access**
- **users adapting to the technology**

Moving to:

- **broadband**
- **multimodal rich connectivity**
- **untethered (wireless) access**
- **the technology adapting to the user**

the need for better preparation and retraining; teacher compensation and the need to provide a more professional work environment; inequalities in school funding; aging school buildings; and poor student performance. We heard how these strains are slowing the full deployment of the Web for learning. Addressing these issues is essential.

In short, the Internet is not a panacea for every problem in education. We need to be realistic. But we also must realize that the Internet is a tool that can help us empower every student and elevate each individual to new levels of intellectual capacity and skill. That is the great opportunity of this new technology.

Such a promise is easily made. It will take a greater commitment to keep.

THE CURRENT CONTEXT FOR WORKFORCE TRAINING IN THE INFORMATION ECONOMY

- **Increased demand for skilled workers.** Skilled jobs now represent 85% of all jobs,[23] in contrast to 20% in 1950.[24] Between 1998 and 2008 more than 2 million new skilled information technology (IT) workers will be needed to fill newly created jobs and to replace workers leaving the field.[25] By 2006 nearly half of all workers will be employed in industries that produce or intensively use information technology products and services.[26]

- **Shortage of skilled workers.** In 1999 nearly 720,000 IT positions went unfilled.[27] The escalating demand for skilled workers in information technology has led to a lifting of the number of visas for high tech workers from 115,000 to 195,000.[28] The demand for high tech labor in Silicon Valley alone is fully one third greater than the current high tech workforce nationwide.[29]

- **Need for continuous training.** It is estimated that 50% of all employees' skills become outdated within 3 to 5 years.[30] To deal with this, corporate training budgets have increased 23.5% between 1994 and 1999.[31]

- **Shift to use of web-based training for workers.** Classroom use in corporate training is expected to drop from the current level of 78% to 64% by 2001.[32] The market for web-based corporate learning is expected to reach $11.4 billion by 2003, up from $550 million in 1998.[33]

- **Growth in corporate universities.** In the last thirteen years the number of companies that have opened corporate universities grew from 400 to 1,800.[34] 40% of Fortune 500 companies have established corporate universities.[35] At the current rate the number of corporate universities will exceed the number of traditional universities by the year 2010.[36]

E-EDUCATION IS BIG BUSINESS NOW—AND WILL BE BIGGER IN THE FUTURE:

- **Education and training is the second largest sector of the U.S. economy. At approximately $815 billion, it represents the nation's second largest expenditure, behind healthcare. The education market currently represents approximately 9% of the gross domestic product.[37]**

- **The K-12 e-learning market is estimated at $1.3 billion and is expected to grow to $6.9 billion in 2003.[38]**

- **The postsecondary online market is estimated at $1.2 billion and it is expected to grow to $7 billion by 2003.[39]**

- **The U.S. corporate e-learning market is estimated at $1.1 billion and it is expected to grow to $11.4 billion by 2003. The global market for e-learning is estimated at $300 billion and is expected to grow to $365 billion by 2003.[40]**

- **Venture capital funding in knowledge enterprises amounted to over $3 billion since January 1999 or about triple the total invested in the previous nine years.[41]**

The 21st Century U.S. Army needs soldiers educated for high tech warfighting and other vital missions. These are soldiers, says Secretary of the Army Louis Caldera, who are comfortable with "a network-centric battlefield," one "where command, control, communication, intelligence, and situational awareness are accomplished digitally and shared instantaneously across the battlefield."

The Army also needs help recruiting and retaining soldiers who are eager to learn new skills and earn a degree. Until now, however, the Army has had difficulty delivering high levels of quality education to soldiers stationed around the world.

Many soldiers take university-based courses while serving, but the costs tend to be high and scheduling difficult. And soldiers rotate locations—a collection of courses from several different institutions may make for a well trained soldier, but may not add up to a full-fledged degree.

The Army is responding by launching a major initiative to educate soldiers through a program called the Army University Access Online[1]—a $600 million effort based on laptops and "anywhere, anytime" learning principles.

> The Army's commitment to distance learning is expected to expand the market for online content and courses, creating incentives for development.

Secretary Caldera believes this new Army initiative will address three vital issues. It will help recruiting. It will improve learner retention. And it will help produce the educated, Information Age soldiers America needs to succeed in the missions and battlefields of tomorrow.

The Army expects to build the largest online educational portal in the world with the objective of enabling any enlisted Army personnel to earn a postsecondary degree or technical certification. To help in this effort, soldier-students will receive tuition assistance, textbooks, laptops, help-desk support, Internet access, academic counseling, extensive course selection, and a command climate that encourages life-long learning.

The Army anticipates that within the first three months of the program 15,000 to 20,000 soldiers will be enrolled and pursuing degrees or professional credentials. The vision for Army University is that eventually every one of the Army's one million soldiers will be able to take advantage of the program.

The Army's commitment to distance learning is expected to expand the market for online content and courses, creating incentives for development. This should, in turn, create a much richer set of offerings for online learners in the civilian sector as well.

Secretary Caldera says that giving adults a "learn while you serve" option will attract more quality recruits. It is an incentive with high-payback potential. Once soldiers are finished

with their service, they will return to civilian life with strong educational credentials and a valuable set of marketable workforce skills.

The program is also expected to improve retention, as more soldiers achieve their personal education goals without leaving the Army.

"It is difficult to articulate the enormous impact that this initiative will have on enlisted soldiers," says Army Sergeant Major Jack L. Tilley. "I can tell you that Army University Access Online is exactly what today's soldiers are looking for—a chance to earn their degrees while they serve. By helping soldiers achieve their personal, professional, and educational goals Army University Access Online reinforces the Army's commitment to investing in its people."

1. See http://eARMYU.com

WEST VIRGINIA: TURNING THE CAMPUS INTO A COMPUTER LAB

The "Digital Divide" takes many forms. Students in Wetzel County,[1] West Virginia, are geographically remote from big city life, and, until recently, school libraries—with out-of-date collections—constituted the main information resource.

School Superintendent Martha Dean realized that web-based learning could transform the academic opportunities and broaden horizons for her students. She wanted to build on the technology program West Virginia had put into place in the elementary schools. But she knew her high school students needed to go beyond the basic skills approach and transition to the self-directed learning activities they would need later in life.

Dean chose the learning approach offered by NETSchools, which gives every student and teacher a laptop connected to a Local Area Network through infrared ports installed in each room. Once every student has a laptop and the infrared ports are in place, the entire campus becomes, in effect, a computer lab. Students can connect in hallways, the cafeteria, and the library as well as in class.

"I never thought it would be possible that kids would give up their free lunchtime to learn," says teacher Darlene Mihalee. "It is not unusual to go down there and see kids with a sandwich in one hand and a keyboard in the other."

Infrastructure was only the beginning.

The school's T-1 connection meant everyone could surf the Web and find information. For Scott McGlumphy, a so-so student before the shift to connected laptops, Web access turned him into a student with a keen interest in anthropology and top grades. "No knowledge is now out of reach," Scott says. "Our imagination is our only limit. And there are billions of sites out there, almost like billions of different worlds you can visit."

Special education students learned to navigate the Web to plan a vacation trip and make reservations. Agricultural students use their laptops to operate the school's commercial greenhouse, enter data in the field, and follow research on plant and animal diseases.

After only six months, 80 percent of Hundred High students were accessing the Internet daily. Test scores went up. Over the course of that first year the 144 students at Hundred High scored higher and ranked above the national mean in every subject, as well as total basic skills, on the Stanford Achievement Test (SAT 9).

Dean is grateful to Congress for the funds her district received through the E-rate program, but she says that a restriction on home use of E-rate funds creates problems for students. She is seeking additional funds and modes of connection so that students can continue to dial-in from home. She is also concerned about teacher training, as well as how to provide both educational and technical support. Dean believes that higher education institutions need to step in and change their teacher preparation programs, so all new teachers have strong technological skills.

Dean also calls for a new teaching outlook.

"I believe that curricular revision must occur. Basic skills must be expanded to include the use of the computer and the Internet to accomplish the goal of enhancing a student's capacity to access, record, analyze, and report information," Dean says. "Students who lack access to technology and the Web will become the second-class citizens of the future."

Thanks to the district's efforts, the students of Wetzel County have soared across the Digital Divide.

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