Raising the Bar: How Education Innovation Can Improve Student Achievement
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Testimony of Assistant Deputy Secretary for Innovation and Improvement Jim Shelton

Chairman Rokita, Ranking Member McCarthy, and Members of the Subcommittee, greetings and thank you for this opportunity to testify today.

I would like to speak with you about two related topics:

- First, the potential of technology to fundamentally transform education, dramatically altering the levels and pace at which we develop America's human capital – our people.
- And second, the vital role of technology in ensuring our international leadership and affirming America's global standing educationally and economically for future generations.

Advances in the learning sciences and in technology provide the United States with a unique opportunity to achieve our aspirations to expand educational access; increase individual opportunity; strengthen national competitiveness; and propel economic growth. However, realizing these opportunities will require new and improved approaches to both educational innovation and the investments and infrastructure to support it. To be blunt, we have reached another "Sputnik Moment", one which challenges Federal, state, and local leaders, and educational stakeholders, to have the vision and courage to do what is necessary to retain America's educational and economic strength.

Learning technology can and will transform education in at least three core ways:

1. First, learning technology will greatly expand access and equity;
2. Second, it will transform teaching and learning; and

3. Third, learning technology will dramatically accelerate and enhance research and development in education.

Increasing Access and Equity

Let me speak first to the issue of expanding access and enhancing equity. If providing our young people with access to learning through technology does nothing else, it will dramatically increase opportunities to learn and excel for all students, especially those isolated by geography or income and those simply hungry for more than their schools are able to offer.

- In rural areas, entities such as the Niswonger Foundation, which is a grantee of the Department of Education's Investing in Innovation Fund, have used technology to enable students to access foreign language instruction and materials, Advanced Placement and other college-level courses, and a variety of learning experiences that were previously unavailable or unaffordable in many isolated geographic areas.
- Both here in the U.S. and across the globe, students are using technology to obtain extra support during and after school from recorded videos and online exercises available through web-based resources, as well as from peers and personal tutors provided through online networks.
- Tens of thousands of students are enrolling in virtual schools and online courses. The flexibility of virtual schools and online courses can benefit all students, but it particularly helps students in unique circumstances like those who are chronically ill, or behind in their credits. Florida Virtual Schools, the only school system in America that gets paid only when the students learn, is serving almost 200,000 students.
- The Department of Defense Education Activity's Virtual High School allows military-connected students around the world to enroll in courses that would otherwise not be

offered in their school. In select instances, students in a remote area are joining live classes offered in larger high schools via video-conference. A one-to-one student-to-device ratio in pilot schools is geared toward easing transition and increasing access for military-connected students.

- Federal civil rights law requires that all educational programs offer equal access to students with disabilities, and numerous new technologies especially target and benefit such students, giving accessibility and universal design new meaning for thousands of students.

All of these innovations, and these are just a few of the examples, are providing opportunities to learn and excel that were often out of reach for millions of students before technology began leveling the playing field. Creating unprecedented equity and access to education alone will make investing in digital infrastructure and learning tools worthwhile; but there are many other benefits.

Transforming Teaching and Learning

The second core shift that technology will accelerate is a fundamental transformation of teaching and learning—which in many respects has been remarkably static for much of the last century. At the most basic level, open, free, and proprietary digital content can be kept up-to-date, and revised and improved at any time. It can replace traditional textbooks, lowering costs and eliminating the back-breaking backpack. It already has moved beyond digitized books to create new media with linked or embedded dictionaries, encyclopedias, assessments and videos, and simulations to give students multiple ways and chances to understand and master content.

We should not underestimate the impact of even seemingly simple innovations. How many students have missed a key concept because the class moved on before they understood, or

because the text was too difficult or because they didn't carry home their heavy books that day? How many times has the fear of being embarrassed prevented a student from asking the teacher to explain a concept for the second, let alone the third or fourth time? These issues are real. They impact learning. And new technology-enabled tools and resources hold the potential to ensure that children do not fall behind in the most basic ways.

But, as the record of many sectors of the economy shows, real transformation does not come from replicating old processes using new technology. Real innovation emerges when technology is leveraged to change and improve products or processes in ways that were impossible or impractical without the technology. I could spend many hours on this topic alone, but let me focus on a few obvious examples of how this applies in teaching, learning, assessment, and research and development.

More than three decades ago, Benjamin Bloom demonstrated what he dubbed the "two sigma problem "—sigma meaning standard deviation. Bloom showed that a student in a given subject, learning through 1:1 tutoring, outperformed students in a traditional classroom by two standard deviations—meaning a student in the 50^{th} percentile would instead be in the 98^{th} percentile. To put this into context, if the U.S. performance improved by just one standard deviation on international assessments, we would be the highest performing nation in the world, and our students performing in the lowest 10 percent would be performing at the level of our current top-quartile students. There is no disputing these findings or the magnitude of their implications, yet until now we have been unable to close the gap between the traditional classroom and the individualized instruction that might solve the "two-sigma problem." Our challenge is to find a way to *affordably* provide each child this opportunity.

Every day, teachers go into classrooms of anywhere from 15 to 60 students and struggle to match each student with the content, instructional approach, and supports to ensure each

student's personal engagement and success. The average secondary school teacher will try to tailor instruction for more than 150 students a day, knowing that each student has a task complicated not only by different levels of preparation and interest each student brings to school, but also by different language and cultural backgrounds and social contexts. In far too many classrooms, we are asking our teachers to meet these demanding goals with little more than an outdated textbook, some colored markers and whatever creativity they can conjure to make the best use of the few hours of the day their students are in front of them. Given these challenges, it is easy to see just how extraordinary our most effective teachers are; and how important it is that we equip all our teachers with the tools to enable them to teach all their students effectively.

Technology holds the legitimate potential, perhaps for the first time, to affordably personalize American education — on a national scale. It enables us to put the right information, tools, and resources in a teacher's hands, so that she can meet a student's needs and pique her interests. However, just as important, technology can enable students to progress through material at their own pace, identify, and explore their passions, and take extra time and access extra support when they need it. In short, new advances in education technology can enable students to take ownership of their own learning, while also enhancing a teacher's capacity to be a facilitator and mentor for such empowered students. What is inspiring is that there are classrooms throughout our country where both students and teachers are using technology to accomplish all of these things.

From flipped classrooms, where online instruction is delivered out of class so teachers can help students with "homework" during class, to blended schools that combine face-to-face teaching methods with computer-based methods, to thoughtful implementations of project-based learning, teachers, schools, and systems are using technology to rethink traditional roles and to personalize teaching and learning. They are using data to better target student needs and access

educational content—enabling students to learn at their own pace and in the ways that suit them best. Teachers are using games to teach collaboration and complex problem-solving skills to deepen learning for all students.

To cite one example, teachers in the Mooresville Graded School District in North Carolina—which provides a laptop for every 4th through 12th grade student using primarily digital curricular materials—use technology as a catalyst to make learning more interesting, build better relationships among students, teachers and parents, and ultimately improve student and school performance on almost every metric. The district—one of the lowest funded districts in the state—has become the second highest performing district in the state, with graduation rates over 90 percent and millions of dollars per year in new college scholarships. And they accelerated achievement and attainment while sustaining a 10 percent reduction in state funding. Veteran Mooresville teachers talk about how their initial skepticism turned into enthusiasm and how now they "can't imagine going back."

Meanwhile, millions of teachers and students have begun using technology-based platforms to support their daily learning lives. Through such platforms, teachers have access to a constant network of support from other teachers in their local community and across the country. Students connect with their teacher, fellow students, and their work, with a tool that they find as well-designed and compelling as Facebook but that actually helps them be productive and achieve. Using such tools, with their associated opportunities for social networking and peer- or group-learning, also helps students engage in deeper learning and further develop 21st century skills such as problem solving, critical thinking, and communication that are critical to success.

Hundreds of thousands of students with visual impairments and significant reading disabilities have been provided access to instructional materials in accessible formats available for download to computers, tablets, or mobile devices. These innovative products and processes

have resulted in more timely delivery of educational materials and increased ease of use and access.

Accelerating Research and Development in Education

Third, I want to talk briefly about how technology can accelerate research and development in education. Both in early learning and higher education, the evidence of the potential of technology-enabled education is mounting.

A quasi-experimental study documented that young children using digital numeracy games in Head Start centers demonstrated significantly greater learning gains than children who did not have the same access. Numerous studies of post-secondary course redesigns leveraging technology have documented that students not only achieved at significantly higher levels of persistence and performance than the control groups, but did so in about half the class time. One particular experiment conducted by Nobel laureate Carl Wieman that studied multiple professors using a new course redesign found that the most significant performance gains were made by the instructor that historically had the lowest student performance. The technology-driven redesign brought that professor up into the range of all other professors.

Finally, I would be remiss if I did not mention that the military has utilized the learning sciences and technology to produce truly remarkable learning gains in the area of Information Technology career and technical education – enabling new recruits, after just 16 weeks of training, to successfully compete with experts with seven to ten years of experience in solving highly complex technical problems such as diagnosing and debugging an enterprise network. These results are preliminary, but they raise profound questions about the conventional wisdom on teaching, learning, and the capacity to acquire technical skills.

These are all wonderful examples of the potential of the learning sciences and technology to

transform education. However, many of you may recall hearing before that this transformation was imminent, only to be disappointed when it failed to come to fruition. So the obvious question is: why will it be different this time?

Leading investors and entrepreneurs say that innovation happens at scale in healthy ecosystems. The good news is that the macro forces underlying the education technology ecosystem are all moving in the right direction. Unlike the situation even five years ago, conditions are ripe for science and technology to produce dramatic gains in opportunity, productivity, and student outcomes. Specifically, the convergence of at least seven trends supports rapid technological transformation in education: (1) ever more powerful and lower cost devices, such as tablets, netbooks, and laptops; (2) high-quality digital content in courses, videos, simulations, and e-books; (3) cloud computing and broadband are putting powerful applications and rich content on almost any device at any time, without the need for local training or technical support; (4) big data collection and analysis to improve the speed and precision of decision-making and help identify what works; (5) increasing comfort across all age groups with using technology; (6) accelerating breakthroughs in neuro, cognitive and behavioral science; and (7) significant pressure to improve the cost effectiveness of public dollars.

The bad news is that it is well-documented that significant gaps remain in the U.S. system for education technology, and historic challenges persist, although there are opportunities to make smarter, more strategic uses of education technology. A number of factors combine to form a difficult market, causing entrepreneurs and investors to either stay away or treat the education sector as a hobby or charitable endeavor, leaving the incumbent providers with little competition or incentive to improve. For example:

- The Federal Communications Commission's E-rate program has successfully increased internet connectivity to nearly 100 percent of schools from less than 10 percent when the

program was created. However, non-Federal organizations have estimated that few schools have the bandwidth to support the applications and uses of today, and fewer still have the devices to allow teachers and students to significantly change the ways in which they work. Achieving a critical mass is vital to transforming any school or system which will not happen without further investment.

- Technology markets require scale, as noted recently by Jim Coulter, the founder of TPG Capital and the co-Chair of the LEAD (Learning Education by Advancing Digital) Commission. The education technology market provides neither the easy access of a large consumer market nor the efficiency of a large institutional market. Complex and bureaucratic purchasing processes make K-12 education difficult to navigate by any but the most experienced providers with the largest sales forces. Further, lack of information and understanding about which tools actually improve student achievement makes purchasing decisions and product differentiation based on performance and quality extremely difficult. But there are ways to address these shortcomings. Building on the examples of Maine and Pennsylvania, whole states or consortia of states can organize to aggregate purchasing power, lower prices, and demand different and better products. And various non-profit and for-profit providers are attempting to develop user-friendly interfaces to become a trusted source for those making decisions about which educational resources to purchase or use.
- Longstanding skepticism of technology in education, combined with inadequate training and support, has also thwarted the widespread adoption and use of education technology. This challenge has been exacerbated by products that were poorly designed, too many of which have been difficult to use and produce dubious results, or products that have been inaccessible to students with disabilities. As a result, we must focus our efforts on

providing evaluated, proven tools in which teachers have confidence, and think comprehensively about how to prepare teachers around the country to integrate these technologies into the classroom.

- Finally, underfunded and unfocused Research and Development (R&D) in this area has limited advancements and, as a result, precluded the kind of leadership evident in other sectors.
    - All levels of government chronically under-invest in education R&D—high-growth industries invest 10-20 percent of sales revenues in R&D; many mature industries invest 2-3 percent. Only 0.2 percent of national K-12 spending is devoted to R&D.
    - The U.S. Department of Education provides no exception to that general trend of under-investment in education R&D. The trajectory of educational innovation would be accelerated exponentially by increasing our investment in the science of learning and learning technology R&D.
    - Going forward, while the public sector invests in model schools or systems, the private sector, both philanthropic and for-profit, can invest in classroom-level innovations that actually work for students and teachers.

These obstacles are substantial but they can be overcome if we have the will to win the global race for economic and educational competitiveness. We have every motivation to do so. Our students and our country deserve no less. Further, opportunities abound to build on progress already in motion. For example, the Department of Education has used competitive grant funding through the Investing in Innovation (i3) Fund and the Race to the Top-District competition to support innovative strategies, interventions, and tools centered on technology. And, the Department of Defense Education Activity has developed a professional learning

framework to be introduced in school year 2013-14, which focuses on creating student-centered, technology infused 21st Century classrooms and schools.

Given the advantages of access and equity, the urgent need to transform teaching and learning for all of our nation's students, and the opportunity to better align and invest in R&D, there is every reason to move ahead rapidly. I will briefly cite three reasons:

1. First, national competitiveness – Countries that are already outperforming us educationally and economically are also ahead of us in the transition to technology-supported learning. Countries such as Singapore and South Korea have recognized that investing in technology enables them to move up faster to higher levels of performance in workforce development, including teaching their students to be creative and innovative, traditionally America's hallmarks. Many of these countries have already made national commitments to realizing their visions.
2. Second, we want to retain international leadership in education technology. The rest of the world has realized that the key to long-term economic success is human capital development. Yet many countries cannot build enough schools or train enough teachers to meet the new demand. To address this challenge they are turning to technology. Today, education is a $5.7 trillion market and growing. The U.S. is primed to export learning technology, but other countries are not standing still. There will be a new equivalent of Google or Microsoft to lead the global learning technology market. I want it to be a U.S. company.
3. Finally, and most important, the educational needs of our children are unmet. We have known for the better part of three decades that we have been cheating our nation's future—that our students are capable of much more than we are enabling them to do.

> The delivery of education must be more exciting and relevant to reflect the best of what school can be. We owe our children and we owe our nation the best possible education, and it is in our power to provide it.

Like so many other times in our history as a nation, we are confronted with the question: what are we willing to do to achieve our goals? Our historic answer has been "whatever it takes." It is time to give that answer once again.

Thank you, and I am happy to answer any questions that you may have.