Testimony Submitted by

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For the Hearing on

"The Promise of Accessible Technology: Challenges and Opportunities"

Hosted by the
Committee on Health, Education, Labor, and Pensions
United States Senate

Washington, D.C.

February 7, 2012

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Executive Summary

The promise that technology holds for enhancing education and improving access to the curriculum is extraordinary. However, it is equally true that technology, if not appropriately designed and implemented, is the biggest threat to our nation's ability to provide a free, appropriate public education to students with disabilities that we have faced since Congress enacted Public Law 94-142. Harnessing the extraordinary promise of technology is within our reach, but it will take leadership, commitment, and ongoing oversight. The alternative is a future where we spend our time, money, and innovative capacity retrofitting bridges to patch the digital divide rather than enjoying the economic and social advantages gained by the increased usability of technology and the increased leveraging of human capacity that results from technology that is designed and built to be accessible to all.

As a blind individual educated in public schools and in post-secondary institutions, an administrator of model educational programs, and a father of two young children about to enter public education, I am concerned that the future is still too unclear—will technology cause segregation or integration for students with disabilities?

Technology changes the paradigm of accessibility because it can be designed from the very beginning to provide the broadest access. In its basic form digital content is accessible to everyone, as it can be easily transformed, converted, and translated into the form that is required by an individual student. By universally designing technologies to handle a broad range of different physical and informational interfaces, we can get significantly closer to equality in education. The result is that we can move from the old accommodations model to a new paradigm of mainstream accessibility, and our practices and policies need to change to meet that new paradigm.

Recommendations for Federal Policy

- Stronger Oversight and Accountability in Government
- Strong, Functional, and Rigorously Enforced Standards
- Projects to Collect, Develop, and Disseminate Best Practice Tools
- Improved Protections against Inaccessible Technology in Education

Technology is transforming the way we create, share, and gain knowledge. If built universally and implemented effectively, technology will make the passion and skill of our greatest teachers even more powerful as we nurture the next generation of leaders for our nation. If we fail to include accessibility in that technology, we will set this generation of students with disabilities back decades. The cost to those individuals and to our country is too great and the opportunity is too promising to stand by and let that happen.

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Mr. Chairman, distinguished members of the committee, and other witnesses, my name is Mark A. Riccobono. I am the executive director for the Jernigan Institute at the National Federation of the Blind. My address is 200 East Wells Street *at Jernigan Place*, Baltimore, Maryland 21230; my telephone is (410) 659-9314, extension 2368.

I appreciate the opportunity to speak with you today on the tremendously important topic of technology and its ability to make education accessible to all students. I am happy to say that the promise that technology holds for enhancing education and improving access to the curriculum is extraordinary. However, it is equally true that technology, if not appropriately designed and implemented, is the biggest threat to our nation's ability to provide a free, appropriate public education to students with disabilities that we have faced since Congress enacted Public Law 94-142. Harnessing the extraordinary promise of technology is within our reach, but it will take leadership, commitment, and ongoing oversight. The alternative is a future where we spend our time, money, and innovative capacity retrofitting bridges to patch the digital divide rather than enjoying the economic and social advantages gained by the increased usability of technology and the increased leveraging of human capacity that results from technology that is designed and built to be accessible to all.

Personal Experience

By way of background, I was diagnosed as being legally blind at age five. I entered the Milwaukee Public Schools (Milwaukee, Wisconsin) and received all of my K-12 education as a blind student integrated into the public schools in that district. My vision loss is a result of glaucoma and aniridia. As I entered kindergarten, there was no doubt that the prospect of my vision getting better was zero and the chance of it getting worse as I progressed through school was very high. As it turned out, my vision steadily got worse—by eighth grade I had lost all of the vision in one eye and had less than 5 percent of normal vision in the other eye.

When I was a student in the K-12 system, technology was something used to supplement the educational curriculum. In my elementary school, the technology was limited to a few computers in the school library, which we used to play educational games in our free time. In middle school, we had a small computer lab, but its regular use was not fully integrated into the curriculum. In high school, we used computers to do specific projects, and a handful of

individual classrooms had dedicated computers. However, technology was still not part of the daily curriculum and was not central to the experience of gaining knowledge. I learned to use a computer with software that read the text on the screen aloud using synthesized computer speech as a means to write papers—since I could not effectively read my own writing. Despite my extremely limited vision, I was never given the opportunity to learn Braille in school.

In 1994, I entered the University of Wisconsin-Madison to pursue a degree in business. With the support of the state's vocational rehabilitation program I was given a laptop computer that weighed about twenty pounds. I was able to use that computer to gain access to some limited online resources, which were still largely in the DOS rather than the Windows environment. Registration for classes was done on the telephone—providing me equal access to the registration system—and books were only available in hard-copy print from the bookstore. In order to gain access to the printed books and course packets, I worked closely with the disability resource center on campus. That office facilitated getting the printed materials read onto cassette tapes if the materials were not already available in that format from another source. The recordings were made by volunteers who chose which parts of the book to read based on where they fell in the course syllabus—assuming I was able to get the syllabus ahead of time.

By the beginning of my junior year, Windows 95 had helped to increase the computing power across campus and in individual dorm rooms, the fast growth of the World Wide Web had created new means for sharing knowledge, and the improvements in desktop scanning technologies made it feasible to create reasonably good electronic copies of printed books. During my junior year I was employed at the McBurney Disability Resource Center on campus and helped to implement improvements in the services to create accessible copies of reading materials for students with disabilities. I helped develop and implement the procedures for converting printed books into electronic files that students with disabilities could access and helped to train students on the systems necessary to access those files. The electronic files significantly reduced the waiting time for students with disabilities to receive their materials and improved our ability to produce materials in Braille.

When I graduated in the spring of 1999, technology was becoming increasingly more integrated into the fabric of the academic experience, but the old paradigm of access to information for students with disabilities still held true. Technology was implemented on campus, and it was the role of the McBurney Disability Resource Center to help figure out what modifications and additional access technologies might be needed to allow students with disabilities to gain access to those systems. Additionally, the primary means for disseminating information was still in hard-copy print, which we worked to convert to a format readable by students with disabilities. While the World Wide Web was used to disseminate some information, the configuration of Web sites was basic and generally easily handled by screen reading technology.

In 2000, I was appointed to be director of the Wisconsin Center for the Blind and Visually Impaired—the agency under the Wisconsin Department of Public Instruction responsible for carrying out statewide outreach services to K-12 students who are blind and the school districts serving those students. I served in that capacity for three and a half years, during which time we spent thousands of state and federal dollars to purchase access technologies that students who are blind used to access curriculum materials. These specialized access technologies had very little

interface with systems in the public schools. We worked closely with school districts to advise them on how to make their computer labs accessible, but we rarely faced instances where the technology was used in a classroom on a daily basis. Our agency had a high tech distance learning lab that we used to connect to similar sites around the state. The lab was used for live interactive learning experiences where students could talk to and be seen by a presenter at another location. We rarely needed to troubleshoot a situation where a student needed to take a course online, as distance learning was still in its infancy in K-12. Finally, we worked to further improve the accessibility of K-12 textbooks by supporting the provisions in the law that ultimately created the National Instructional Materials Access Standard (NIMAS). The theory behind NIMAS was that access to instructional materials would be improved by having a clear electronic file standard for book files coming from publishers. The paradigm was still about accommodating students with disabilities in educational environments largely dominated by chalkboards and paper shuffling rather than keyboards and mouse clicks.

I began overseeing national education programs for the National Federation of the Blind in late 2003, and soon after, I enrolled in a program at Johns Hopkins University to pursue a master's degree in education. My experience as a blind student in higher education was dramatically different than it had been just five years earlier as I finished by bachelor's degree. The vast majority of my interactions with the systems of the university were through the Internet. I registered for classes, accessed library materials, communicated with professors and advisors, downloaded course packets, and bought books online. The online systems were frequently challenging and forced me to find workarounds due to inaccessibility. Compared to my undergraduate experience, there was much more reasonably-accessible digital content available, which resulted in my ability to navigate my coursework with a greater degree of independence than ever before. Where there were barriers, I was determined to figure out a way around them so I could get my degree. However, many students with disabilities are not prepared to fight through the frustration and delays. Had I been pursuing a degree in science or engineering, I would have had even more difficulty. Technology was rapidly becoming more complex and more integrated into the fabric of education, and blind students were beginning to face more barriers to accessibility. Meanwhile, in my coursework we studied the education system and the impact of technology on teaching and learning interactions. I came to understand that the future is uncertain—whether technology would facilitate unprecedented access to information and full integration or be the force that unintentionally segregates students with disabilities into an unequal learning environment.

Today as a lifelong learner still seeking new knowledge, and an administrator of model educational programs, and a father of two young children about to enter public education (one of whom has the same eye condition I have), I am concerned that the future is still too unclear—will technology cause segregation or integration for students with disabilities?

A New Paradigm

There are two central elements to making education accessible to all students. The first is access to educational facilities. Although there still is work to be done in this area, the implementation of the Americans with Disabilities Act (ADA) has significantly improved this nation's infrastructure for providing all people physical access to the educational environment. The second is access to information. For decades now we have been working to improve access to

information in education for students with disabilities. Some of those efforts have been to make curriculum adjustments that better facilitate students obtaining and integrating knowledge. Other efforts have been to convey information in the form that makes it accessible—such as converting printed materials into Braille or using American Sign Language. Technology will either enhance our progress or make some of our previous efforts meaningless.

The schoolhouse is now more accessible to students with disabilities than at any other time in history. But how will history view the great progress we have made when students with disabilities can get in the front door, to the classroom, and to a desk, but in the end they are shut out of the curriculum because the powerful technological tools used to convey knowledge are inaccessible to them and/or the alternative technologies are inadequate? Will we wait until families of young children with disabilities opt for home schooling in mass numbers because there are too many barriers to fight through in the mainstream educational technology in their local schools? Will we wait until students with disabilities stop coming to mainstream universities because the systems central to the student experience—everything from putting money on your meal card to reading the literature of the world—are not accessible to them in an equally integrated manner? Technology is no longer a supplement to the educational experience; it is an essential access point for education and employment in the twenty-first century.

Technology changes the paradigm of accessibility because it can be designed from the very beginning to provide the broadest access. In its basic form digital content is accessible to everyone, as it can be easily transformed, converted, and translated into the form that is required by an individual student. By universally designing technologies to handle a broad range of different physical and informational interfaces, we can get significantly closer to equality in education. Today we are getting a glimpse of what the well-designed future can be. Consider the blind student in a classroom environment that uses the iPad. The student can use Apple's built-in VoiceOver screen reading technology and participate in lessons alongside her sighted peers, and she can take out a refreshable Braille display (a supplemental access technology) and connect it to the iPad to read in Braille the reading lesson the teacher uploaded an hour before class. With this powerful accessibility built into a mainstream device, we begin to understand that technology can get us much closer to equality in education than even the most vocal advocates had imagined. But the opposite is also true.

When the old paradigm of "accommodation" persists, educational institutions adopt technologies that are incredibly complex but have not been designed for access by students with disabilities—they miss the opportunity and unknowingly create new challenges. This means the educational institution has to find an alternative, which brings an additional expense and will most likely be unequal. Imagine the blind student who attempts to log on to the university library site, search for research articles, and obtain relevant digital copies of articles for a course project. Imagine the frustration when the student cannot effectively perform the search because the database was not designed according to well-accepted Web accessibility standards. The student contacts the library (during normal business hours only), and the librarian is pleased to meet his responsibility to accommodate by performing the search for the student and pulling the relevant articles. The student provides as much information as possible about the desired search terms (even though non-disabled students use the process of searching to narrow their focus), and the librarian agrees to e-mail the student the digital copies of the articles. The librarian identifies twenty-five relevant

articles but only ten are available as full text (accessible to the student). The other fifteen are provided in inaccessible PDF files, which the student must take and run through a program that attempts to perform optical character recognition on the files. All of that has to be done before even getting to the abstract of the article to know if it is one that is worth reading for the project. And just imagine if the search terms were not quite right and another search is needed but the library is closed until Monday. Meanwhile, other students in the project group are uploading notes to an online wiki for planning the project. Of course, the wiki is a Web platform that was also not built with accessibility in mind. The student decides to switch to work for another course so she attempts to pull up a required class video from an online learning management system. The video is offered in Flash, and accessibility has not been properly implemented, which results in the student being unable to play the video. All of these barriers and more are faced by students today, even though providing accessibility in these technology applications is possible. Unless we commit ourselves to the new paradigm, this is the experience for a student with a disability in the future where technology is built and implemented without accessibility from the beginning.

The Shift of Technology in Education (The Opportunity)

As technology becomes more central to the educational experience and accessibility is built into the mainstream technology, we should observe the technology market becoming more effective in its delivery of products to increase accessibility for people with disabilities. In the old paradigm, very expensive, low-volume products were created to assist people with disabilities to gain access to information. Specialized electronic devices allowing a blind person to write and read back the Braille code in electronic form have been produced for decades. These devices—generically referred to as electronic Braille notetakers—have historically had limited interaction with mainstream computers and have generally cost more than $5,000. As mainstream technology incorporates more accessibility into the native design, the need for these highly specialized and segregated devices goes down. This means that the access technology industry can focus on needs that the mainstream market is unlikely to effectively address. For example, although Apple's iOS devices include great accessibility support (screen reading and screen magnification technology for blind users) and interoperability with third-party refreshable Braille displays, Apple itself is unlikely to get into the business of designing, building, and distributing Braille display devices. However, Apple's leadership in native accessibility in the iOS platform opens up a new market for devices that further enhance the accessibility of the Apple products and provide innovative solutions to the access to information challenge. In addition to refreshable Braille displays, there will still be a need for a number of products that are critical in providing access to the curriculum but are unlikely to come from the mainstream market. Examples of such technologies are tools for producing hard-copy Braille (Braille embossers) and tactile graphics.

To illustrate this technology shift, let's compare the old specialized model to the new paradigm of accessible mainstream technology. The old access technology model is represented by the BrailleNote Apex—a Braille notetaking/PDA device available from HumanWare at a retail price of $6,379. The BrailleNote Apex has a fairly wide distribution in K-12 education as a specialized device for blind students. The new paradigm is represented by an Apple iPhone 4S 16GB with a retail price of $199. Because the iPhone does not include refreshable Braille built into the device, we need to add a separate piece of access technology. In order to make the comparison fairly equal, I chose to add the Alva BC640 40-cell refreshable Braille display at a retail price of

$4,199. This means on price alone our new mainstream option retails for $4,398 (almost exactly $2,000 less than the specialized technology option). Table 1 compares the products based on hardware capacity and processing speed. In this comparison we find that the mainstream option is not only less expensive but far more powerful than the specialized option. Finally, the chart does not compare the availability of applications between these two solutions. While we could easily detail the applications available for the BrailleNote Apex (those built in and those available for hundreds of extra dollars), we would not be able to do that for the iOS platform. There are hundreds of thousands of applications in the Apple App Store. Even when you consider that Apple does not currently require applications to be accessible to be in the App Store, blind users of the iOS platform have found a growing number of powerful accessible applications to serve every need from taking notes to reading books to engaging in social networking. It is fair to say that the applications available in the mainstream model exponentially exceed those in the specialized model.

The Failure in Technology Implementation (The Challenge)

I believe it is fair to say that, with only a few limited exceptions, educational institutions at the K-12 and post-secondary level are currently failing to make a passing grade in the subject of realizing the promise of technology for students with disabilities. However, it is not entirely their fault. These institutions have 100 percent of the responsibility for ensuring their programs and services are accessible and, while they should develop more capacity to ensure the accessibility of the technologies they purchase, the reality is they cannot effectively test the accessibility for every piece of technology on the market—the technology vendors need to do better. There is a need for shared responsibility, clear standards, and strong enforcement.

Books and Instructional Materials

Let's examine just a few technologies in the educational space to understand the barriers students with disabilities currently face. Central to the educational experience is the book. In growing numbers K-12 schools and universities are moving away from static hard-copy, expensive print books to the use of dynamic, easily-updated and supplemented, and less expensive e-books. The mainstream move to e-books has great promise for students with disabilities. Digital content is not inherently inaccessible like the print book. The basic digital content of a book can be read aloud using speech technologies or enlarged using magnification software without much trouble. In fact, people with disabilities, specifically those with "print disabilities," have been using digital versions of books since the late 1980s. The e-book is frequently delivered via a device or reading system (e.g., Amazon's Kindle, Apple's iPad, or Adobe's PDF product). As long as the delivery system for the e-book includes accessibility, students with print disabilities will have equal access to the content of the book and the functionality of the reading system. In practical terms this means that we have the promise of all students having access to the same book, at the same time, and at the same price. This is a tremendous leap forward in terms of timely access to materials compared to the old paradigm, and it saves the significant amount of human resources that were being used to convert inaccessible print back into an accessible format.

The reality of e-book adoptions in both K-12 and higher education is that, in general, the producers of textbooks and to some extent the purchasers of those books are stuck in the old paradigm of accessibility. Accessibility is often not built into e-book readers and, when it is built

in, it does not provide the same level of functionality and navigation that is provided to the reader without a disability. Two examples at either end of the spectrum of accessibility are products provided by Apple and Barnes & Noble. Apple recently launched iBooks 2.0 with an aim at revolutionizing the educational book space. Apple is the industry leader for built-in accessibility due to its commitment to out-of-the-box accessibility in their iOS (iPad, iPhone, iPod) and Mac products. This means that a blind student can purchase the iPad, for example, at the same price as everyone else and begin using it with the built-in VoiceOver screen reader from the moment it comes out of the box. While the blind student can purchase one of the new iBook 2.0 titles and read it straight through, she will not be able to navigate the book or have access to the same functionality as her non-disabled peers—not perfect but far more accessible than the old paradigm. In contrast, many universities have begun creating relationships with Barnes & Noble for provision of e-textbooks with focus on the relatively inexpensive Nook device for delivery of those books. The Nook includes no accessibility features and leaves a print-disabled student to find a separate solution. Most certainly the separate solution will also be unequal as the print-disabled student will not have any of the functionality that the Nook provides to all other users. There are a number of other book reading systems and devices delivering various e-book formats with varying degrees of inaccessible content and features and most fall down when accessibility is considered. The promise of "same book, same time" is near but not yet fully delivered.

Why would any educational institution choose the Nook considering its inaccessibility? I believe it is largely because they are stuck in the old paradigm of having to accommodate students with disabilities. Therefore, it is natural to the schools to purchase something that is inaccessible and figure out an alternative for students with disabilities. Furthermore, the educational institutions have complete responsibility under the law for ensuring equal access to their educational programs. The old paradigm has created the practice of buying the product you feel best meets what your need is and working out accessibility if you have to do so. However, the new paradigm should suggest that schools start demanding complete accessibility in their technology products, including e-books, and hold the producers of those technologies responsible. The educational textbook market is a significant piece of the publishing industry and, with the growing adoption of e-books, we need to ensure that the books being used in education are accessible to students with print disabilities.

A final problem related to the adoption of accessible e-books in K-12 is the existing NIMAS standard. Before the e-book market began taking off in education, NIMAS was the most effective policy solution to helping K-12 schools deliver more timely textbooks to their students with print disabilities. While NIMAS helped to create some standardization in the electronic files, it has not made a noticeable difference in the delivery of better and more timely instructional materials to students with disabilities. Furthermore, NIMAS is now a barrier to mainstream access to books at the K-12 level. There is little incentive for publishers of e-books for the K-12 market to produce fully accessible e-books as long as they can meet their legal obligation to provide a NIMAS file. As the e-books become more sophisticated and include greater functionality—ability to annotate, link to online content, etc.—the student using the NIMAS version of the book will receive increasingly unequal access.

Cloud-Based Education and Dedicated Portable Devices

Many schools are utilizing the tremendous resources available through applications and databases available "in the cloud." Frequently schools make educational resources available through Web sites that are actually portals to sophisticated software applications that run over the Internet rather than being locally installed on a hardware device. This provides great flexibility to schools and allows them to take advantage of a tremendous amount of technology that can be freely implemented. Because cloud-based applications are not installed locally, the school can leverage whatever Internet-enabled devices they have available or they can have individual students bring their own device.

Take for example Google's effort to gain wide support for adoption of Google Apps for Education in schools across the country as a means of providing e-mail and collaboration tools to students and faculty. Google Apps for Education is a free suite of hosted communication and collaboration applications that includes Gmail, Google Calendar, Google Talk, Google Docs, and Google Sites. We have found that each of these applications contains significant accessibility barriers for blind people utilizing screen access technology. These applications are attractive to schools because they are powerful and their price tag does not stretch the education budget. However, you cannot accommodate students in an equally integrated manner when they are shut out of a technology as powerful as Google Apps for Education. Schools face the choice of segregating students with disabilities or enhancing integration by only adopting technologies that are accessible. While we hope all schools make the right decision, if they do not, the individual student has very few options available, and every day that a student with a disability waits for the technology to be made accessible is another day of learning lost.

In other cases, schools are adopting broad programs to purchase technology and put a device in the hands of each student. Consider a story from last summer's *Powell Tribune* (Powell, Wyoming) entitled "School district adopts the iPad." The story details the plan to spend $722,000 for the purchase of 1,180 second-generation iPads in order to put one in the hands of each middle and high school student in the district. The story does not talk at all about accessibility, although it does talk about the ways that implementing this technology will cut down on other costs such as textbooks and computer-based testing. This raises the question of whether or not the applications used on the iPads will be designed to be accessible to students with disabilities. If not, how will the district accommodate those students, and will it create segregation or integration?

Even more alarming is a report from *CNET News* entitled "27,000 Google Chromebooks headed to U.S. schools." The article announces the plan to distribute new Chromebooks to school districts in Iowa, Illinois, and South Carolina. The article credits a Google official as saying, "We now have hundreds of schools across 41 states that have outfitted at least one classroom with Chromebooks." The Chromebook is a tablet device that provides computing power while operating applications from the cloud. This device presents significant access barriers to students who are blind, yet these school districts are proceeding with a plan to issue Chromebooks to students for use in school and at home. This means non-disabled students have around-the-clock access to information and those who are blind have unequal access and are potentially shut out of certain applications.

These are just a few examples of technologies that are being rapidly and broadly implemented with limited to no accessibility. There are dozens of other inaccessible technologies by dozens of other technology companies big and small being purchased by educational institutions largely using public money. Examples of other educational technologies where we have found limited accessibility even after the system was implemented in K-12 schools or universities include:

- Interactive White Boards (IWBs)
- Online course management systems
- Software for performing virtual science experiments
- Web sites for courses, programs, schools, and entire districts which provide important information and essential notices
- Online journals
- Educational resources produced and distributed by federal grant projects
- Computer-based assessments
- Online applications for admission to programs
- Classroom devices such as clickers

Furthermore, this does not take into account the technologies that teachers and faculty members with disabilities need to interact with to create and post educational content, perform research, log grades, or do any of the other staff functions required by their employer and utilizing a computerized system owned by the educational institution.

Recommendations for Federal Policy

Based on my personal experience as a blind person in the education system (K-12 through master's degree), an administrator of educational programs for blind children and adults, a father with young children about to enter America's public education system, and an advocate who works with blind students and faculty across the country, I offer the following recommendations to facilitate the use of technology to enhance accessibility and academic outcomes for students at all levels:

- Stronger Oversight and Accountability in Government

In order to meet the promise of technology in education we need strong leadership. That leadership begins with the government cleaning up its own practices. Federal agencies dealing with educational institutions and providing grants to institutions to do cutting edge research and education are among the offenders. For example, while the United States Department of Education has been more responsive to dialogue lately, they still do not have clear checks and balances to prevent the distribution of grants that will fund projects resulting in the development of inaccessible digital instructional materials. The agency needs to have an official who reports directly to the Secretary who can ensure that the entire infrastructure of educational technology efforts includes real accessibility. Furthermore, the Department of Education needs to closely monitor and enforce accessibility requirements in its distribution of grants.

Another significant agency of concern is the National Science Foundation, which funds a tremendous amount of research and educational innovation. In recent correspondence from the Foundation to Kareem Dale, Special Assistant to the President for Disability Policy, as a follow up to concerns raised about the accessibility of NSF funded projects, the Foundation said in part:

> When a grant proposal is submitted to the NSF, the Authorized Organizational Representative (AOR) from the proposing organization electronically signs the proposal. By electronically signing the proposal, the AOR certifies the organization agrees to comply with NSF's Nondiscrimination Certification. That certification states that the organization agrees to comply with a multitude of civil rights statutes, including the Rehabilitation Act, as well as all regulations and policies issued by NSF pursuant to these statutes.

The practical experience of researchers with disabilities and those attempting to use educational products from NSF-funded programs is that the technologies and materials are frequently not accessible. I would recommend that "checking a box" is not enough. We need a proactive approach. What tools is NSF giving potential grantees to understand accessibility and help them build it in? What guidelines and examples does the agency provide for grantees to know what works and what doesn't? How often does accessibility get discussed at project director conferences? And how clear is the complaint process to those who find violations? When America is interested in boosting its science, technology, and engineering workforce, we should not be leaving people with disabilities behind.

Finally, some agencies are working on being more proactive, strengthening their enforcement of accessibility requirements, and bringing more attention to the issues. A recent request for proposal from the United States Department of Labor included the statement,

> All online and technology-enabled courses developed under this SGA must incorporate the principles of universal design in order to ensure that they are readily accessible to qualified individuals with disabilities in full compliance with the Americans with Disability Act and Sections 504 and 508 of the Federal Rehabilitation Act of 1973, as amended.

A good step forward if the agency sticks to it, asks for clear documentation of how the project is meeting this requirement (not just a checkbox), and takes swift action when this provision is violated. However, what happens when you go to the Department of Labor Web site and click on one of the links that takes you to a third-party site like Facebook? You are met with a new page that states:

> You are exiting the Department of Labor's Web server. The Department of Labor does not endorse, takes no responsibility for, and exercises no control over the linked organization or its views, or contents, nor does it vouch for the accuracy or accessibility of the information contained on the destination server. The Department of Labor also cannot authorize the use of copyrighted materials contained in linked Web sites. Users must request such authorization from the

> sponsor of the linked Web site. Thank you for visiting our site. Please click on the link below to continue.

The Department is presumably posting information to Facebook for the purpose of communicating vital government information and news to the public. Facebook presents many accessibility challenges to people with disabilities. We might reasonably assume that the individual posting information to Facebook on behalf of the Department is an employee or contractor of the government—unless there is a volunteer that has been authorized to perform this service. Yet the Department claims no responsibility for the accessibility of the content presented on the Facebook page. Advocates have found getting Facebook to improve its accessibility frustratingly slow. Who is taking responsibility for accessibility? How many other third-party sites containing vital government information are not accessible and have nobody taking responsibility for their accessibility? Where is the leadership, and who is working to ensure that all citizens of this great nation have access to information?

We need to do more to move government from the old accommodations model into the new mainstream access model of technology. Greater leadership, proactive training, and rigorous reinforcement is required. There should be more centralized responsibility for ensuring accessibility within federal agencies and within the policies of those agencies. In particular, the government needs to take more aggressive steps to ensure that federal grant funds are not going to projects where accessibility is ignored. Furthermore, the government needs to provide leadership in these areas by ensuring that government sites meet the highest standards of accessibility.

- Strong, Enforceable, and Functional Standards

Those who resist the requirement that technologies be accessible from the design phase argue that it is too hard to know what accessible means and what truly is universal design, and that having a standard limits innovation. Despite these claims, many strong sets of standards have been developed that have gone a long way towards improving accessibility, and new innovative solutions are coming to market when the talent is focused in that direction (e.g., Apple's use of unique interface gestures that make the iPhone accessible to blind people). But there are not good comprehensive standards to guide the accessibility of technology in educational institutions.

I recommend that the Congress take swift action to authorize the United States Access Board to compile functional guidelines in the area of instructional materials. The recent report of the Federal Advisory Commission on Accessible Instructional Materials in Post Secondary Institutions for Students with Disabilities provided as their first recommendation that "Congress should authorize the United States Access Board to establish guidelines for accessible instructional materials that will be used by government, in the private sector, and in postsecondary academic settings." This Commission of experts defined "instructional materials" broadly by stating,

> Instructional materials are the curricular content (printed and digital books, journals, course packs, articles, music, tests, videos, instructor-created PDFs and PowerPoint documents, web pages, etc.), as well as the technologies required

> (hardware, firmware, software and applications) for the manipulation, annotation and dissemination of content. This definition also includes any other required instructional software and applications used to facilitate the teaching and learning process, including learning software, courseware/learning management systems, digital 'learning objects,' library databases, and others.

This Commission also emphasized the importance of functional requirements by noting that specifying file types or specific technologies was not the answer. The Commission went on to firmly state that

> Technology developed or deployed to facilitate access to instructional materials must permit a user with a print disability the opportunity to acquire the same information, engage in the same transactions and enjoy the same services at the same time as the user without a disability, and with a substantially equivalent ease of use.

It is worth noting that a functional set of technology guidelines meant to specifically address education will apply in K-12 as well as post-secondary programs as the functional requirements for accessibility should be the same at all levels. This clarifies accessibility for all parties and reduces the uncertainty about whether a particular technology will be viewed as being accessible. This work will also create the framework for creating proactive tools and technical examples to help technology developers understand accessibility. These standards will become more critical as people with disabilities rely more on mainstream rather than specialized technology, to ensure that the accessibility of these technologies does not erode. Ultimately, these guidelines should be enforceable by linking them to existing civil rights and public accommodations protections.

- Projects to Collect, Develop, and Disseminate Best Practice Tools

Congress and federal agencies could help advance accessibility significantly by putting together more efforts to support the development and dissemination of resources in the areas of implementing accessible online content, tools to test accessibility of publications, best practices for purchasing and implementing accessible technologies, and other related topics. There is a great need to collect together best practices related to the design and implementation of accessible technologies and content so it can be better understood in the educational system. Federal agencies should make accessibility a priority track at conferences sponsored by the government and consideration should be given to a national conference on accessible technology in education. Furthermore, the U.S. Department of Education should collect case studies of innovative approaches to ensuring accessibility across the technology infrastructure of school districts and universities and make those examples available via the Internet.

The government could also help to raise understanding of accessibility within the information technology industry by first ensuring that government IT professionals receive more resources and training on what accessibility means, how to require it in the purchasing process, and how to test that accessibility has been met. The stronger the accessibility requirements in technology purchasing, the higher the demand will be in the industry for IT professionals, programmers, and computer engineers who truly understand accessibility and universal design. This will ultimately

trickle down to the university programs and other professional training programs creating a systemic approach to raising the importance of accessibility.

- Improved Protections against Inaccessible Technology in Education

I believe that leadership, strong functional standards, proactive best practices, and greater government accountability for accessibility of technology in this nation's educational facilities will make a tremendous difference. I am not convinced that it will be enough to really hit the tipping point where all technologies are universally designed and available to all students on the first day they are implemented in the classroom. This is a real threat to access to education for students with disabilities, and I believe Congress should strengthen the shared responsibility for accessibility and the remedies available to students and faculty with disabilities who are segregated to second-class access.

First, a disabled college student, faced with inaccessible technology and a school that is not interested in taking the steps necessary to make it accessible, has ways to address the problem for herself and systemically—with a complaint to either the Department of Education or Department of Justice or a suit under Title II (if a public college) or Title III (if a private one). The parents of a K-12 student, however, have a more complex set of hoops to jump through with relatively little possibility of making systemic change. Generally, parents of children with disabilities are restricted to provisions under the Individuals with Disabilities Education Act (IDEA) and challenges to the IEP. Take for example a school district that adopts an inaccessible technology that is used in every classroom for every student. Due to the priority of the IEP process for accommodating students, a claim of discrimination because of inaccessibility would first have to exhaust the complaint procedures under IDEA. This further emphasizes the old accommodations model rather than taking advantage of the promise for universal access that technology can deliver. We need clearer protection under the law in cases where inaccessible technology is widely adopted and systemically bars the participation of students with disabilities to clarify the unintended consequences of the IDEA and the IEP process.

Secondly, educational institutions at all levels have the entire responsibility under federal law for providing equal access to instructional technologies. If a student encounters pervasive discrimination because of the proliferation of an inaccessible digital book, platform, or device, her remedies are entirely against the educational institution, including, in the case of Section 504, cutting off federal funding. Meanwhile, the companies that sell hundreds of thousands of dollars of inaccessible technology into the education market share none of the responsibility for the discrimination against students with disabilities. Furthermore, companies that do not include accessibility in their products may enjoy a price advantage because their products include less robust features than the technologies that come with accessibility built in. Schools can, of course, seek contractual representations and warranties and indemnity clauses to extend liability to educational vendors, but many lack the market power to insist on such provisions. The civil rights laws should be strengthened so that companies systemically placing inaccessible technologies into K-12 or post-secondary education programs can be held accountable for their role in shutting out students with disabilities. Specifically, I recommend that Congress consider extending the private right of action to companies whose products create systemic barriers to the full participation of students with disabilities in the educational system. Along with a strong

functional standard of accessibility, this will encourage accessibility, reward those implementing universal design, and punish those misrepresenting the accessibility of their technologies.

Third, it is critical that we recognize the tremendous sacrifice that a student with a disability makes when bringing a complaint regarding accessibility against her school. Consider the Ph.D. candidate pursuing a career in academia. If in the middle of her study she decides she can no longer take the technology barriers she faces in the university's systems, she has a terrible choice to make. Option 1: File a complaint against her university and potentially upset some of the very mentors she came to the university to work under. Furthermore, her complaint will put her in the position of applying for jobs at other universities and listing references from her current university where many will think of her as a troublemaker. Option 2: Bite her tongue, accept whatever extra cost there is to her to work through the inaccessible technology, and hope to get out successfully as fast as she can. Option 3: Drop out. In the same way any other group has faced real and perceived retaliation for attempting to achieve equality in society, students with disabilities face a real barrier when fighting for accessible technology. Congress needs to carefully consider the pressure on students with disabilities and create stronger protections that give stronger supports to students and help to share the responsibility of accessibility. Technology accessibility is a central civil rights issue for the twenty-first century, and if Congress does not take stronger actions, we will make people with disabilities second-class citizens in a digital era.

Conclusion

Technology is transforming the way we create, share, and gain knowledge. If built universally and implemented effectively, technology will make the passion and skill of our greatest teachers even more powerful as we nurture the next generation of leaders for our nation. If we fail to include accessibility in that technology, we will set this generation of students with disabilities back decades. The cost to those individuals and to our country is too great and the opportunity is too promising to stand by and let that happen.

As a blind father working to build a future for my own children as well as the blind children that are now entering the education system, it concerns me that we might miss the tremendous opportunity that is within our reach. It worries me that our failure to make universal access to technology a reality may potentially shut one of my children out of educational opportunities and may prevent me, as a blind parent, from having the same access to information and resources regarding my children's education as my sighted peers. By welcoming the new paradigm of mainstream access, providing government leadership in programs and grant-funded projects, collecting and disseminating best practices in implementing accessible technology, building tools to check for accessibility barriers, deepening awareness and expertise among IT professionals, and strengthening nondiscrimination protections under the law, we can make a huge difference.

Distinguished members of this committee, I deeply appreciate the opportunity to present my perspective and recommendations regarding the intersection of technology and education for students with disabilities. Your leadership in putting this hearing together is extremely meaningful and will contribute significantly to the shift to a new paradigm of accessibility in education. We know the type of future we want, we understand the promise of technology, and we must act quickly to make it a reality.

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Table 1. Comparison of iPhone and BrailleNote

	iPhone 4S	BrailleNote Apex
Processor	1GHz dual-core A5[1]	Freescale iMX32[2] (approx. 532MHz[3])
RAM	512MB	256MB
Internal Storage	16/32/64GB	8GB
GPS	Internal	External
Camera	8 megapixel	None
External Synchronization	Wi-Fi/Cloud, USB	USB/SD Card
Web Browsing Capabilities	Full browser capable of rendering HTML 5	Mobile browser best for text or simple pages.
Price	16GB iPhone 4S ($199) + Alva BC640 40-cell refreshable Braille display ($4,199): $4,398	BrailleNote Apex 32 cell Braille display: $6,379

[1] http://www.pcworld.com/article/241158/iphone_4s_vs_the_competition_spec_showdown_chart.html
[2] http://www.humanware.com/en-usa/products/blindness/braillenotes/_details/id_161/braillenote_apex_qt_32.html
[3] http://www.freescale.com/webapp/sps/site/taxonomy.jsp?code=IMX31_FAMILY. Information of iMX32 is not available, but datasheets show iMX31/32 listed together; specifications appear to be similar.

-----Original Message-----
From: Leddy, Mark H. [mailto:mleddy@nsf.gov]
Sent: Thursday, January 05, 2012 2:48 PM
To: Dale, Kareem A.
Cc: Suresh, Subra; Marrett, Cora; Rison, Kathryn R.; Ferrini-Mundy, Joan E.; Olds, Barbara; Macklin, Sheila V.; Gold, Eric S; Postell, Claudia J; Strausser, Beth A.; Feldman, Jean I.; Poston, Muriel; Santiago, Victor A.; Moriarty, Mary
Subject: Requested Information About NSF Enforcement and Monitoring of Rehabilitation Act of 1973
Importance: High

Kareem Dale
Special Assistant to the President for Disability Policy
Office of Public Engagement
The White House

Dear Kareem,

Thank you for inviting me to attend the October 28, 2011 "Briefing on the Accessibility of Science, Technology, Engineering and Mathematics (STEM) Education and Careers for People with Disabilities." During the meeting Dr. Gardner and you asked for information about how NSF enforces and monitors awardee compliance with the Rehabilitation Act of 1973 (29 USC § 794). The following response is offered for your consideration.

When a grant proposal is submitted to the NSF, the Authorized Organizational Representative (AOR) from the proposing organization electronically signs the proposal. By electronically signing the proposal, the AOR certifies the organization agrees to comply with NSF's Nondiscrimination Certification. That certification states that the organization agrees to comply with a multitude of civil rights statutes, including the Rehabilitation Act, as well as all regulations and policies issued by NSF pursuant to these statutes.

NSF has the responsibility to monitor awardee compliance with the Rehabilitation Act. Specifically, in accordance with its regulations, NSF is required to conduct a prompt investigation whenever it receives information suggesting a possible failure to comply with the requirements of the Rehabilitation Act. At the conclusion of its investigation, NSF informs the awardee in writing of its findings of fact and conclusions of law. If NSF determines that the awardee failed to comply with the Rehabilitation Act, NSF sets forth the measures that the awardee must take to bring itself into compliance. If the awardee is unable or unwilling to take the measures set forth by NSF, NSF may take appropriate action against the awardee including, but not limited to, the termination of any NSF funding to the awardee.

In addition, pursuant to its regulations, NSF is authorized to periodically review the practices and policies of awardees to determine whether they are complying with the requirements of the Rehabilitation Act. The regulations do not specify a particular number of compliance reviews that NSF is required to undertake in a given year.

Thank you for this inquiry. Please advise if there is any additional information we can provide.

Best, Mark

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