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LEVERAGING TECHNOLOGY TO RECLAIM AMERICAN EDUCATIONAL LEADERSHIP

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THE FUTURE OF EDUCATION TECHNOLOGY

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IMAGINING THE EDUCATIONAL ENVIRONMENT OF THE FUTURE

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P R O C E E D I N G S

MR. WEST: Good morning. I'm Darrell West, vice president of Governance Studies and director of the Center for Technology Innovation here at Brookings. And I'd like to welcome you to our forum on "Leveraging Technology to Reclaim American Educational Leadership."

I think everybody recognized how important education is to personal development, social opportunity, and economic prosperity. Learning is an essential ingredient in how well people do. And I feel like, personally, I am Exhibit A in this regard because I grew up on a small dairy farm in rural Ohio, but through a great education system in the 1960s and 1970s was able to eventually end up teaching at Brown University and then coming to Brookings two years ago.

But I think many of us worry about whether today's generations of kids are going to experience the same opportunities and prosperity that others have had. We need to get more low-income use in postsecondary education and provide greater access to quality education for more Americans.

Now, there obviously are many ways to think about improving our education system, but technology innovation represents an important part of that overall puzzle. And that's what we really want to focus on today.

Technology has the potential to improve education by improving access for remote areas personalizing learning, making class times more flexible, and providing online assessment tools. Wired classrooms and instructional sets allow for education that is adaptive to student needs letting pupils learn at their own pace receiving individualized instruction and being assessed in real-time. So it represents a way to build and look at education attainment more systematically than is possible today.

To help us understand how we can leverage technology to improve learning, we have brought together a spectacular set of speakers. Today we are going to

hear from top White House and Department of Education officials about their views on education technology and education innovation. We will have a panel on improving the future education environment. We will discuss the state of education research and development, we will look at how to encourage experimentation and adoption of new approaches, and at noontime we will have a keynote address from Governor Bob Wise of West Virginia about his organization's work on digital learning.

For our first session, we are pleased to several distinguished leaders from the White House. Phil Weiser is senior advisor for technology and innovation to the National Economic Council Director. In that position, he works on a wide range of issues related to technology and innovation. Previously, he was a professor of law at the University of Colorado.

We also will hear from Aneesh Chopra. Aneesh is the chief technology officer for the federal government. He serves as assistant to the President and associate director for technology within the Office of Science and Technology Policy, and in that position he advises the President on technology innovation and ways to encourage new approaches.

We're also pleased to welcome Roberto Rodriguez to Brookings. Roberto is special assistant to President Obama for education at the Domestic Policy Council of the White House. His task is to coordinate education policy for the administration, and previously he was chief education counsel to the late Senator Edward Kennedy for the Senate Health Education Labor and Pensions Committee.

So let's start with Phil. You advise the President on many technology issues. What should the federal government do to expand the adoption of technology in education?

MR. WEISER: Well, I'm going to start with a point that's a little bit broader that puts that question in context, if I could, which is we have seen over the last 20 or so years the information technology revolution, change in fundamental ways a

series of industries operate. So if you think today about how people buy or sell stocks

and how they did it 20 years ago, it has changed from people having to call up a broker

and pay $100 or so per trade to people doing it on their own with the click of a mouse, as

they say, for generally $10 a trade, right, a 10-X reduction in costs. In many cases

they're getting greater quality access information, you know, at their fingertips. That's a

pretty fundamental change.

Similarly, in other industries, we've seen huge ways that technology has

changed consumers' behavior. Think about the development of smartphones and how

people now may not say they needed or wanted alarm clocks, they've got one on their

phone. They may not need a checker set because they've got one on their phone. It's

created huge opportunities. In the education world, we're only beginning to glimpse

some of those efforts. They've not kind of gone throughout the whole system, and that's

something that, if you see that, you realize what the opportunities are.

In other industries, health care for example, also energy similar

opportunities exist. And from the perspective of looking at innovation as a driver to help

not only our economy but our national priorities, education stands out, and for that reason

we've decided, the three of us, to get together an interagency effort to help bring the best

of our thinking to ensure that our policy's effectively coordinated and framed to seize

these opportunities. Because today we're glimpsing some of them, but we know we can

do better. And we're very fortunate to have at the Department of Education Jim Shelton

and Karen Cator and the fantastic work they're doing. You'll hear about that today.

The vision that we have in this Department of Education more generally

about improving education with every tool we have, including technology innovation, is

one of this administration's top priorities. And having Roberto in the White House to help

oversee and work with that is a huge asset, having a chief technology officer.

And then in my case, having someone who sees from the economic

perspective why this matter is part of our overall vision to make this a signature effort of

the administration, and we're going to be working on this because -- and this is worth sort

of explaining a little bit -- you can lower costs and you can raise quality by using

technology in ways we haven't. On range of different ones -- Darrell mentioned some --

how do we assess student learning? How do we try to make learning more

personalized? How do we find ways to bring learning to people who don't have it?

So in Colorado where I'm from, Pam Shockley on the University of

Colorado, Colorado Springs campus has put together a consortium of 10 institutions of

higher learning in using Cisco TelePresence technology to bring education to all parts of

the state where they may not have certain courses. This is something which has been

talked about for a long time, but we're seeing significant progress on it.

Even in a more sort of nationwide model, a local company called

StraighterLine has been able to develop $100 a course for people who might not even be

in college, but then can start taking courses and then transfer for college credit. This can

make education accessible and affordable by leveraging technology. That's not the way

the system was built up, and one challenge that is -- in many areas is you have a certain

legacy people are used to -- change isn't easy. And one role public policy can play is to

help try to create the vision and the opportunities for that sort of change.

So we're very excited about this opportunity, and thank you for joining us

here today.

MR. WEST: Thank you, Phil.

Aneesh, speaking of this vision, what do you see as the biggest

opportunities as well as the barriers to progress in this area?

MR. CHOPRA: Well, I focus on three, and I'll get to them momentarily.

But let me just amplify Phil's comments and set the stage from a technology and

innovation benchmarking perspective.

It was February of last year, Darrell; Rob Atkinson published a report at

the ITIF looking at about 25 key indicators of innovation performance benchmarking 40

countries. And as most of these studies go, it rendered a judgment about whether the U.S. is number one, two, three, or four, and it ranks us six. But you could pick any study and it would say the U.S. is two or five or whatever different benchmarking studies exist to make your point.

But this particular study look at a derivative value, which is across these 25 indicators, whether you render a judgment about where we are static is one thing; but if you go back to the same set of indicators from 2000 to 2009, basically a decade, what was the rate of change? And what was the derivative value of the U.S. performance against the derivative value of the other 39 countries to be benchmarked?

And the bottom line of the Atkinson study called "The Atlantic Century" was that the United States was 40th out of 40 countries in the rate of change on key performance indicators. I bring that up as backdrop, Darrell, because just about two weeks ago Secretary Arnie Duncan -- who's a rock star, by the way and pretty huge.

MR. WEST: We thought you were the rock star.

MR. CHOPRA: Yeah, I wish. That guy's the man. Secretary Duncan, when soberly -- if that's a term -- reviewing the PISA scores, looking at performance globally, came to roughly the same conclusion. If you go back a decade on reading literature, 15-year-olds in the U.S. essentially made no progress over the decade. If you look at math, virtually the same mediocre performance. I think in math we ranked 23rd, Jim, if I recall. And the only area we showed even slight performance improvement was in science where we went from sort of bottom of the heap, if you will, to I think 17th. So not much to particularly celebrate.

So the conclusion that Secretary Duncan drew, his words, was that a kind explanation was the lack of productivity in the educational system. And I found that framing very helpful in the technology and the innovation context, Darrell, because Profession Jorgensen had studies the overall economy since 1995 and found that two-thirds of the productivity growth was attributed to investments in IT, much in the same

way Phil outlined kind of the examples, stock market and so forth.

Ergo, if productivity is at the root cause of our challenges in educational performance and in the broader context we've seen a relationship to some degree, then there may be opportunities to further understand the power of information technology, not that it's the sole, but in my voice on this three-legged stool that we're hearing, I'm particularly emphasizing those aspects, and those are three.

Number one, much of what has led to the Information Revolution has been this notion of open standards and the ability to build and scale on what works. We don't have, technologically, a standards framework that would allow us to understand how content should be distributed in the classrooms. And given the comment you made, Darrell, about personalized instruction, we really don't have a standards framework for assessments, you know. In the traditional sense -- I remember this in my state of the Commonwealth of Virginia had -- we have a statewide database like, what was your testing score, one value, the student and the teacher. That's like in a big statewide database. That's a single moment of assessment.

And as I've said on occasion, my four-year-old on her iPod touch is using learning apps where she's making judgments literally every few seconds, and that is data, assessment data. So the notion that we're going to have a single value of assessment measured in some state database, and you've got this proliferation of tools that can allow you to assess far more rapidly, means we've got to get our arms around assessment.

By the way, on that topic, I'm pleased that under Karen's leadership and Jim's leadership at the Department of Ed, Monday will be a notice in the *Federal Register* calling for public input on standards for interoperability on issues around assessment and content. I think it's available today on the Department of Education's website and then on the *Federal Register,* that wonderfully powerful document you all love reading, on Monday.

Second, too, briefly, and then I want to have Roberto frame it, I am also a big proponent in the area of technology and innovation. If you look at productivity gains, a lot of it is on building on research and development activities. Kalil, who will speak later today, can diagnose the billion-dollar industries within IT that all have their origins in government-funded research and development. I think there's a dozen examples.

Just yesterday we were with the CEO and founder of Akemi Technologies, who I didn't know got his concepts through a DARPA grant a decade ago.

And third, and certainly not least, perhaps most importantly, we see the power of open data throughout our overall approach to productivity and innovation in the context of government more generally in the same spirit. How might we do more to leverage information to help navigate this complex field to understand what works and what doesn't?

So we can go on and on, but, Darrell, I wanted to give you those three key policy points and then hand it off to my partner in crime, Roberto.

MR. WEST: Thank you very much. Roberto and Phil and Aneesh have teed up the importance of innovation. You coordinate education issues for the President. How can the government go about encouraging new models of learning?

MR. RODRIGUEZ: Well, I think that's actually why we're here today and why we're so excited about this forum. I think, you know, Aneesh described the moment that we have in education is sobering. The President on Monday really hit home the importance of the *Sputnik* moment for all of us in terms of American education. The OECD data and our standing on PISA, I think, really underscores the importance of doing more to really raise the quality of our education system across the board for all students in all subjects, and we really believe that harnessing technology can be a key tool and lever to do that.

We know that we are lacking behind other nations

-- China, South Korea, Finland, Canada -- with respect to not only the attainment

educationally of some of our students, but also with respect to some of the strategies that

we need to bring to scale as a nation to really transform teaching and learning and

transform our classrooms into really 21st century classrooms.

We also are framed by an important imperative that the President has shaped for

us last year to again, by the end of this decade, by 2020, to lead the world with the

highest proportion of college graduates. That's not just a higher education strategy,

that's really an unimperative that calls for us to do better in terms of improving

opportunities and outcomes for our students, really from cradle all the way through high

school graduation and up through college.

So the challenges are great out there. I think we really believe, and as

Phil has alluded to, education and the education sector really has tremendous potential.

If we can really harness technology, new modes of technology, and really build up the

type of capacity that's needed at the school level, at the district level, at the state level to

be able to implement these new technological tools to really transform learning for our

students.

We also know that our students today in this generation need to be

prepared with a whole new set of global skills. We need to be sure that we're preparing

all of our students for college and career which means making sure they have a solid

foundation in key academic subjects, but also that they have the types of skills that they

need to be able to succeed in a global marketplace, that they can be strong

communicators, collaborators, problem-solvers, that they can do better in terms of

analyzing complex skills and really bringing the maximum to bear on that.

So, you know, I think the demand of the skills in terms of our new work

force and the growing proportion of jobs that we have in today's economy really demand

that we look at the education endeavor in a new light and we use technology as a key

lever there.

So there are really three kind of basic -- that I'd like to outline three basic, I think, benefits to really looking at education technology to transform our education landscape. And, you know, Jim and Karen have done great work through our education technology report this year to outline these that we'll have a great discussion and detailed discussion here. But, just very briefly, I'd like to mention them.

First, really using technology to really help provide the analytics that we need to understand data better and to use data better to improve instruction and to identify what's working and what's not working and what needs greater attention in the classroom. And one of the primary modes that we can look at that, and one of the kind of key framings of that discussion, has been assessment. And Aneesh alluded to this, but it's both looking at how we can use technology better to deliver formative assessments that provide real-time data about how students are learning about the types of additional helps and supports that they need to be able to succeed; web-based tutoring models that can really look at and study students' behavior, students' approach to problem-solving, to be able to break that down, provide a greater picture of that to teachers; also looking at what we can do in terms of harnessing technology for summative assessment.

And we've really had a great conversation about raising the rigor and relevance of our standards across the country so that they reflect college and career readiness. This is a kind of key foundation of our education approach at the White House, and we're supporting with $350 million, our administration, the development of a next generation of assessments that are really aligned to college and career readiness that states are able to use. And we have 44 states around the country that are engaged in one of two consortia that are really developing these new assessment and looking at technology as an opportunity to really not only provide a richer measure of student learning, but also to be able to adapt that measure so that we not only can know where our students are with respect to their master of grade-level content, but we know how we can challenge our most gifted students, how we can really help our students at the

bottom of the curve accelerate their learning to be able to succeed.

And finally, the importance of diagnostic assessment in what technology can do around really diagnosing learning needs early. So that's really the first piece.

The second is to look at how we can use technology to better personalize the learning environment and better respond to individual student needs. That's much more of a pedagogical exercise but one that I think is very exciting, and this is looking at how we can better engage students in learning in their classrooms, how we can use technology to really connect to students' individual interests, and really help enrich instruction for students.

And I should say that's not just an exercise that is important within the classroom; there is the ability to personalize learning outside of the classroom, and in out-of-school learning time. And we really need to maximize every hour of a student's attention and engagement in order to really help them succeed and get the skills that they'll need to be able to succeed in college and career by the time they graduate. And that means really looking at our out-of-school environments also as important learning environments and how we can use technology there. We have some wonderful work that's going on supported by Carnegie right now looking at libraries as out-of-school learning environments and what we can do there to really engage student learning.

And then I'd say the final piece is really doing more to harness technology as a point of access for a rigorous curriculum for students, and the ability to provide and really transcend miles, to be able to deliver in remote areas and areas where we might have understaffed schools or understaffed classrooms, or we might not be able to have the type of school faculty that are able to deliver rigorous courses to be able to use technology and use digital media as an opportunity to deliver that rigorous level of instruction for students in key areas.

And Phil alluded to this. We're not only seeing this in the context of K-12 education, and obviously we're seeing a number of states -- Florida is an example -- that

looks at virtual schools to be able to deliver those types of courses. We're seeing this in

higher education, and our administration is deeply committed to doing more to really help

in that sector as well, utilize technology as a key mode to deliver the type of courses and

more enriched curriculum that students need to be able to graduate from higher

education ready for a career and with the career-ready skills they need to succeed.

So thrilled to be part of this conversation, and we're really deeply

committed to moving this agenda, moving this agenda forward with all of your

collaboration and help.

MR. WEST: Okay, thank you very much.

We have time for two or three questions, so we have people with

microphones, so if you can raise your hand. We have a question her up front. If you

could just give us your name and your organization. And we also would ask you just to

keep your questions brief, too. Thanks.

MS. GETTMAN: Thank you; I'm Lucy Gettman with the National School

Boards Association. I'm waving around a brochure from our technology leadership

network. Public schools are absolutely interested in engaging in the transformative

potential of education technology, and I'd be very interested in hearing from our panelists

about ways that we can partner in this very important project.

MR. WEST: Amen.

SPEAKER: So let me start with one high-low point, and then let my

colleagues join it. The challenge that happens in technology markets is you need scale,

which means your have to have a basic standards, base framework so that you can have

products that can scale and get disseminated. And one challenge to overcome -- I'll let

my partners talk about some solutions -- is if the, you know, procurement systems or

ways in which things happen are entirely diffused, that is sort of a considerable barrier to

get over. So in terms of possible ways to do that, I would say a couple of things:

One, please help us distinguish nouns from verbs. What I mean by that

is --

SPEAKER: He's an English professor.

SPEAKER: Yes. When I served at the state level, one of the pleasures that I had was to visit schools in e very corner of the Commonwealth. And, inevitably, because I was the secretary of technology, the school board, or the host of my visit, wanted to show me the nouns: Look at all the hardware and the software and the electronic blah, blah, blah, and isn't this amazing? And I would pretend to smile. Inside I was ripped apart because I was focused much more on the verb, to what end? What purpose are we pursuing the acquisitioning of these tools? And you could help a great deal myth-busting by less -- man, I had school boards telling me our capital plan is going to put millions into X, Y, and Z, name-your-vendor-blah. And I was just heartbroken because they didn't articulate any particular problem they were solving with the introduction of these high-cost --

And then what was really depressing is I saw most of that happening in parts of the country that really didn't have resources for much of anything. I'm a frugal engineering guy: design constraints, low-cost, build and innovate around those constraints against a verb. If my problem is getting the underperforming students up to a certain level, how we pursue, so that's goal one.

Goal two, once we articulate the verbs, you can form a coalition of the willing to encourage entrepreneurial thinking to find new approaches to address the verbs, because if it is just the narrow sliver of vendors that live only in the education technology world kind of continue to incrementally improve their wonderful products, we're not going to get to where we want to be. What we need is a platform for new thinking, breakthrough ideas, new entrepreneurial activities that could enter the market because you've given them a much clearer picture of what you want.

So if we shift to verbs and form a coalition of the willing -- I'm just on the fly here riffing for you as a school board leader -- I am confident you can be a catalyst for

break-through ideas entering the market far more than, you know, frankly, federal policy in this issue, organizing at the grass-roots level community by community coalition of the willing, we're with you. We want to be there to help.

SPEAKER: You know, Lucy, we've had this frontier that I think in approaching technology in education we've really -- the entire conversation has been around connectivity and has been around some of that Aneesh is alluding to of putting a computer in a classroom. And we all, all of us that have visited, done classroom visits, have seen these computers sitting in a corner not being utilized by teachers in their lesson plans or an instruction. That's not to speak ill of teachers. It is to say that we need a different conversation about what technology looks like with respect to addressing student learning needs and how teachers and how principals and other school leaders can really use technology in new and innovative ways.

And that's precisely what we embark to try to engage in here is to try to do more to demonstrate how technology can be used to improve instruction. And with educators, and you know this, you don't -- they don't -- the ah-ha moment is not until they're actually in another classroom seeing something used. And until you break down the barriers -- and a lot of those are perceptual barriers of, you know, that's not for me, I can't use that. I have -- you know, I'm supposed to be on page 24 on day 5 of my pacing guide.

Until we kind of break through that and say, okay, this is how you can actually use and embed technology as a key tool to deliver core content, that's really what we're after. And I think we're just -- there's a whole host of ideas out there that we can mine and really bring to scale. But unless there are really almost a potential of those ideas is owned by folks in schools, we're not going to get there.

MR. WEST: Thank you. And this morning we will pursue many of those ideas.

We're out of time on this session, but I want to thank Phil, Aneesh, and

Roberto for sharing their views with us. Thank you very much. (Applause)

SPEAKER: Go, Jim, go. Go, Jim, go.

MR. WEST: That's a pretty good introduction right there.

For our next session, I'm pleased to welcome Jim Shelton to Brookings.

Jim is the assistant deputy secretary for innovation and improvement in the U.S.

Department of Education. In that position, he works on teacher quality, school choice,

and learning technology programs. Previously, he served as a program director for the

Education Division of the Bill and Melinda Gates Foundation. And, as you heard earlier,

Jim along with Karen Cator, who we'll be hearing from later, put together this amazing

report on education technology and personalized learning.

So please join me in welcoming Jim Shelton to Brookings. (Applause)

MR. SHELTON: Good morning.

SPEAKER: Good morning.

MR. SHELTON: Yeah, I'm in education. I say "good morning," you say

"good morning," back. Good morning.

GROUP: Good morning.

MR. SHELTON: Good deal. So, first, Darrell, thank you very much for

hosting this here. I couldn't be more honored to be here with you, and I couldn't thank

you more for actually bringing attention to this important issue. Of course, then, you did

what you probably should never do to another one of your guests, which is ask me if I

was nervous before I came up here, which, you know, I was trying not to be. And then I

was reminded that my boss is a rock star, and then I'm coming on after the U2 of federal

policy. And then I recognized also that I'm being followed by, you will see, folks that are

masters of communication and rocket scientists, in some cases literally.

But all of that didn't make me as nervous as the fact that last night I was

going over my remarks that I've been working on for a couple of weeks, and I had -- for

those of you who don't know, I'm a recovering management consultant -- and I had an

experience that I used to have when I was a consultant, which is what I call the *Jurassic Park* moment.

Many of you may have seen this movie where, in fact, there is a world's best hunter, who is on this island with the folks, and there's all -- it's fraught with danger. And at some point he has to protect everyone from these velociraptor dinosaurs. And he goes out into the jungle because he knows that there's just one out there. And just as he is about to take him out, he realized the other one is about to eat him.

I used to do my consulting work in telecommunications, in the airline industry, primarily. So there were times when you would be working as a -- when you work for a top firm, you have the opportunity to work for companies that are at the top of the food chain. And so you work on opportunities and how you describe the opportunities for them. And you're working them for months, and then sometimes what happens is that at the very end you go, oh, crap, I wasn't looking this way.

That's what happened to me last night. And let me tell you why. See, the basic story line that all of you who are here know is this: The situation? We are underperforming on education. The complication? We have to hurry up and make a change. The resolution? Technology can help us do that. Great. Here's the challenge: In the amount of time that we actually think that we have, we don't. Let me tell you why, and I will apologize for being your "downer" for the morning in advance.

You see, the reality is that we have pursued education and education technology in much the way that Aneesh described, from position of a market leader that is dominant where, in fact, we believe that we can maintain our dominant position by investing in our core systems.

Terry Moe, who will be up here later on to talk about the impact of that on other industries and sectors, and we'll see actually the implications of how that plays out here.

We have heard our President say that the countries that actually out-

educate us today will out-compete us tomorrow, and that is still fundamentally true. The correlations between education and prosperity at both the micro individual level and at the macro national level still hold. But the reality is also that while we are standing still, not only are other countries passing us by but they are increasingly improving on the trajectory at which they are making improvement.

Let me say that again. Not only are other countries passing us by, they are getting better and better at figuring out how to increase the pace at which they improve.

McKenzie & Company just recently released a report called *How The World's Most Improved School Systems Keep Getting Better*. For those of you who haven't seen it, it's an interesting taxonomy. They have now broken it down between systems that are poor and how they move to fair, from fair to good, from good to great, from great to excellent. And what it shows is that there are systems around the world that have made dramatic progress, not incremental progress, dramatic progress in as little as six years moving from one category to the next.

The thing that is important about that is that this is one of the first times that we have seen management science applied to the context of educational performance improvement. And once you start to have that kind of understanding of the products and processes involved in making that kind of progress, then you can actually apply technology to them to improve the pace at which you actually make improvement. You can involve, you can enervate at an accelerated rate. So now that some of these things are starting to be demystified, we will see an increasing gap, not only for ourselves within our country but between us and the rest of the world.

Think about the U.S. when it came to cellular telephony. We led in the innovation and the opportunity. But because we had an investment in the infrastructure of our core landline system, and other countries started off without that infrastructure, they leapfrogged us in the use of those technologies. Other countries today find

themselves in that unique position. They see the same correlation between prosperity

that we do -- education and prosperity that we do, and yet they can't train the teachers or

build the schools fast enough. Therefore, they are going to find other ways to get there

from here. It's just that simple. And, believe me, they are turning to technology.

Because of the fundamentals of the technology world, they are going allow this

transformation are the same everywhere.

Think about it. In a few years ubiquitous broadband, ever cheaper

devices, mobile devices any time anywhere, plough computing meaning I don't have to

have all that capability even in my device. I can deliver the power of the most powerful

computers from anywhere to anywhere, and big data, meaning now I have the ability to

take all of that instrumentation that we have out there, to gather all the data about what's

actually happening in human interaction and mine it. If I have a great hypothesis about

what's happening, even better, but now we can actually crunch enough data when we

don't have a hypothesis to understand the patterns.

That infrastructure creates an entirely different infrastructure for learning

and learning technology. It bodes the opportunity for people to make rapid progress in

understanding what works, what doesn't, and in what context in ways that has never

happened before. And it means that, in fact, people who have to make rapid change,

people who have large populations that have been excluded from their educational

systems, say, China, will start to figure out how they actually create this infrastructure to

make much more rapid progress.

If that wasn't enough that the imperative of the nation's educational

system wasn't enough, the reality is that education is more than a $2 trillion industry

worldwide. It means there is a tremendous opportunity for the reallocation of public

resources and for opportunities on the private sector side. And regardless of how we feel

about that here in the United States, there are people and entrepreneurs around the

world who see that opportunity and who are going to pursue it. There are nations who

actually understand it and are going to pursue it.

Think about the aerospace industry which is only $1.3 trillion, but most countries see it as a strategic industry. We have watched the motivations and the machinations of nations around the aerospace industry for years worrying about how they subsidize their state-run airlines and how they position themselves on competition of airlines. What do you think is going to happen when they pivot towards learning and education as a strategic industry for their countries?

And then, finally, the half-life of skills and industries, as many of you may have read in John Seely's most recent book, that half-life of those skills and industries is getting shorter and shorter. We're seeing whole sectors disappear in less than a decade. Think about Blockbuster meeting Netflix, Netflix's version 1.0 with the mail meeting Netflix's version 2.0 with delivery to your home. Whole segments of industries, whole organizations, whole companies come and gone in less than two decades.

New skills acquired, new opportunities created. How do you move quickly to reposition your entire labor force, your adults and your young people, when industries and skills and knowledge move that quickly? That is the challenge facing the nations of the world, and it is one that you will only be able to actually address with technologies that allow you to move that fluently and to evolve that quickly.

The second thing -- I've mentioned this earlier -- the science of teaching and learning is not at a point of inflection. What we now understand about neuroscience, cognitive science, behavioral science, motivational theory, and, as I said, management science, we now have a deeper understanding on how those thing impact learning than we've ever had before, and that's without trying. This country invests .1 percent of the industry in R&D for education.

Most mature industries spend between 3 and 5 percent on R&D. Most industries that are innovative spend up to 20 and in some cases 25 percent on R&D. What we know is that technology enhances our ability to take advantage of the new

insight in all these different areas. It accelerates not only the pace at which we can

improve learning outcomes but the pace at which we can learn about these learning

outcomes. You know, that's something that both Tom and Bror will talk about later.

The other thing that makes this important is that once you actually

understand and build this infrastructure, you can build this in advantage and exploit that

advantage that's sustained over time. So in other words, the countries that invest first in

the infrastructures that support advanced work in learning technology and the

understanding of how learning happens over time, will be able to build exponentially over

time on that infrastructure because their pace of learning about learning will keep growing

at the same time. And, as I said earlier, other nations are willing to invest.

So I laid out two fundamental reasons why we have to get moving and rather

quickly. The good news for us is that this is when we are at our best as a country. We

can talk about *Sputnik*, we can talk about the Internet, we can talk about the human

genome. In each of those cases, we as a country have actually traded the opportunity to

build new sectors and new industries to address the problems facing our countries and to

propel ourselves back into a position of American leadership. We have to seize that

opportunity now as a nation around learning technology, and the opportunity is significant

because what we know is that the what is powerful.

People are very kind to say Jim and Karen did a great job creating

national education technology plan. Jim is verbally challenged. Karen did a great job

putting together a national education technology plan. And the most important thing

about it is that it says learning powered by technology. When Karen talks, I'm sure she

will talk about the need to create a learning nation and the ways that technology can

actually help us to do that.

So let's talk about, then, what is it, specifically, that we need to do to

reach this new world, because we're going to talk about the what, but the how is very,

very important. What we know is that we have to invest in accelerating the development

of breakthrough technologies. We know the importance of DARPA on the defense side and the aerospace side. We know the importance of NIH on the health side. We don't have the equivalent in education, and we know that we need that kind of investment from government to stimulate the investment that we need from the private sector.

The second, this new R&D infrastructure we know is going to be critically important to making the kind of leap forward that we can. It's something that the colleges and universities as well as our government agencies need to take seriously and need to find out how we leverage the resources in the work that we're doing so that we get much more leverage out of the minimal resources that we're putting into R&D today.

And the third is, as you heard said, is that we have to create as much different ecosystem and environment that's actually much more attractive to entrepreneurs, both social and otherwise so that you get more philanthropic bang for your philanthropic and traditional capital market buck.

I was so glad when the woman from the NSBA asked the question about what needs to happen. People say why doesn't innovation happen in education? The market is the toughest market, I think, in the world. It's highly fragmented. And, most importantly, performance does not dictate outcome, opportunity, or scale. You can be the best and not be able to penetrate a district or school even for years.

We can do things to change on all of those fronts, and if we do, the opportunity is tremendous. Before us we have the opportunity to close the gaps that don't make sense. We know that there's a 4- to 5,000-word gap between the students who start school well, well prepared and the students who don't. Why don't these learning apps close that gap for us? Any parent or grandparent in the room who has a child under the age of 3 knows that you can buy 15 minutes with a mobile phone at any point.

Someone who knew the truth.

Why aren't those things filled with rich content that actually drive to

outcomes, and every time a child interacts with it, why isn't it actually collecting that data to help us understand what the profile is of that student and what they need to do to actually get ready for school? How close are they, and what actually should they access next? How do we use technology to help teachers with the challenges that they face every single day?

Think about it. We ask a teacher to walk into a room with 20, 30, even some cases now 35 to 40 students and know exactly what each student needs, know exactly what they're interested in so they can be motivated, and then connected to the tool and resources that are going to be most useful to them at that particular moment in time, to group the students accordingly, et cetera, et cetera, and what do we give them to do that? A whiteboard or, at best, a digital board that doesn't have any intelligence in it other than what it allows you to project on it.

Why does a common retail site have more insight into what you want next than a teacher in front of the classroom has about their students? And we're doing all this in the face of a challenge that we know is the most important one we're going to face for a long time, an economic environment that demands that we figure out how we do all of this with less than we've ever had before.

Our aspirations are going up, our resources are going down, there is no other time more pressing for innovation than this particular moment in time, and we have the knowledge and the know-how. The question is do we have the will? Anyone who has used technology in their own lives and then walks around our schools and sees our students tuned out in a way that you know that you've seen them tune -- exactly the opposite way that you've seen them tuned in when they're using technology outside of school in every other environment knows that there's something wrong with this picture.

So from the individual moral perspective, from the national security perspective, from the economic perspective, and from the commonsense perspective we have the opportunity, and we need to seize it. The question is, will we? Thank you.

(Applause)

MR. WEST: Jim, thank you very much for that strong wake-up call. It's very sobering to see other places spending up to 25 percent on research and development, especially given the links that you laid out between infrastructure and some of the education and economic benefits.

Our next panel is going to be moderated by Russ Whitehurst. Russ is the director of the Brown Center for Education at Brookings and the holder of the Herman and George R. Brown chair. He and his speakers -- I'd like to welcome them up here -- will be discussing the topic of imagining the education environment of the future. So if Stacey, Karen, Terry, and Tom can come up?

MR. WHITEHURST: Good morning. I had prepared remarks, but the White House took them all and said all of the important things.

So, I'll reframe my introduction by offering to you the premise that education, at some point in the future in the U.S. -- maybe it will be 10 years, maybe it will be 20 years, maybe it will be 30 years -- will look dramatically different than it does now. And that dramatic transformation is going to be driven by technology.

We've heard Jim and others allude to the urgency of pushing that transformation as quickly as possible. It's a national imperative. This panel is about imagining the future, and we're going to frame it in terms of what's the fuel that will move that transformation forward? And what are the barriers to doing so?

The speakers' bios are in your folders, so I will not spend time on that. We'll just move to the questions, the answers, and the issues.

So I'll turn first to Karen Cator. Karen is in the Department of Education. She heads the technology program there. You've heard that the Department has recently issued a technology plan for the future. So, Karen, my question is, how is your plan going to generate a rapid transformation to new ways of teaching and new ways of learning?

MS. CATOR: Thank you. And that's for all of the opening comments. Really did frame this unbelievably well.

So, what the National Education Technology plan does -- and this is also available digitally, of course -- the -- and hopefully what you can see is, it's about learning.

So really what this does is, as suggested, provides the verbs. It talks very little, if any, about the nouns, and talks about the verbs. What do we need to have happen?

So it really does kind of five things. First of all, it articulates that high-level vision of what it looks like to have a powered-up learning environment. And it goes from early learning all the way through career, really thinking about how people learn today. What is the opportunity for learning? So, articulating the high-level vision is a first thing.

The second is that it's tied to the ground with research, with practice, with -- it's chock full of sidebars of examples. So this is really important because this is one of the ways that we will, I think, make progress is by looking at kind of what's happening out there.

The National Education Technology Plan was actually created with a technical working group from colleges and universities, practitioners, policymakers, people who really made sure that it was tied to the ground with the strongest research and practice and evidence that we could find.

There are five sections of the plan. And then a very important section called Getting Started Now. We published this draft online last spring, and got lots of public comment and talked about it widely. And one of the things that people asked, just like people are asking today; okay, what do we do first? How do we get started? What do we need to do? So there's actually a section in here called Getting Started Now and it's like, this is actually what we will do in the next five years from the Department of

Education standpoint.

So, let me talk really quickly about the five sections. The five sections first starts with learning. The biggest, baddest, broadest section of the plan and it lays out all of the verbs associated with personalized, engaged, interesting learning environments that are powered up with technology. The opportunity to provide students what they need to be doing every single day so what they're doing is as productive as possible.

Second chapter is about assessment. And people have been talking about assessment all day today. The Holy Grail being that assessments are embedded throughout the day, throughout the year, throughout everything that students are doing so we get smarter and smarter, better and better at providing them the interventions, the resources, the interesting experiences that will move them along their personal trajectory.

The next section is about teaching. Interestingly, the most difficult section. We wanted to make sure that nobody got to the end of the teaching chapter and said something like, oh, I get it. Technology will replace teachers. On the contrary, it absolutely will power up the teaching profession. We focused on how people can move themselves as professional educators, how they can be highly connected to the data, to the tools, the content, the resources, the experts, and whatever else they need to be as highly effective as possible. So, the teaching section was about the highly connected educator.

The next section was infrastructure. It kind of said, okay, if we buy the teaching, learning, and assessment vision, then what do we need to put this in place? Broadband everywhere, devices in the hands of students and teachers, all the time. And we need, obviously, everything else that goes along with it. That was the only part that got anywhere close to sort of, how do we do this.

The -- and then productivity was the final chapter. And Jim talked a lot about productivity. We need to make sure that our systems are as productive as possible

so every single student is making progress every single day. And I'll say one last thing, the whole vision is really associated with making sure that learning is not "individualized" as in everybody's just headphones on, doing what they do. But this vision of learning is incredibly social and participatory, as we know the learning experience should be.

Thank you.

MR. WHITEHURST: Thanks. Tom Kalil is in the Office of Science and Technology Policy, where he's the deputy director for policy. Tom and I have had some conversations about this, and most of the planning and rhetoric around transformational educational technology focuses on the supply side. So, we'll invest more in R&D, for example, so we have better products.

Tom has been thinking about the demand side of this equation, which was alluded to in earlier comments. And so I wonder if you could talk to us about that, Tom.

MR. KALIL: Sure. Well, as Jim noted, we invest .1 percent of K through 12 expenditures in research and development. So that gives us some sense for why technology has not had the same impact in education as it has in other sectors.

And I believe that it is imperative that we increase research and development in a series of fascinating ideas about how technology might improve learning outcomes, whether that's developing digital tutors; or taking advantage of advances in educational data mining and learning analytics; or developing high-quality interactive simulations that allow us to understand concepts involving time and motion in a much more intuitive way; or developing games that are as compelling as *Halo 3* or *World of Warcraft*, but teach us something more than how to kill monsters and take their treasure; or with the advance in technologies like personal fabrication, the emergence of the $1,000 3-D printer, create an environment in which a kid can design, fabricate, test, and sell just about anything in the same way that we saw with the *Star Trek* replicator.

But I think an issue that we don't talk enough about is the demand side.

And clearly, as Jim noted, for the entrepreneur the education sector is a challenging one. You have 15,000 different school districts, you have lengthy adoption cycles, you have low per-pupil expenditures on software. You don't have a lot of independent, rigorous evaluation that would pass the Russ Whitehurst test of being high-quality educational research.

So, it's no wonder that, you know, venture capitalists are not lined up around the block to invest in this sector. Or, why it's possible for a company that is developing yet another first-person shooter game is going to have a higher development budget than software for middle school math and science.

Well, it turns out that the global health community faced this same problem, which is that if you're a pharmaceutical company, left to your own devices you will invest more in male pattern baldness or another Viagra drug than you will in vaccines for diseases of the poor. And some economists came up with a very clever notion called an advanced market commitment. An advanced market commitment is a purchase order for a product which does not exist yet. So, five countries plus the Gates Foundation -- almost at the level of its own sovereign country -- said to the pharmaceutical industry, if you develop a vaccine which is safe and effective, we commit that we will purchase a certain number of doses at a certain price per dose. And that has motivated for-profit pharmaceutical companies to accelerate the development of vaccine that is going to save the lives of millions of children from pneumonia and meningitis.

Well, the question is, if we can do that in global health, why can't we do that in education? So, what would be required?

The first thing that we'd have to do is to identify some learning outcomes where everyone agrees, A, it's important; and, B, we have some idea of how we would recognize when a next generation learning environment would be able to deliver that outcome. So we'd have to have consensus on both the ends and the means.

So, I'm not an education expert, so I hope that you treat this as a

provocation and have people who actually know about education to do a better job of defining some potential learning outcomes. But let me just give you some examples.

What if we could make every C student in Algebra -- or middle school math and science, more broadly -- an A student? What if we could have a dramatic improvement in learning outcomes?

What if we could greatly reduce the gap in vocabulary size between rich and poor kids? In Beverly Hills, there are 198 age-appropriate books per household. There are .02 in Watts. Can we do better than that with mobile devices, cloud computing, speech recognition, text to speech, game design, that type of thing?

Could we allow adult learners who are struggling to balance competing demands of work and family and gain new skills to do so in a third to a half of the time? There's some research from Carnegie Mellon University that suggests that's possible.

Could we enable an English language learner that is reading two grade levels below grade level to catch up over the course of a year in interacting in an external generation learning environment?

So, one potential scenario would be that the education community could, A, define some of these learning outcomes; and then B, how to create a large enough carrot either in the form of an advanced market commitment or some other procurement such that the entrepreneur would have a reasonably high level of confidence that if they delivered a product that met that learning outcome using a predetermined assessment instrument, that there would be a market?

So, I firmly believe that all of the technological innovation that we're talking about is also going to require institutional innovation. So, we have to look at new policy instruments like advanced market commitments. We have to look at new, you know, learning policies like moving towards competency-based assessment as opposed to student credit hours.

So, I hope that we can be focused not only on these incredible

opportunities in technological innovation, like digital tutors and educational data mining and learning analytics and serious games, and all these other things, but that we could also be focused on institutional and policy innovation as well, so that we could actually achieve the ambitious goals that Jim talked about earlier this morning.

MR. WHITEHURST: Thanks, Tom. That's almost a Brookings-like policy proposal. I really, really like it. So if things don't work out for you at the White House, you know where to find me. (Laughter)

Our next speaker, Terry Moe, is a friend and colleague and published a book in 2009 that, I think, is a fresh and important examination of the politics of technology change. There's a sense out there among many of us that if you build it, they will use it. And I think Terry has perhaps a jaundiced view about the speed with which that will happen.

So, Terry.

MR. MOE: All right. You know, Jim Shelton said that he was going to be --

SPEAKER: Microphone.

MR. MOE: -- the downer at the conference, but he's not. I am.

So, look, I think that long-term -- and I mean long-term, right? I don't know how long this is going to take. It could take 10 years; it could take 50 years, no kidding. Technology is going to completely transform American education. It's going to revolutionize the way students learn, the way schools are organized, the way teachers teach, everything.

And right now, it's early. This is just beginning to get going. And I think most policy makers and most educators; it's just not on their radar screens. It's like for them, I think it's like computers in the classroom are something. That's not what this is.

This is a true revolution in the way education is carried out, and I think it promises enormous benefits for students, and for the nation.

All right. So the question is how are we going to get there? That's the depressing part, right? So I think that when most proponents think about this, the way they think about it is that it's going to be driven by the benefits of technology, you know, which in large measure it is. Right? It has so much to offer. And the idea is that if you can provide it, if you've got the ideas, they will embrace it. Right?

Well, you know, that's not entirely true. Everybody knows that, you know, educators and policy makers are sort of wedded to, you know, traditional schooling. And they think that that's the normal way to educate kids. Of course, it is. And that this newfangled stuff -- kids working on computers -- it creates all kinds of problems and, you know, how are the kids ever going to get socialized, and computers can't teach as well as teachers can, and they need, you know, one-on-one help from a teacher, and so on. And then there are all these issues about how are we going to hold these new kinds of schools accountable? How are we going to fund them? What are we going to do about regulating these schools, because the regulations have to be completely different because they're not anything like regular schools, right? So there are all these problems.

And as a result, people are just sort of resistant to it. It's a normal resistance that you would find with any kind of innovation, right? And I think all these things are legitimate. I mean, there are good reasons why people would be skeptical and why they would worry about how we're going to regulate these new things, and so on.

But there's another kind of resistance out there. This is the depressing part, right? The other kind of resistance has nothing to do with whether technology is beneficial for kids. What happens is that technological innovation is threatening. It is threatening to jobs and to the existing distribution of money. And there are powerful interests that care about jobs and money. Right?

And I sort of -- I think most conferences like this just talk about the technology side and they would really rather not talk about the political side. And, you

know, I don't want to make anybody uncomfortable, right, but the fact of the matter is that

schools are government agencies that are run by the government. And if these

innovations are going to be adopted, they're going to be adopted through the policy

process. Okay, that's a political process. And that is shaped by power and by interests.

So, big picture? What is the advance of technology? It is the

substitution of technology for labor. That's what this is. And historically, that has been

the key to progress and productivity across all industries through time. It's the key to

increasing productivity, efficiency, standards of living, everything. And education has

been immune to this, you know, forever. It's been a teacher and 30 students and, right?

This is this basic way of carrying out education. Now, that's no longer true. Now we can

substitute technology for labor and there can be enormous gains because of it.

But what that means is, we're not going to need as many teachers per student in

the future. That's a very good thing. Technology is cheap, labor is really expensive.

This is great for society, it's great for kids, just not good for, you know, the existing pool of

teachers and it's not good for the unions, right?

So, the fact of the matter is they're very powerful and they are -- they

don't like this. They are threatened by the substitution of technology for labor, right? And

so they are resisting this and using their power to keep it at bay, to limit its expansion.

Also, there are other dimensions to it. One is that online learning, virtual

learning basically breaks the constraints of geography. You don't have to have schools

in districts with teachers and kids all concentrated in the same place. They can be

anywhere. The schools can be anywhere, the teachers can be anywhere. This is bad,

right? From the union's standpoint it's very difficult to organize teachers who are all over

the place. It's bad from the district standpoint because they can't control the teachers

who are out there, and the money, and so on. This is not a good thing from their

standpoint.

Also, technology just proliferates choices. This is a really exciting thing.

This is going to be the biggest boost to school choice that's ever happened. Well, what that means is that when parents and kids and families have new alternatives they can leave the regular public schools. This is not good if you run the regular public schools.

Okay. So, there is now political opposition to this that has nothing to do with its benefits. And in the future, this will just continue, all right?

There are reasons why. You know, say in Oregon. You know, if you're a virtual school you have to organize or enroll half the kids from your district. Well, you know, from a technological standpoint, that's stupid, right? Because you can enroll kids from everywhere, right? There's no constraint -- well, they want it to be constrained. In California, a virtual school can only organize kids, enroll kids, from contiguous counties. Why do you suppose that is? In Wisconsin, there's a 5,000 student limit statewide on the number of kids that virtual schools can enroll. Why is that? They're just keeping a lid on it.

So the potential is just tremendous, right? There's this dynamic market ready to go but there are forces at work in the political process that are trying to bottle it up because it's threatening. So, I think it's important -- you know, maybe people don't want to talk about this, I assume they don't. But it is a reality. It limits the progress that we can make, and I think the fact of the matter is that it is going to make progress slow and difficult. And it's very important for proponents to know what they're up against and to push it. Because this is not going to happen unless it does get pushed and it's not going to happen in our lifetimes if it doesn't get pushed. But when it does happen, I think the benefits are going to be extraordinary.

Thank you.

MR. WHITEHURST: Thank you, Terry. And I'll leave it to the audience to question you. (Laughter)

Stacey Childress is one of the chieftains of this independent nation called the Gates Foundation that was alluded to previously. They're actually, in some areas of

education R&D, investing more than the federal government. And they plan. And those

are two very powerful levers for change. They do have a new technology plan, and I'd

like Stacey to talk to us about it, and, again, address the question of how it moves us

from here to a dramatically different future.

MS. CHILDRESS: Great. Thank you, Russ.

I would like to try to pull together a number of things that have been kind

of in the ether this morning, both from the first panel and Jim's remarks and my

colleagues here, and put it in the context of what this might look like for a student if we

had all of these terrific innovations and this infrastructure and the policy context.

And so just a thin slice of that. What if instead of thinking about schools

and classrooms and -- we imagined students as each having their own learning map, a

personalized trek to success, and started from that premise.

Every student in America had one of these maps. And they had a data-

enabled GPS system embedded in that map that could help them traverse their learning

journey with the tools they needed to be successful. With the kinds of innovations we've

been talking about this morning, that's possible, imminently possible. And almost every

technological building block to at least get that started is available. And as some have

pointed out this morning, in use in other sectors to great effect.

So the challenge is how do we begin to move those technological tools,

know-how, advances, brains into the hands of students and teachers at the learning

moment? So that that kind of vision for how students could navigate over time becomes

a reality rather than having to wait 50 years, perhaps in 5 or 10 years. So I think that's a

big question for all of us.

And one good question is, why now? And Terry was raising some of

this. The claim that technology would -- is going to transform education is not new. I

mean, we've been hearing this for decades and it simply hasn't happened. And I think a

number of folks this morning have identified some of the trends and the coming together

of forces that make it more likely now than before. But one thing we haven't talked

specifically about that I want to double-click on just a little bit. We talked about open data

standards and standards for content and those kinds of things, and we absolutely have to

have a standards infrastructure to make innovation pay off at the value added point of

teaching and learning. The other kinds of standards we need for that are academic

standards.

And one thing that we have today that we didn't have a year ago today is

that 44 states and the District of Columbia have voluntarily signed onto a common set of

academic standards. Which means for the first time we have a roadmap to success that

goes coast to coast. Now as a platform for innovation, for entrepreneurs and technology

providers, and for the demand side that is a very powerful dynamic that we didn't have

just a year ago.

One of the dynamics that that set of standards creates -- and we're

starting to hear this in our work in schools and districts. The train is coming. Adoption of

the standards happened in boardrooms. Only 44 boardrooms. Implementation of the

standards is going to happen in hundreds of thousands of classrooms, and there is a time

limit attached to those. They must be implemented over the next couple of years. And

so we're actually hearing from teachers and from school leaders that they need tools

now, content now, that helps them move their students from not great performance on

the current mediocre standards regime under which they're operating in their state to

fantastic performance against a much more demanding set of standards. And that's a

huge innovation challenge, but it does create more momentum, more pressure to find

ways to help students to meet those.

And we've known for years -- and kind of traditional teaching and learning

community has acknowledged for years -- that differentiated instruction, you know,

personalized learning, you know, Bloom's finding on the 2 sigma effect of one-to-one

tutoring can help move students in dramatic ways. And technology can actually make

that possible at scale in classrooms.

So the coming together of all of these forces at once out in the

ecosystem really does make now different from a year ago or five years ago. It doesn't

make it inevitable, but it does make it different.

So, some of you know I was on the faculty of Harvard Business School

for a number of years before joining the Gates Foundation last summer. And one thing

that we do is case studies. Cases and cases and cases. And so I'm still kind of wired

that way. So I wanted to give you three just mini-examples of things that are already

going on that just give a hint of what the promise could look like if we imagined students

having learning maps that were data-enabled and allowed them to move toward mastery.

Reasoning Mind is an organization based in Houston that some of you

might know. They have an online mathematics set of courses. Starts in third grade,

currently goes to seventh grade and they're building up. It's a complete learning

environment for students -- virtual learning environment, but it exists inside classrooms.

And they're getting some pretty remarkable results. And the key is that the program

adjusts moment by moment as students move through the content.

Now, the student thinks they're just moving through this fun, engaging

way of doing math. And it turns out all along the way they're receiving progress checks.

And the next activity they do every time takes into account everything they've done

before, including that very last thing they did to assign the next set of exercises, tasks,

problem sets. That's happening now in classrooms all over the country, touching about

20,000 students. And teachers have a dashboard where they can punch in at any time

and see where every kid in their classroom or sets of classrooms are, and their learning

trajectory. And then spend their value added time with students one-on-one or in small

groups going deeper only on the things that those students really need deeper help on,

and letting the technology take care of the normal path to mastery.

Wireless Generation, a company that many of you know, has an early

grade literacy program product called Bursts. And Bursts lets teachers have on their

smartphone or PDA a program that allows them to continuously just put very low-intensity

data in about how students are doing on reading aloud in the classroom. They upload

that into an intelligent engine, they get back on their smartphone, some suggestions

about what to do next for every kid in the class, and some suggestions for grouping for

one-on-one or small group instruction. That's already in use.

Many of you know School of One. School of One in New York takes

content from various suppliers, maps that against a learning progression for every

student, and every day students have a personalized playlist much like you can do with

your iPod that is specifically designed for that student that day, depending on what they

most need next based on what they did yesterday and the day before, and the day

before.

All of these are still relatively early stage and have a long way to go, but

all of them are in use in districts, in classrooms now. And so the challenge is how do we

really blow that out.

So we think, in our team at the Gates Foundation, which is the Next Generation

model's team, that we need at least three things. And these are big categories.

One, we need more of these building blocks, right? More of the content, more of the

tools, more of the algorithms that use data just, you know, ubiquitously to help students

move along. We've got some, but we need many more of those. The more of those

building blocks we have, the more kinds of learning models -- not just the Schools of

One, not just Rocket Ship -- we've got, you know, the same five guys are showing up at

all of the conferences like this to talk about their terrific -- it feels like a movement. Yeah,

there are five. And it's always the same -- I love them, and we're supporting many of

them. But, you know, we need 50 or 500 that are really trying not just to deliver online

learning, which is important, but to figure out how do you really use technology at the

teaching and learning moment to dramatically unbundled and personalize learning

experiences for students.

So we need many more of those learning models, and more building blocks will help us get more of those learning models, and vice versa because of the supply demand.

And then as Terry was talking about, we need an enabling environment that allows these kinds of things to really get created and then proliferate rapidly, and at scale. It includes policies, it includes the political context, and it also includes the market conditions that make it attractive for entrepreneurs to do this. And so these advanced market commitments and demand aggregation activities are incredibly important at the same time we're investing on the supply side along with private capital. We think all of those things have to do it.

So, let's just as I wrap up, go back to that map analogy for a second. And one way to think about it is maybe not a killer app for education, but it certainly is an application that could catalyze a lot of innovation. So if you had these data-enabled maps that sat on an intelligent engine and every kid in America could have one, think about the incentives for entrepreneurs to find ways to plug tools and content and micro-assessments into the nodes on that map to help students have lots of options about how to move through. Really could accelerate an ecosystem of development on tools and content that students and their teachers and parents need to help them move.

Another exciting thing about this -- and I'll wrap up with this -- imagine the power those sorts of maps could have in putting students -- more of students' learning in their own hands. And so when students are younger and earlier in their learning trajectory, maybe a digital backpack that has kind of a set of tools that are pre-selected with lots of expertise, and they have exactly what they need to traverse their maps. But as students moved on to more complex learning tasks you can imagine them earning, at some point, a digital driver's license, or a learning passport that allowed them many more options, many more ways to explore and experiment with their own learning.

But all against a very high bar on what the learning destination is supposed to look like.

So, lots of movement and different paths and different trajectories, but heading in the same place, which is the high-quality learning outcomes that we all agree have to be in place to solve some of these competitive issues that folks were talking about earlier.

I'll stop there.

MR. WHITEHURST: Thank you. We're going to take a couple of questions from the audience. There's an older piece of technology that has an imperative from me, and that's the clock. I have an obligation to be somewhere else. So, I'm going to ask my colleague Darrell West to moderate the question period. Thanks.

MR. WEST: Question right there?

So if you can give us your name and your organization.

MR. McTIGHE: Sure. Joe McTighe from CAPE, the Council for American Private Education.

I think more than any other education reform, technology lends itself most readily to universal application, whether it is the level of schooling -- pre-K through higher education; or the location of schooling -- classroom, non-classroom; or the sponsorship of schooling -- public, private, home.

The Bob Wise-Jeb Bush manifesto called for universal access to publicly-funded digital learning, regardless of the type of school the child attends. Is that part of the White House vision as well?

MR. KALIL: I think clearly one opportunity that we have in the technology area that we don't have in other areas is that particularly if you're talking about the software and the content and the applications, it really is something that can scale. So, a lot of things cost, you know, X-thousand dollars per person that you're trying to reach. And clearly what we see in the digital era is the ability to scale very rapidly with low marginal costs. That's why you can see startups go from 0 users to 80 million users

in a very short period of time.

So, I think we certainly have to have a discussion about how we get the upfront investment in research and development and product development that is going to lead to some of these transformational learning outcomes. And that's why I think looking at the demand side is so important.

It's something that could happen from, as Aneesh was saying, coalitions of the willing. So, imagine if 10 urban school districts got together or 5 states or 10 virtual high schools, and, again, said to the private sector this is what we want. This is -- we'd be willing to pay for a next generation learning environment that delivered the following outcomes.

MR. WEST: Right there, there's a question. On the aisle.

MR. NIEDEL: Mark Niedel. I wanted to follow up with Terry on what's blocking progress. Jim mentioned that performance doesn't generate results. Because Stacey mentioned some excellent ideas. Suppose I as a parent see that. I'm wondering social media are going to allow parents to go around the current administrators and teachers to organize and demand of either the school board or the mayor, saying, hey. We see this Houston experiment, we want it here. And we're going to organize and we're going to demand that you bring it here, or else we don't elect you. Is that a possibility? Is that?

MR. MOE: Yeah, I think it's a possibility. I also think it's really important. I mean, the more pressure there is on the demand side from families, the more likely these things are to happen. And I think the demand is going to go through the roof.

However, on the other side school board members are often beholden to teachers' unions, right? Because they're elected, right? And guess who's active and involved in the school board elections, right? So, they're under heavy pressure to think about jobs and to think about money. And the same is true at the state level.

So, you're fighting against a power structure that is truly awesome, right?

MR. NIEDEL: Do you think the social media are following the barriers for parents to organize so that there's really the possibility --

MR. MOE: Yes. Yes, I do. But you still have to recognize -- see, I'd want to encourage that. I think this is fantastic. But you have to recognize that this power structure that you're up against is massive. The teachers' unions have 5 million members nationwide. You know, multiply that by $600 a year and you're talking about billions of dollars that they have to spend. And they are enormously powerful in this process. And if they want to keep a lid on it, you know, you've got a big mountain to climb in trying to get districts and states to loosen up and actually authorize schools, enroll more students, and really let this thing go. Because so far it hasn't been unleashed.

MR. WEST: Okay, Karen, do you want to jump in there?

MS. CATOR: Yeah, I just actually wanted to respond to one thing. I actually don't think we need to set it up as kind of technology or teachers. I think that's absolutely -- I understand why you're saying that and I understand maybe it's, you know -- but I know so many teachers, endless numbers of teachers, who are absolutely wanting to power up their classroom. So, I don't think that it's an us or them, or it's a teachers or technology. It is making teachers much more effective by making sure every single student has those resources in their hands every single day.

So I think that we don't need to get into the -- a power struggle. I also know the school board's association, they host site visits to schools that are already powered up. And so there is actually a growing movement, and I think one of the things that we can do to help people who are uncomfortable with the conversation, build huge transparency. Get those schools out in the open, make videos, make -- tell stories. Show what it looks like to have a classroom where students are leaning forward, they're engaged, they're involved, they're thinking, they're interacting with others. And so I think that that's a huge part of our solution as well.

MR. WEST: Let's take a couple more questions simultaneously, then we'll give our panel a chance to respond. On the aisle there?

MS. KLEIN: Hi. Andrea Klein with the Total Family Care Coalition. I'm all for technology. I really think that we should be going down the broadband route. But my concern is how are we going to incorporate the educational aspirations with what are the business needs? Where are we as a nation looking for to be competitive globally? And what is us as a nation -- what are the industries going to be for the future so that we can prepare not just our kids, but those that have been displaced?

MR. WEST: Okay. Good question, let's take one more. We'll take one more question and then give our panel a chance to respond. Yeah, right there.

MR. MARTINEZ: Jaime Martinez, Department of Energy. I was impressed by Mr. Moe's reference to disruptive innovation in schools. It's probably the more enlightened comment I've heard in a series of -- such of the conferences I've attended last year.

In any case, I wondered where the preparation of teachers by the various institutions of higher learning comes into this picture in terms of making an eventual change in the system.

MR. WEST: Okay Stacey, do you want to take the first question?

MS. CHILDRESS: I'd rather take the last question, if that's all right.

(Laughter)

MR. WEST: Okay, take the last question.

MS. CHILDRESS: Having spent some time at a university. So, the ed school question is an interesting one. The teacher prep question. Clearly, it would be preferable for teacher education programs to kind of get religion about this new way of powering up their classrooms and have kind of waves of new cohorts of new teachers who probably themselves at their very young age are digital natives and have grown up just kind of immersed in technology. And I think it's not a goal that is impossible.

But what I would say about it and what I say when I'm asked is, don't we have to wait until the ed schools kind of retool to prepare teachers to teach this way before we make a massive move? And forgive the snarkiness of the comment but, our ed schools aren't preparing teachers today to teach in the environments we're asking them to go in and teach in. So it's not as if we've got a system that's performing wonderfully preparing teachers to teach in analog classrooms, and that we have to wait for them to get religion on the digital classroom. It doesn't work now.

And so, would it be great if it worked? Yes. But I don't think it's a gating factor on the rapidity with which we're all prepared to move to transform the way classrooms work.

MS. CATOR: Yeah, sure. I can jump in and actually to the first question, I think that the answer is, we don't know. We don't know what the jobs of the future will be, so we absolutely have to make sure that kids are learning how to learn every single day. So it's enjoying the day as it is today, and it's also preparing students to continue to learn. So that's the first answer.

On the teacher front. You know, one thing is interesting. If you look at the demographics of those people who play games on Facebook, like the Zynga games. You know, *Farmville* and such? It's actually something like 55-year-old women or middle-aged women. This whole conversation about teachers and technology I find interesting because I do think we just need to remember that teachers are college-educated, teachers are learners, teachers actually want to do the very best for their students every single day. So, I think what we've had is a situation where they've been trying to buoy up this print-based classroom at the same time kind of bringing in some things in the back; it's a very unwieldy situation in a classroom.

So when we actually can make this transition from a print-based classroom to a digital learning environment, within the structures of classrooms and teachers and adults and kids and interactions, then I think it's going to actually become a lot easier for

teachers to be trained and understand how to manage an environment where students are actually kind of online and powered up.

MR. MOE: I'd like to make one comment on the teacher side. You know, technology is not anti-teacher. And I certainly didn't mean to imply that. I think technology does empower teachers; it does make teachers a great deal more productive. And it is going to lead, ultimately, to their playing a variety of differentiated roles that are very different and much more exciting, right, than a lot of the things that they do now. Right? So this is a huge plus for teachers. It's just that we won't need as many teachers, right?

There is going to be a massive substitution of technology for labor over the long haul that I think this is a very good thing. Teachers are going to play a critical role, still, in the whole system. But there won't be as many of them per student. And that is the sticking point. Not that it doesn't empower teachers, it does. It's just that there won't be as many teachers per student.

MR. WEST: Okay. I want to thank Karen and Tom and Terry and Stacey for sharing their thoughts with us. So please join me in expressing our thanks to them. (Applause)