Testimony and Statement for the Record of

Margaret Honey

Vice President and Director
Education Development Center, Center for Children and Technology

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My name is Margaret Honey and I am a Vice President at the Education Development Center, an educational not-for-profit, and I direct EDC's Center for Children and Technology. Our Center, established in 1980, was one of the first groups to undertake research and development on educational technology. I have been affiliated with the Center for 16 years and have been working in the education and technology field for more than 20 years. It is a pleasure to have an opportunity to address the committee.

I was asked to speak to the question of what we now know about technology's effectiveness as a teaching and learning tool and how we might think about the role of the Federal government in this enterprise. I have divided my remarks into three sections, each of which addresses a specific question:

1. What have we learned about the educational benefits of technology?
2. What have we learned over several decades of experimentation about how to build quality educational technology applications?
3. What should be the federal government's role in advancing educational technology?

Benefits of Educational Technology

After more than two decades of research on the benefits of educational technology we now have decisive evidence that technology use can lead to positive effects on student achievement.[1] Specifically,

- In studies of large-scale statewide technology implementations, these efforts have been correlated with increases in students' performance on standardized tests.[2]
- Software supporting the acquisition of early literacy skills – including phonemic awareness, vocabulary development, reading comprehension, and spelling – can support student learning gains.[3]
- Mathematics software – programs like Carnegie Learning's Algebra Tutor, for example, that supports experimentation and problem solving – enables students to

embrace key mathematical concepts that are otherwise difficult for many students to grasp.[4]

- Scientific simulations, microcomputer-based laboratories, and scientific visualization tools have all been shown to result in students' increased understanding of core science concepts.[5]

In addition, we know that technologies offer teachers and students opportunities that would otherwise be extremely difficult to realize in classroom contexts. Assessment, information access, collaboration, and expression are four areas where educational technologies demonstrate particular promise – and there is a broad consensus among school reformers regarding the central importance of these issues for improving student achievement.

Assessment

With respect to assessment, technologies have critical roles to play in helping educators to use data effectively and efficiently to improve instruction.[6] Companies like Wireless Generation are pioneering the development of diagnostic software applications that teachers can use in their everyday work to collect learning data that can lead to direct improvement in instruction. These applications can now reside on handheld computers like Palm Pilots, making it possible for teachers to chart student progress over time, identify where a student is having trouble, and modify instruction to help the student succeed. If our goal is for schools to use data to enable *all* students to achieve, then these kinds of diagnostic assessment tools are essential in helping teachers to do this work effectively.

Information Access

During the past decade we have seen a tremendous growth in the range of archival materials that are available on the web. Digital archives have been and continue to be developed by museums, libraries, scientific and other archival institutions. These collections are among the most exciting resources driving educational interest in information and multimedia technologies. Collections as diverse as National Center for Supercomputing's Astronomy Digital Image Library and the holdings of the Louvre Museum have been digitized and provide classroom teachers and their students with access to artifacts and information previously available only to specialized scholars or academic researchers. They give teachers and students opportunities to work with an extraordinary array of authentic materials and up-to-date information that would not find their way into classrooms were it not for the growth and development of technologies.[7] Access to this data literally gives all schools – regardless of their geography or wealth – the potential to have libraries of unparalleled collections and connections to the same materials that our nation's greatest universities have.

Collaboration

Technologies offer many other opportunities to teachers and students. Consider, for example, the issue of collaboration. Teachers are the one professional group in our society that is largely isolated from colleagues during the working day. Phones in classrooms are uncommon at best and shared planning time for teachers is rare in most

schools. Much of our work at the Center for Children and Technology has focused on using the communications capabilities of the Internet to develop new models for teacher professional development and collaboration that have the potential for providing teachers with networks of support.

We have worked, for example, with the Library of Congress to develop the American Memory Fellows program.[8] This program brings teams of teachers together in both virtual and face-to-face learning communities to develop, test, and publish creative classroom applications that make use of the Library's digitized collections in American History. Teachers learn how to work with primary-source archives that include photographs, pamphlets, films, and audio recordings from American history and culture. Technology makes access to these materials possible and enables teachers to work together to build lesson plans and curriculum for their classrooms.

Expression

Technologies also create new opportunities in which kids can express and communicate their ideas. It is no longer uncommon for schools to encourage reports in multimedia format or for students to build web resources that can be used by others. A team of fifth and sixth graders, for example, created a website called "Online Math Applications" which includes information and exploration of math in connection with music, stock market investments, travel, economic projections and history. They use online calculators, stories, problems, simulations and demonstrations to teach their peers. This site and hundreds more have been created by students participating in an academic contest called ThinkQuest.™[9]

The Importance of Context

There are thousands of examples of work being done in schools with technology that lead to important gains in student learning. What is most important, however, is that we recognize that technology will not result in measurable gains unless the school context is receptive and well organized for technology use. In more than 20 years of work, we have learned a single lesson over and over again – school context is a critical factor in determining the degree to which educators can creatively and deeply use technology. No matter how well designed the technology, how comprehensive the training program, and how creative individual teachers are, if they work in a context that is not supportive of and receptive to the use of technology for instructional purposes the technology will have little impact on students' learning. [10]

We have learned through our work with numerous school districts around the country, that if technologies are to be used to support real gains in educational outcomes, then five factors must be in place and these factors must work in concert with each other.[11]

1. There must be **leadership** around technology use that is anchored in **solid educational objectives**. Simply placing technologies in schools does little good. Effective technology use is always targeted at specific educational objectives; whether for literacy or science learning, focus is the key to success.

2. There must be sustained and intensive **professional development** that takes place in the service of the core vision, not simply around technology for its own sake, and this development must be a process that needs to be embedded in the culture of schools.
3. There must be **adequate technology resources** in the school including hardware and technical support to keep things running smoothly.
4. There must be recognition that real change and lasting results take **time**.
5. And, finally **evaluations** must be conducted that enable school leaders and teachers to determine whether they are realizing their goals, and how to adjust if necessary.

Effective Software Design

Several decades of experimentation and research in developing educational software have also taught us some critical lessons. To be effective educational software must accomplish three things. It must:

- Build upon what we know from research about the key areas of knowledge acquisition, including both concepts and procedures, which children must master. Carnegie Learning's Algebra Tutor and Wireless Generation's Diagnostic Reading Assessment are both examples of software applications that are substantially grounded in research about how students learn algebra and how they master early literacy strategies.
- Address real challenges that teachers are facing, and make the task at hand easier to accomplish. The most effective software is always developed in collaboration with teachers and is based on extensive research done in classrooms, to ensure both usefulness and effectiveness. IBM's Reinventing Education Partnerships are a very promising model in this regard.
- Be applicable across multiple contexts and multiple curricula by addressing core learning challenges, not curriculum specific skills and tasks. It should not matter, for example, whether my district uses a balanced literacy curriculum or one that emphasizes teaching phonics. Effective educational software should support the processes associated with learning how to read and be applicable regardless of any specific instructional approach.

The Role of the Federal Government

The Federal role in educational technology is critical in two respects: leadership and funding. The U.S. Department of Education's Office of Educational Technology has provided critical leadership in helping promote a comprehensive vision for the effective use of technology in our schools. This office has defined and administered programs, convened national and regional conferences to bring together state and local technology leaders, compiled and disseminated a well-research library of best-practices information, and put forward two national technology plans.[12]

The Federal Government has also been an essential partner in technology funding. Thirty-five percent of all educational technology funding has been federal. This is a remarkable figure when compared to the 6.6% that the federal government contributes overall to education funding.[13] And the results have been pronounced. Last year the Department of Education released the findings of the Expert Technology Panel. Of the

two exemplary and five promising programs that were identified, the federal government originally funded all seven. The Department's Challenge Grant Program along with the National Science Foundation made these and many other innovations possible. Other federal initiatives are helping introduce technology into schools of education so that our newest teachers will be effectively prepared to make technology a substantial partner in the learning process. And, of course, the E-Rate program has resulted in the wiring of over one million classrooms, the vast majority of which are in high poverty communities.[14]

Conclusion

I hope you will conclude from my testimony that we are getting measurable results from educational technology, that we know what it takes to make new educational technology programs successful, and that the Federal Government must continue to provide the leadership and funding without which this progress would not have occurred.

I would further hope that the leaders in this room have the vision to realize that the progress we have made has prepared us for an entirely new level of leadership and funding – that it may be time to conceive of an education initiative on the scale of the Apollo Program or the Genome Project. Indeed, I would submit that the top rating given to education issues in every public opinion poll suggests that the American people have never been more ready to be captivated by such a vision.

Within this decade it will be possible to develop the technologies and to expand the capacity of the educational system, such that every day of school – from kindergarten through college – will be an intellectual adventure tailored to each student's particular learning needs. It will be possible for our teachers to see clearly how each child is progressing, and it will be possible to activate all of the resources in school, at home, and in our communities to ensure that no child is left behind.

If we do this, then every other great goal we might set for this country surely will follow.

Thank you.

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