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Technology in Education: Leveling the Playing Field

Blake White
Director of Strategic Alliances
Corporate Development/Strategic Investments
Apple Computer, Inc.
Cupertino, CA

Opening Remarks

Congresswoman Brown, Congressman Clyburn, distinguished guests, as a concerned citizen, resident of the very diverse educationally concerned City of Oakland (where I am a constituent of one of the founding members of the CBC -- Hon. Ron Dellums), and as a father of two, I would like to thank the Congressional Black Caucus for putting our children's education front and center and for considering how technology might further improve the prospects of our public schools.

On behalf of Apple Computer, the leading supplier of personal computers to primary and secondary schools, with approximately 60 percent of the market share (according to the industry research firm Market Data Retrieval, Inc. of Parsipanny, N.J.), thank you for inviting our company to speak before such an impressive group of government, education, and industry leaders. Apple has a long history of supporting education, from K-12 through university training.

For example:

• Apple believes its products are widely accepted by the education market because they reflect input from teachers and numerous educational software developers who support Apple's efforts.

• The Apple Classroom of Tomorrow (ACOT) is a working partnership between Apple and 14 public schools in Minnesota, Ohio, California, and Tennessee to study what happens in a learning environment in which all students and teachers have ready access to a variety of interactive technologies. Apple provides the computer hardware, full-time site coordinators, ongoing technical support, and a telecommunications network linking all of the ACOT sites.

• Vivarium is a long-range research program working with the Open Magnet School here in Los Angeles and led by Ann Marion, Apple Fellow Alan Kay, a team of Apple researchers, as well as graduate students from M.I.T. and Caltech. Its mission is to examine the intuitive thinking of young children and possible implications for computer graphics, user interfaces and artificial intelligence.

I am an engineer by training, I am not an expert in education. Obviously, as a Director at Apple, I hope to adequately represent Apple's philosophies and positions on technology in education, but I plan to take an industry perspective rather than limit my remarks to Apple. I also promise not to give you an Apple sales pitch. Mr. Lawson asked me to address the topic -- *Technology in Education; Leveling the Playing Field* -- from the perspective of someone experienced in the high-tech industry, as well as from the perspective of one who is a product of the public school/university system and the father of two African-American children currently in the public school system. It is from this combined perspective that I hope to offer new food for thought in the short time we have together.

I will not be so presumptuous as say that technology will solve all of our educational problems. Technology alone cannot solve the problems of school funding, of institutional racism, of teachers who may not truly believe in the innate learning ability of ALL children, of parents who may not stress the value of education, of a lack of self esteem, of family and/or community problems, or lack of motivation by the student. Computers cannot be a substitute for human contact, role models, encouragement, and love. The computer is not offered as the total solution, but as an important classroom tool that can empower teachers, administrators, and students. It frees teachers to be more like "coaches of learning." It enhances instructional time, provides new learning experiences to motivate students who are academically "at risk." It challenges exceptional learners and improves all students' understanding and retention of difficult concepts

The Reorganization of Work

The United Sates is being impacted by a Global Economic Restructuring. In the past, our strategic resources were the natural materials that we turned into manufactured products. Today, information and ideas from our workers are the strategic resources that improve productivity. The result is that America has gone from resource-rich to resource-poor virtually overnight.

The old manufacturing-centered, mass-production, Industrial Age model in which work was broken into simple repetitive tasks required little training or knowledge. In the old model of work, we had a managerial class based on the command-and-control model. And we had a working class that wasn't expected to think. Consequently, our nation's education requirements were low by today's standards.

Two key problems in education have resulted from this work model: (1) Only a fraction of the work force has received an adequate education. (2) The repetitive nature of manufacturing-centered jobs has reinforced an educational system which focuses on the memorization of facts, and not the use of knowledge.

In addition, the work practices of the previous age have allowed our educational system to neglect those students who do not go on to college. In the United States, about 20% of students go on to college, while the other 80% do not. (The black community's statistics are much more dramatic.) When we think of testing in the old educational model, it's essentially a process of sorting out the students who aren't going to make it all the way through to college. Consequently, about 80% of the new entrants to the work force in this country have not received an adequate education.

If we look at other leading industrial nations, we can see in Germany, Japan, Southeast Asia, and in most of Europe that there is a very well-placed process for those students who aren't going on to college. These individuals receive vocational training, and in many cases, certificates for entry-level jobs that provide them with the chance for skill-intensive jobs after completing other courses.

Ray Marshall, former US Secretary of Labor, said there are three options when it comes to using technology in the workplace:

- First, we can have unskilled workers, managed by the elite, and supervised by bureaucrats.
- Second, we can have illiterate workers, using leading edge technology to compensate for their lack of skills.

> *[For example, you can go into a fast food restaurant today and see a hamburger symbol on the cash register so that an unskilled worker can punch the hamburger symbol. The cash register has enough intelligence in its computer chip to work out the price of the item, and the number of times the button was punched. No reading or counting required!]*

- The third option is to have well-educated workers using leading edge technology. (My preference, combining the best of W.E.B. DuBois and Booker T. Washington)

Obviously, in the African-American community, we cannot afford to allow our long-standing commitment to education waiver; and as my father said -- "the more education the better." But reality tells us that the goal of a college education may be unreachable by far too many. Let's face it, by the year 2000, a vast majority of all jobs in the global economy will NOT require a college degree, but will demand an enormous amount of training so that the front line employees can adapt quickly and effectively to new processes and new technologies. The new global information-intensive economy needs workers that can quickly adapt to changes in the marketplace and make critical decisions at lower and lower levels of the work force hierarchy.

But some structural process needs to be in place that starts to build in, systemically, the transition from school to work and the encouragement of people once they are in the workforce to continue the lifelong process of training and learning. This is necessary because jobs are going to change.

In fact, today people can expect to have four or five different careers during their working lives, as opposed to having one job on an assembly line doing the same task over and over in a machine-like fashion. It's a very different world in front of us, and we need to make systemic changes throughout all of society.

For this, a new education model is needed -- one that accommodates the special needs of every student. The Reorganization of Work will be one of the major themes of the 1990's. Likewise, there will have to be a corresponding Reorganization of Learning.

The Reorganization of Learning

Apple sees the repositioning of education away from the teacher-centered distribution of knowledge and toward the learning-centered acquisition of knowledge. This vision is based on the premise that different people learn in different ways. The objective is to make learning resources accessible and flexible in order to accommodate diverse needs.

Similarly, in this "transformed school," the role of the student will be as a collaborator, and sometimes even as the expert, rather than just a listener. This means that the teacher's role, which today is always that of the expert and fact-teller will also change. The teacher in the future will become the facilitator helping the students to develop, but also the teacher will be a learner and collaborator as well. Through collaboration, students become better prepared to take their thinking and reasoning skills with them into the professional world.

In the past, we've measured education in terms of the quantity of what one knows. In the future, I think it will shift to the quality of understanding. It doesn't do much good just to know a lot. What is important is whether you can understand it and apply it. Point of view is often more valuable than one's I.Q. The ability to understand concepts from several different perspectives is extremely important and, in a world dominated by media hype and a flood of information, the ability to tell sense from nonsense it critical.

In the transformed school, the concept of knowledge will be the transformation of facts and the acquisition of knowledge. It will include the ability to navigate through information and be selective, to understand -- not just memorize. At Apple, we call this product vision the "Knowledge Navigator" which transforms the education process into the inquiry and acquisition of knowledge.

The Role of Technology in Learning

Until recently, technology was being used only to speed up production in the Industrial Age economy. If you look at the computer industry, it started out as the data processing industry. Its purpose was to put information into a computer and systematize the work, much like the factory model in the manufacturing-centered economy.

Through new technologies, education tools can be made available to anyone, anytime and anywhere. Much of this technology is already here and only needs to be adopted for this purpose. This includes multimedia, two-way video conferencing, miniaturization, wireless technologies, intelligent agents, and high-speed digital communications networks. The proposed National Information Infrastructure will be one of the essential pieces in leveling the playing field by allowing access to the same resources for all.

Using computers for learning is different than the traditional way of teaching, because it offers an interactive environment for the user. The personal computer is a tool with which you can try things, make mistakes and learn through trial-and-error. The act of doing something is a far more effective means of learning. The computer's graphics capabilities offer an important advantage to students who learn best with visual reinforcement. Interactive multimedia is computer-centered learning that combines text, action and still pictures, animation, sound and music to produce a learning environment that is rich in sensory content. Such environments accommodate students' individual learning styles and give them a chance to experience what they're learning -- a key component in comprehension and retention.

Computers used to enhance and strengthen the curriculum in basics, such as language, science and math, are also a key component in allowing teachers and schools to accommodate individual learning styles, enhance students' interactions with each other, build self-confidence, and improve motivation.

According to the Office of Technology Assessment (OTA), in schools where computers are integrated into the classroom to help deliver the curriculum, students show substantial improvement in math, reading and writing. They also exhibit more higher-order thinking skills, are better behaved and show much more motivation to learn. The OTA concluded that the computer can be used as a tool to help children understand abstract concepts, process information, appreciate different perspectives, develop critical-thinking skills, and collaborate on problem-solving.

Consider the following examples:

• A first grade boy works at a computer to practice forming words and simple sentences. He types a word. As it appears on the screen, the computer's speech synthesizer repeats the word back to him, so that the child begins to recognize the sounds of consonants and vowels and their combinations. The immediate feedback of hearing the word pronounced as he spelled it helps him recognize his own spelling mistakes.

• One of his classmates is practicing her penmanship. She traces the shapes of letters with her finger on a computer monitor overlay. If she forms the letter incorrectly, an illustration of the proper pen strokes appears on the screen.

• Teachers are discovering that writing skills improve once students have access to word processing, since it eliminates the time and frustration associated with revisions and corrections and enables young writers to concentrate on organizing their thoughts and refining their style.

• Open Magnet School here in Los Angeles, where the Vivarium curriculum has been implemented, uses Macintosh computers to enable children to create and study plant and animal ecologies to test their hypotheses about nature. They use computer animation and graphics to design animals and the environments in which they live, and program the animals' behavioral characteristics.

• Electronic mail systems allow students to communicate with other students and teachers around the world. In fact, students were actually connected on-line with schools in Germany during the time that the Berlin Wall was coming down. So it's incredibly exciting for kids to actually get first-hand reports from people who are living "history in the making." [The implications for teaching and practicing foreign languages are tremendous.]

• Two-way interactive instruction allows students to see the screen of someone else in another location at the same time that they're looking at their screen. This ability to work collaboratively—interactively—over long distances is something that is being tested in Kentucky.

• In the information age, the ability to exchange information not only with classmates but with the city library, commercial databases, bulletin boards, or even the Library of Congress can help students develop lifelong skills for accessing and handling information. We can also expect to see the day when a student can use computer technology to explore a Virtual Museum, moving room to room, examining exhibits via long-distance interactive 3-D movies.

• The Steel Valley School District near Pittsburgh, Pennsylvania has a business education curriculum that includes a small business simulation in which students spend several months

managing an institutional supply company. Order and delivery data, sales figures and correspondence are entered onto a database and shared electronically. The students have moved away from routine tasks and paper shuffling to problem solving and decision making.

• Likewise, students at Bell High School in east Los Angeles used computer graphics to publish school posters, tickets to events, teachers' lesson plans, tests, the school newspaper, newsletters to parents, and administrative forms. Their experience at school has led to several students landing jobs in publishing, graphic design, and advertising.

However, greater access to these tools is necessary. The OTA estimates that most of the students who have access to a computer spend an average of only one hour per week operating one.

Conclusion

In barely 10 years, the personal computer has evolved from a classroom novelty to a widely used instructional tool. But there's a long road ahead before all children and teachers have significant access to technology that will empower them to meet the demands of the 21st century -- a future where classroom computers will be as commonplace as pencils and where all students will open an "electronic textbook" to the vast array of images, words and sounds that multimedia makes possible. Only then will individual students and teachers be empowered to work and learn to their fullest potential.

This technology cannot be available only to the affluent. We must avoid the trap of "haves" and "have-nots." Inner-city schools and and deprived rural areas must also have access. Our experience disproves the popular myth that kids who have not grown up with the same advantages as affluent kids are unable to learn at the same rate. These kids have very bright minds. What they need is a chance to be exposed to the kind of mind-amplifying tools that more affluent kids have. That's a very important finding for the nation because we are a multicultural, very diverse population and we've got to build on that as a strength.

New technologies, such as multimedia and distance learning with telecommunications technologies, will be ways of leveraging our best teachers, our best schools and giving the reform movement a chance to take hold in a place where it can be most effective—in the classroom.

Apple's Chairman, John Sculley, best described the Apple vision for education in saying --
"By the end of this century, we want to create in this country a true learning society -- where learning is not bound by the age of the students, or the walls of the institution, but where it is a lifelong process rich in knowledge and rich in enjoyment."

However, reforming our work model and our education model will not be easy. Among other things, it will require investment. This country had once invested in interstate highways, electric power grids, network television, and national newspapers, for the purpose of increasing access to physical resources. In the same way, the new education system will require investment in building a data superhighway. We must recognize that what we are investing in is as important as any investment we've ever made in the infrastructure of this country. We are investing in the future generations of this country, and this will directly affect the quality of life that we have. And it will directly affect our productivity as a nation and our ability to compete in the new economy—a global, dynamic, information-age economy.

