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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 at the Brookings Institution. And I am pleased to welcome you here this morning to our forum on distance learning. And we are webcasting this event live, so we also would like to welcome our viewers from around the country, as well as around the globe.

And we have set up a Twitter feed at **#TechCTI**, that's **#TechCTI**. If you'd like to post comments or ask questions during the forum, you're welcome to avail yourselves of that. And when we get to the Q&A, we'll actually take questions, both from the Twitter audience and web cast audience, as well as those of you who are here with us today.

Educators around the world are experimenting with distance learning as a way to improve access to digital materials. Distance learning connects geographically remote students with instructors and fellow classmates and allows for collaboration and shared learning experiences. The question is what students, teachers, and administrators can do to harness the power of social networking to improve educational outcomes.

Brookings just published a book of mine a couple weeks ago entitled *Digital Schools* in which I look at many of the new educational technology innovations that are taking place around the United States, as well as outside of the United States. There are really fascinating innovations taking place in distance learning, in social collaboration, in the use of mobile technology in video games. There are new assessment tools that are coming online.

One of the things I like about technology is it allows for real time data analytics so we can actually look at what students are learning in a much more nuanced manner than

we've ever made possible before. So we have copies of the book outside if you are interested in that.

To help us understand these new tools, we are pleased to welcome Senator Mark Begich. The senator was elected to the Senate from Alaska in 2008, after serving as mayor of Anchorage for nearly six years. He has spoken out on education issues and the importance of innovation in the classroom.

He also chairs the Commerce Committee's Subcommittee on Oceans, Atmosphere, Fisheries, and the Coast Guard, as well as the Democratic Steering and Outreach Committee. So today he will discuss some of his thoughts on education and education technology and answer a few questions. So please join me in welcoming the senator to The Brookings Institution. (Applause)

SENATOR BEGICH: Thank you all very much. Thank you for the opportunity first to the Brookings, and Battelle, thank you very much for sponsoring this. Let me give you a little sense of where I come from. I come from a family of educators, my mother, my father, my sisters, my sister-in-law, my brothers have worked in education, so education is part of who we are in our family, and it's obviously something that I think is pretty important.

And then you come from a state that is pretty diverse in the sense of its distance and how to deliver education. And if you have 80 percent of your communities not connected by the road network, the only way to get to them is you fly to them, you boat to them, or in the winter you might snow machine to them, a pretty difficult area to get folks, to get all their education, as well as just basic supplies to survive, so thank you very much.

And even though I don't sit on the Help Committee, the Education Committee for the Senate, I am thoroughly active in this arena. I've learned on thing in

the Senate, it really doesn't matter, well, it does matter what committees you're on, I shouldn't say that, but because you're one person in the Senate, you can make in roads in a variety of areas. If you care enough about it and you want to talk about it in rural education, it's one of those that we are pretty aggressive about. We have great challenges. Half our Alaska native population, which is about 17 percent of our state, is under the age of 18, and so it's a pretty significant -- and predominantly live in rural communities all across the state, and small villages that, in some cases, may not even have running water. So education for us is what I think -- and having it delivered -- is fairly important.

I tell people all the time, I don't know all the depths of how it all works, but I know what I want, and I'll give you an example.

I remember when I was on the local City Council in 1988, '89, '90, right in that range. I was on there for 10 years, but in that first three years, I was 26 when I got elected, and back then they had a mechanism which was called a pager. Some of you might not even know what that is. And they had a portable computer called the Capro, which was like a suit -- they were selling those -- it's in the museum down the street, but it's like a suitcase.

But I remember I had been in the real estate business, and, you know, we'd have these Tuesday night meetings. If you've ever been subjected to a City Council meeting, I apologize for that. But you'd go there and testify on the issue and you're there until midnight or 1:00 in the morning, and, you know, so I have apartments, and I was always concerned if I'm there and an emergency happens, I need to be available. So I had this little pager, and it made no music, all it did was beep three beeps, beep, beep, beep, that's it, nothing more than that. So, once in a while in those first early three years, it went off a couple times, nothing major. But the other members got so frustrated that

they put together a resolution to ban this technology from the Assembly Room.

You know, I remember we owned the phone company, one of the largest phone companies in the country, because no one would provide phone service to Anchorage, so we had to create our own company many, many years prior, and we were getting ready to market, sell it, and cities got a free, from the government, a license for mobile phone service.

Now, you've got to put yourself back there. I remember sitting in a meeting which is now public, it was an executive meeting, but it was a private meeting with the Assembly members, and we were looking at our phone company, you know, the hard line and yellow pages were doing great, a lot of cash flow. But this thing called mobile phone was losing money hands over fist, and people -- we've got to get rid of this thing, it's a money loser, who's going to carry around a phone, right, and this is a serious discussion, and so I was 27 at that point, a couple years after I was on there, and I said -- any of you watch *Star Trek*? And I said, you know, that's going to happen, and they looked at me like I was a nut ball. And several years later, we got ready to sell the phone company, and the reason we got the money we got for the phone company was one piece of equipment in there, a license to deliver phone service through mobile devices. That was the cash cow. That was the cash flow of the future, not yellow pages, which I mean, you know, now we get them at the door once in a while and like what are they doing with this, it's like a door stop, you know. It's the most amazing transformation in a very, very short time.

But delivering education through this is a challenge and also very different for some people. My generation understood it to a certain extent. My son's generation, who's 10 now, it will be a no brainer for them. They will wonder why we're not delivering education through the new means of technology.

You know, we talk about how we're going to develop our education system. I know delivery is one piece, STEM legislation is another piece, which we like to call in our office STEAM: science, technology, engineering, arts, and math. I'll give you an example.

With my young son who, you know, you always want your kids to play some music, I mean I did, I don't do it now, but I did then, I didn't want to, but he loves numbers. So, you know, we're trying to get him interested in the piano, he has no interest until we moved the keys into numbers rather than letters, then he thought it was kind of like a mathematical problem, thought it was very interesting. Now, he can pick music and pretty much, within a very short time, learn it, memorize it.

I remember his first recital, concert at the school, this was a year ago, and he wanted to do his own piece, and the teacher was like, you know, oh, God, what does this mean? So he did the classical piece, as required, and then he nailed it in the latter half of it with a Lady Gaga song, "Piano," all by memory, because of the mathematical elements of music. So for me it's not just science and technology and engineering and math, which we're way behind.

I was just doing a speech last night on the floor, and it was about all this election money and all this, and I was talking about when the last time we had major reforms to our election policy, and it was 1972 when Watergate and all this occurred, but then I was looking at what happened in 1972, and by fluke I looked, fiber optics were invented in 1972, which now we just kind of take for granted how important it is.

But what was interesting, the two major inventions in those days, it said USA, USA. I remember as a kid going to the Almanac and looking at the inventions section. I always thought it was pretty interesting, USA, USA, USA. Today, that's not the case. We're so far behind in these areas, it's unbelievable -- it's appalling actually. And so from my perspective, in order for the next generation to be successful, for this country

to be successful in this new global economy we live in, the issues of STEM and reaching to the far ends of this country is going to be critical.

More people are living in rural America especially now than ever before. People are moving to rural America, and we have to make sure there's connectivity to it, the hardest access, but the most important, in my view.

You know, we have a couple policies, and my view is, you know, as I just said, we have to think about this new world, how we compete in this global economy, but also how we innovate innovation. If we don't do that in the sense of allowing maybe these young kids or teachers to express the new opportunities that are available to them or what they're thinking the possibilities are, we're never going to advance this economy at the level we need to.

I've introduced three bills in my time here, my short time here already focused on quality teachers and expanding some of the programs we already have that are working very well.

For example, in the University of Alaska, we have a program which is the Alaska Committee of Science and Engineering Program, this is, you know, I walked into this program when I was mayor -- I was mayor of Anchorage for five and a half years before I came here, and there was like seventh graders building computers from scratch. Back in seventh grade, I was banging boards together, you know.

They were building computers. And this partnership that we had and have today is with the university, the private sector, and our education K through 12, and they were doing it in the summer time.

In Alaska you had to put this all in perspective. When you get to summer, you really want to be out in the summer, and to be in school is not something a kid looks forward to. But these kids were enthusiastic, they were excited about it,

because they were taking knowledge and transforming it into something they can feel and touch, and at the end of the day, they got to keep that computer. It was amazing watching these young people, these seventh and eighth graders.

The same program also has another program called Tablet Tutoring Program where rural students out in rural communities with college -- team up with college tutors and use the tablets as white boards out in rural Alaska, taking that technology right in their hands.

We were talking in the car on the way here, and I said we have no idea today where we're going to be five years from now, 10 years from now. We do a lot of video conferencing to folks all around the state and Skyping and so forth. When the technology advances, and it will, and what we'll see in the future, it'll be like I am sitting right here, but it'll be video. It will be different than we can imagine today.

Now, a lot of us will be like some of the members I sat around with 20+ years ago that said mobile what, but it will change because of technology, but we can't do it unless we have young people who are understanding the value of STEM education and understanding how to utilize that in the best way.

So from our end, we also have with those tablets and that college connection, we have oil and gas companies working with them. Why? Because they see this as a huge piece of their job opportunities in the future.

So it's public, both on higher education and K through 12 and private sector combining their efforts and working with seventh and eighth graders. And I will tell you, I did a lot of work in juvenile justice systems. Six, seven, eight, highest risk kids in any school, any city, any community, at risk of getting in trouble. Why? Because they're changing. Their bars are changing, their rides, how they're interacting with people. So if you can give them something constructive, you can take that energy and shift it.

They're the highest risk kids, why not give them something them something that they can do something positive about? From my end also we have introduced a program called Effective STEM Teaching and Learning. It provides grants to states, develop comprehensive STEM strategies, but also another piece of this, and this, as I mentioned in my opening, you know, I'm surrounded by educators in my household, and I actually chaired the Postsecondary Education Commission for the State of Alaska for seven years and the Student Loan Corporation for seven years. And the important part as you develop these STEM strategies and providing grants to schools and so forth, you need to also provide capacity for the educators to get the professional training, because here's what we like to do.

I've learned this, again, in less than four years here. We love to pass laws here that sound good, and then we tell teachers good luck, we want you to succeed, and when they don't, then we find them, we penalize them like No Child Left Behind, which, just so you know, I hate that bill. I should have run a whole campaign on that when I ran for Senate, another issue. But this is the way it works. They pass, sounds good, and then we give them no professional development support.

We expect the teachers to know how to teach us a new concept or new subject matter in very short order, usually by the next school year, and go get busy teaching it -- you must know it because we passed the law, so you must know it. Well, our bills always focus -- everything we do is not only about, like in this case, grants to communities for STEM education, we also then make sure there's professional development, because the combination of the two will make those schools more successful no matter where they are.

We also introduced -- now, for rural communities, housing is a big issue. Now, people say, well, what do you mean? Well, you know, if you don't have a teacher

or a young person who becomes a teacher from that same community teaching that community, you're importing someone, and housing is a big piece of the equation. Can they find quality, affordable housing to live in the rural community they're about to go?

In Alaska, I guarantee you housing is important. And so we have to ensure that there's adequate housing and allow for teachers to have the capacity to be able to not worry about that, but focus on their kids. So we've introduced a bill that focuses on making sure there are some resources.

The third bill I introduced is investing innovation at I3. You know, when I first got here, everyone in D.C. does these cookie-cutter deals. They say, you know, if we do this program, it's going to work everywhere. Well, not for rural America, not for rural Alaska. You have to keep in perspective that there are different circumstances. And innovation, we know innovation on the ground floor is happening in the classroom, in the community schools or wherever they might be, and instead of trying to say, well, that is great in Alaska, so we're going to replicate it everywhere, let's figure out how to take what they're doing and expand it in their community if they want to.

So these innovation grants are focused on what works on the ground floor, not to bring it from here down, but let it bubble from the bottom up. And the same thing – again -- allowing efforts to ensure that there's a rural component, and the I3 contains a 25 percent set-aside for rural communities, because, again, rural communities get left out.

Every bill I see now, I don't care if it's FAA, defense, transportation, education, we look at the rural component, and it's always amazing to me, you hear this, well, it's going to work. If it works in New York, it will work everywhere. If it works in Seattle, it's going to work everywhere. They have no clue when you go to a rural community where the school might be 10 people.

My school graduation class, high school, was 30 people, that's it. A school of 225, that's it, you know. It's not that, you know, we think that rural is better or urban is better, but you've got to make sure the resources are allocated properly so rural America is not left behind. And it's important that as we grow cities, we ensure that rural America is complemented.

The other essential piece overlaying all of this in rural America is access to broadband, access to communications. Where we are today at 3G, 4G, you know, all these different levels of speed, where we will be in 10, 15 years from now, we can't even fathom. I don't care if there was a conference on the future, we have no concept of where it's going to be.

If I took you back, like I said, to the days of the late '80s, early '90s, real early like '90, '91, and I pulled up on the website and said let's find a conference that occurred there on communications of the future, you'd rarely see what we're seeing today.

An iPad, you know, where you can communicate as I just described to you, as a white board to rural communities. People will, you know, there will be some guy in those conferences in the back corner that will be having all those great ideas and people will say, you know, he's kind of different, you know. I don't know what he's talking about, but I've got a fax machine, you know. I don't know what he's talking about, you know. What do you mean, in the air, you know? I mean you've got to hook it up, you know.

So, I mean, it's hard to believe that, but if you went back and looked at news articles and see where we were and what people were talking about, or even publications that people were doing for the conferences all the teachers were going to, or educators, you'd be amazed what they talked about then and what we're talking about

now. In 20 years from now, we'll look back and say, that's what we were talking about. We're so far ahead of that, it's unbelievable.

So the opportunity of distance learning access is going to be a big piece of this, because if you can't deliver it, no way can we improve the capacity of our young people in these rural communities.

And the distance learning for Alaska -- and I was in Kodiak, Alaska, the largest Coast Guard base in the country, a fishing community, pretty significant, and I love that there's this teacher who, on the screen, he had three classes going throughout the Kodiak region from different grade levels, and he could carry on a conversation with each without each one engaging with the other. In other words, if he's teaching fifth grade, that person saw that, but he saw it all.

This teacher, I think he came from Nebraska, I can't remember where he came from, but it was the Midwest, I thought he was going to jump through the screen because he was so excited. We had to actually stop him because of his presentation, said okay, I got it.

What was amazing is, that teacher, he said this is the most exciting education opportunity he ever had, and he had been teaching for many years. But he said he was able to do something he's never done before, connecting with people from different levels and engaging them when he, you know, for example, he engaged them at certain levels, all three of his students, sometimes he separated them out. And the kids, of course, were, you know, it was no big deal, bam, bam, bam, bam, they're working off of this, not new to them, but for him, it was new, exciting, innovative.

When we move up the speeds of delivery, it'll be like he was sitting in each one of their rooms, and when that happens, we will explode in the education capacity. Today, when you talk to business leaders, I can tell you in the defense

industry, you know, it's interesting where we're at right now.

We bought in the last three years, when you're talking about science and technology, more unmanned aircraft than manned aircraft. So what do you think that means? They're now trying to figure out, these guys that operate these that aren't on the front lines, they've figured out that, you know, because they're not on the front lines, but they kind of are on the front lines, how do we award them for their service? Because they're at a computer with a joystick in California running these things in Afghanistan.

The technology is exploding, and what it means in the future is still undetermined, except I do believe every step we move in technology, delivering education to this means we've advanced. But we have a lot of work to do to get our young people in our education system to recognize the capital investment it takes, the human capital investment it takes, and ensuring these young people have the educators to move them to the next arena.

Let me just end there and just say thank you very much. As you get a sense here, I get pretty excited about this because, you know, I work in an environment where they're challenged a little bit around technology, let me just say that.

And so when I think about the future, where we're going to be, I just know where we've been, and I've had these discussions with folks that are -- when I came in at 26, in the assembly, I was the youngest one ever elected, and so when I was talking about pagers, they looked at me like I was a nut ball. Well, you know what the end of that story is? You go into that assembly chamber today, everyone is on a computer, all of it's virtual, people call in. You can now vote via the communication network there, the assembly members can.

The testimony that we get, we have this unbelievable technology in the assembly room to bring people from all over the world to testify. People have their cell

phones, they're connected. That's a lot now, because they recognize the value of this tool to inform the public, but educate themselves in what they need to do. So from the day they outlawed it 20 years ago until today, where we'll be 20 years from now is unknown. But I can tell you, the kids of today, when I'm sitting around, hopefully retired in some form, they'll be talking a language and I'll have no clue what they'll be talking about, and I'll be excited about it because it will mean that we've advanced beyond where we even thought we could be. So again, thank you very much, and I'll be happy to take a couple questions if that's okay. I don't know what the time is. But thank you all very much. (Applause)

MR. WEST: Okay. The senator has time just for a couple of questions. So if you can raise your hand, if you can give us your name and organization, and we would ask you to keep your questions brief so we can get to more people. We have a question here up front, so there's a microphone coming over to you.

MS. ORCHOWSKI: Thank you. Peggy Orchowski, I'm a congressional correspondent with a Hispanic outlook on higher education, and, of course, there's a lot of interest in this, but there's some dark sides that are going to have to be worked out. I think a lot of teachers are really afraid of being replaced. There's an article today in the *Washington Post* about giving grants in Virginia for teachers to show how they can be replaced by the computer, you know, Internet. And there's nothing that can really replace a good teacher. A lot of teachers, they're just pushing buttons. So what are you finding? I mean you have a multitask teacher, but I think a lot of teachers are really, really going to push back.

SENATOR BEGICH: Yeah, I think you'll find that it doesn't matter what industry, when there's technology advancement, people get nervous. The assumption is we have enough teachers today, that's not a good assumption, when one of the biggest

issues we debate is teacher-pupil ratios, the biggest issue we debate. So how do you enhance that?

My sister, who started in education teaching a program keeping young people, young women, in school who became pregnant, that was her program, today she now runs the programs on how to access teachers to teach their kids through distance learning. So there are new advancements.

The reality is, you're going to have in any organization, doesn't matter if it's teachers or whatever, you're going to have, when you move technology up, you will have some who say I don't want to deal with that, I don't want to do that. Well, okay, they're probably not going to be honestly the best teachers with this new world we're about to get to. It's not a question if it's happening, you know. It's happening, so we have to adapt.

Second is, you'll have younger teachers who have come up through the system who say, of course, this is what we do, this is what we use. You know, to imagine when I went to high school, we could barely be allowed to have a calculator in the classroom, a hand-held calculator, you know. IBM Selectric Typewriter 2, the big deal on that one was correctable tape that went backwards. That was like an advancement beyond belief, but we advance.

And I think teachers, it will open up new doors. For one, instead of teachers constantly spending so much time just trying to manage their classes and move from point to point, I believe if we do this right, we will give more capacity for teachers to expand and be innovative in more education arenas. I really believe it, because what happens, imagine, I mean you all know a teacher, you're a teacher, you're under great stress every day, you're trying to just get -- you know, you're getting your class prep done, and it's tough, and then at the end of the day, you don't even have time to think

about what you want to do to really get creative with your students, to bring them beyond where they are today, and that's a struggle, but I think you're going to have this.

It's going to be a friction, but I do believe those smart school districts that figure out how to nip and meld it are going to be able to utilize their teachers and maximize the teachers. Because the assumption right now is, we don't have enough teachers in the school system. Anyone who thinks there's more teachers than we need, let me know, I missed that train. And we have a great education system in Anchorage, Alaska, where I was mayor, but I'm going to tell you, if we could hire another 50 teachers, we'd do it. But if we can augment it and nail this new technology with kids who want to learn it, then I think we're going to get the best of both worlds, you will have people.

MR. WEST: Okay. I think we have time just for one more question. Right on the aisle is a question, and then the senator has to get back to Capitol Hill, because we think we'll vote because we have to go there and say yea and nay, because there's no technology in the Senate chambers.

MR. LEVY: Hi, I'm Jonathan Levy. I'm one of the technology program officers at IES, the Institute of Education Sciences, which is part of the U.S. Department of Education. So I'm particularly interested in the couple programs you mentioned for the middle school students, the sixth to eighth graders, that build your own computer over the summer and the tablet. Have there been any longitudinal studies to see whether those programs had any impact on the students, say improved learning outcomes or increased choice in STEM education?

SENATOR BEGICH: Yeah, there have been. Actually we had them here. I'm looking at Pru here, who works for me, we had this group here about a month, two months ago maybe, two or three months ago, we had them actually do a presentation here, and they were at the museum, and we had the students here building

these computers. And there are some great stories, we'd be happy to share them to you, but there's no question the impact it's having. And there's a piece that's hard to measure, and that is, you know, because they don't necessarily do this, sixth, seventh, eighth graders, again, high-risk students making bad choices at times and the outcome of that. It's hard to determine until you go down a lot further, but there clearly is some clear evidence that they're engaged and they're changing into a positive environment.

We have huge data on what our Alaskan young people and their bad behavior, keep it simple here, has been and what programs like this do to move them to the other side. So we'll be happy to share that with you. But it's, you know, it is like taking shop and put it on steroids, okay, which I also think we should keep shop in the classroom, but that's another story for another day, because people need to work with their hands, you know. They have to understand that because that creates another kind of learning. Book and computer, that's one piece, but you have to have this other piece, this physical activity. And I think in the case of the computer construction, that they're actually building these things, it's an amazing outcome. So absolutely, we'll share with you.

I'll take one more quick one. She's nervous, but that's okay, I'll take one more.

MR. WEST: Well, you have to always keep your staff on edge. There's one back there, I saw his hand up. Yes, somebody. There he is, yeah, right.

MR. WINTER: Thank you. I had a hand up. Thank you, Senator. Fred Winter, also from the U.S. Department of Education, but from the Fund for the Improvement of Postsecondary Ed, which, like fiber optics, is celebrating its 40th anniversary this year.

SENATOR BEGICH: There we go.

MR. WINTER: A question for you. In light of the federal budget constraints and potential cuts, sequestration, other issues, what do you see as specific possibilities in the federal role in contributing to the technological progress you see over the next few decades?

SENATOR BEGICH: Well, the stimulus bill, as you know, put a lot of money into broadband, high-speed broadband around the country. We've benefited. A hundred and some villages now will have access to high-speed broadband they didn't have four years ago, as an example. That's a huge investment.

But on a broader sense, you know, when we get to this collision course in November and December, on the federal budget and all of this, my argument has been very simple. There are three things -- I don't care if you're a senator that's so liberal -- we have three things we have to do to solve this budget problem, which will then go to your question then a little more broadly, and that is, we're going to have to deal with budget cuts, revenue, investment, investment in education, energy, and infrastructure. If we don't do this piece, I guarantee you, 10 years from now we'll have this discussion and wonder why we're now number 50 in the world on these areas, not 23, 24, or 25, but 50. And so the challenge is getting people to understand that.

Our former governor, when I had a debate on the stimulus bill with her, we talked about broadband, and she considered that a social program, a social service program, you know. Broadband is the highway of this century, you know. The government interstate system is not a social program, it's an economic opportunity in connecting people. Well, this is the new connection, and so we have to make sure people understand that who are in the political arena, and I think there's been some great effort.

The stimulus bill pumped some good money into this, but not enough.

Hundreds of millions of dollars, billions of dollars of investment have to be done. And it's just like when we laid the roads down in this country, this broadband is the next piece of this equation in a way that doesn't matter where you live, if you can access high-speed broadband and be able to touch the world from wherever you are, that is critical for us. Thank you very much.

MR. WEST: Okay. Please join me in thanking the senator. (Applause)

We also are pleased to have a panel of experts with us, so moderating that session will be Michelle Davis, who is a senior writer for *Education Week and Digital Directions*. So, Michelle, and the panel, if you can come up.

MS. DAVIS: Good morning. I'm looking forward to continuing the discussion that the senator started earlier today, and I want to start by describing just a little bit about the current landscape of online learning. Distance learning with technology can mean many things today. According to iNACOL, the International Association for K-12 Online Learning, there were an estimated 1 million enrollments in distance education courses in K-12 schools during the 2009/2010 school year, which is up from about 50,000 a decade ago.

But higher education, of course, has been out front in tapping online education. More than 6.1 million college students took an online course during the fall of 2010, according to a report from the Sloan Consortium.

Distance education can come in many forms. Students can now opt for full-time online education, they can take advantage of higher ed courses, they can access online material while they have a face-to-face instructor, they can use social networking, video gaming. And technology is also bringing science experts, advanced classes, and language lessons to students who otherwise would not have access to them. And in a lot of environments, particularly urban environments, schools are using online credit

recovery to help students focus on concepts they need to relearn instead of having them sit through lessons on things that they've already mastered, on top of what they've already mastered.

And they're using mobile phones, they're using iPads, desktop computers and laptops, all kinds of technology to do all of this. And the way the courses are delivered, sort of the structures, are also numerous. School districts and universities are creating their own online courses. States have established virtual schools. And a host of private providers are also offering their services.

States like Michigan, Idaho, and Florida have also adopted requirements that mandate students take an online course before they graduate from high school. But the rise of online and distance education has also brought up a lot of questions and concerns about quality, access, and how to sort through all of the type of options that are out there for schools and for students.

Studies in Colorado and Minnesota suggested that full-time online student achievement there didn't measure up to peers and traditional face-to-face school settings. And as someone mentioned earlier, the research field is still catching up when it comes to evaluating the effectiveness of online education. But the good news is that today we have two very knowledgeable experts here to discuss the state of online education from their perspective and what we're going to see in the future.

We'll hear from James Werle, the director of the Internet2 K20 Initiative, and Eric Fingerhut, the vice president for Education and STEM Learning at the Battelle Memorial Institute. And after we have a chat, we're going to invite you to ask questions, so be thinking about them through our discussion.

So, James, I want to start with you. If you could just tell us a little bit about your initiative, and particularly about how you're meshing higher education and K12

with technology.

MR. WERLE: Sure. So I'll start by saying the Internet2 K20 Initiative has sort of grown into a larger effort called the U.S. UCAN but it has continued to focus on connecting community anchor institutions across the country to various state and regional not for profit research and education networks and to Internet2, which is our national high performance network which is dedicating to serving research and education community in the United States.

So just to give you a quick sense for the number of institutions that are currently connected to where we are today, there are roughly 65,000 community anchor institutions connected to this advanced infrastructure, of which about 54,000 or so, it's an estimate, about 54,000 are K12 schools. And so that's roughly about a third of all public and private K12 entities in the United States.

So additionally, there are about 4,500 out of roughly 17,000 public libraries connected, a fairly large number of bachelorate colleges and universities, as well as other kind of not for profit museums and science centers using Aquaria as well.

So beyond connectivity, the Internet2 K20 Initiative is really focused on developing communities to practice -- what do you do with this connectivity, what can you actually achieve, and what are the benefits to distance education. So I'll just give you maybe just a couple examples.

One of them is, if you consider 212 some odd, you know, higher ed institutions that connect to the members of Internet2, there are, you know, large numbers of usually high end, sophisticated, scientific apparatus equipment that are on these campuses, telescopes, you know, microscopes and this sort of thing, and so, you know, sometimes these sit idle. They're not always in use for research purposes.

So increasingly, these kind of instruments are being networked to

Internet2 and made available to those institutions that have -- the broader education community that have access to this advanced research and education networking infrastructure. So we're providing access to K12 students and their teachers, and, you know, what we're seeing, those that have access, the students, the level of engagement and the excitement and the authenticity of using that same sort of equipment literally that, you know, real scientists are using on a daily basis has a pretty profound impact in their engagement levels and their enthusiasm for learning science. So that's one area we're focusing on.

Another I'll mention is using the network to connect researchers -- they have various other experts to K12 students and teachers in their classroom using really high end, sophisticated next generation interactive video conferencing, sort of as the Center was describing.

That kind of Star Trek environment is increasingly --- we're seeing it in higher ed being deployed, increasingly just beginning to see that capacity, in turn, to K12. And when you combine that with the networking infrastructure, where you're moving -- we've arrived and so the future is here today. And what we're seeing is you have an opportunity for say, marine biologists to use -- he's got his wet suit on and diving gear and he's exploring the Great Barrier Reef or Monterey Bay Marine Sanctuary and able to communicate in real time with those students; or an oceanographer is out on a research voyage and making new discoveries on a daily basis and they will connect as they're happening live with students in the classroom; or a physicist who's working CERN's Large Hadron Collider sharing the discoveries in real time.

So there are immense learning opportunities and professional development opportunities that are enabled when you combine that technology, you know, deploy that technology. There's also I think something else that's going on that's

really interesting and that's --

MS. DAVIS: Well, let me stop you for one second and let me ask Eric, because you're talking about a lot of science and technology, and so let me ask you a little bit about how STEM research and what you're doing sort of comes into play here.

MR. FINGERHUT: Sure. Well, I think the word of the day is going to be networks, because there's -- in addition to STEM, right, because I think there's two different kinds of networks that we need to talk about. One is the kind that James has been speaking of, which is the ability to bring the technology into the schools, and the enormously exciting statistic that he's given us, about 54,000 schools being connected. But if you take the examples then of the types of things that can come over the network, the marine biologist that James just cited, the educators know that that just doesn't make a lesson like that, right, and it doesn't just connect to standards and all the things that teachers have to do.

So somehow this has to be packaged into and developed into the type of curriculum that can advance STEM education. Now, there's lots of good people out there doing that kind of work, too.

The challenge they have is how do we connect into the schools, right. Do we have to go knocking on every one of these 54,000, you know, schools and find out the name of the science teacher, you know, and connect, how do we do this? And so I want to say that there's really good news here, because, you know, I noted when the Senator was speaking, he talked about how desperately behind we are in STEM education, so I come bearing good news, right.

There's a growing STEM movement in this country of educational organizations, advocacy groups, who are just focused on building the types of community of practice among STEM educators so that we can quickly distribute out into schools in

useable format these tools that James has described. So let me be more specific.

So Battelle is headquartered in Columbus, Ohio. We're best known as a R&D organization. We manage six of the Department of Energy national labs, and a lab for the Department of Homeland Security, and another probably billion dollars worth of research for other departments, but in our founding documents, the will of Gordon Battelle, we were committed to STEM education because we knew we had to train the next generation of scientists and technology leaders, so it's always been part of our mission.

We helped start a single STEM high school in Columbus called the Metro School. The state then asked us to try to spread that around the state. We now manage something called the Ohio STEM Learning Network, which is schools and programs all over the state connected together.

One of the labs we manage for the Department of Energy is the Oak Ridge National Lab. So the State of Tennessee, which many people in the room will know was one of the original winners of the Race to the Top award, one of the first two finalists, invited -- asked Battelle would we help replicate a STEM learning network in Tennessee, so we now manage the Tennessee STEM Innovation Network, which is a state-wide network.

Then, with some assistance from the Gates Foundation, there were other states that were starting to do similar activities, so Battelle was asked, could we try to connect up and see. We started connecting people. There was such energy around people wanting to work together, to share best practices, to be able to pirate things, to get them out, to get them to scale quickly. So just a month ago in Dallas we launched a multi state network, it's called STEM X, so there's 13 states already that have connected together. Each of these states has a state organization that is spreading best practices,

connecting together teachers, advocating for STEM.

Battelle is sponsoring STEM X, so there's no money being wasted on administration. That's a contribution that we make, it's headquartered at Battelle. So my point is that when we get Internet2 into the schools and we get these marine biologists, and at Battelle, we have the scientists at the labs, many of whom are in rural areas, to the Senator's point, who would like to help, we increasingly have a network that can get these things out into the schools quickly.

MS. DAVIS: Now, I mean these are all really amazing things, these scientists and marine biologists that schools might be able to tap into, but do the schools have the ability to, you know, the cool video conferencing that you talked about, the broadband capability, the technology that they need to actually bring this stuff to the students?

And I know the Senator talked a lot about rural environments, but, you know, urban environments have some of the same challenges sort of in a different way. Are you finding that you can actually bring these things to the school district?

MR. FINGERHUT: So, again, James' work is critical to spreading this. The bad point of Internet2, I don't want to speak for him, is the university community, and one of the things that the STEM networks at each state are very deliberate about is connecting into the university community, into their research universities, their land grant universities.

And so it's really very possible for almost every school in this country, even if they're not one of the 54,000 that, you know, that James has already connected up, but to partner with a research university that has the Internet2 backbone.

So, for example, I mentioned, you know, Oak Ridge National Lab, so we have a new STEM school in Knoxville, which is Oak Ridge is outside of Knoxville, it's in

downtown Knoxville, but you've got the University of Tennessee Knoxville that they can partner up with even though that school might not yet be wired.

So the critical partners in spreading STEM education are, of course, the community and their schools, but also business, because business brings the practical applications of science and technology.

One of the things we know about STEM education -- that's why the marine biologist example is such a good example, right, what helps students learn is seeing how it's applied in the real world. Business helps that with internships and other project based activities. But then higher education, they're a critical partner. They train the teachers. The Senator spoke about the need to continue to grow the number of teachers who have this capability, but also the connectivity.

If I could just add one other thing about teachers. The senator made the point correctly that there aren't enough teachers, particularly those that have the STEM subject matter expertise, and they certainly -- even if they have the subject matter expertise, they may not have the experience of having worked in a lab or worked in a private sector experience where they can actually empower to the kids what this is about, right.

We're learning this calculus because you're going to build a bridge, you know, or you're going to clean the water or clean the air. And so the scientists in the labs, again, we manage six Department of Energy labs, but those are managed by others, as well, in private laboratories, these folks should be viewed as part of the teaching core.

They could be paired with a teacher who knows the standards and has all of the, you know, the pedagogical training necessary and appropriate licensures. But what comes into the classroom is really the real life teachers. So we need to view all the

scientists using Internet2's connectivity and these STEM networks' capacity as part of our scientific teaching core.

MS. DAVIS: James, let me ask you, is state policy playing a role in what you're doing? Because there are a number of states who have now adopted these requirements that school districts provide an online course and that students take an online course before graduation, is that helping get the technology into the districts that you need? Is that helping your efforts?

MR. WERLE: Yeah, I think so. I mean it created the demand for true broadband -- drives the build-out. The stimulus bill, I think the Senator mentioned, as well, has been a great boom for efforts towards further deepening connectivity out especially into rural areas where billions of dollars were invested in the infrastructure, and it's benefited both, you know, not for profit organizations like Internet2 and the various state regional education networks, but also the partners in the private sector that are so critical to getting that tail circuit connected, that last mile circuit connected, and none of this would be possible without them, and so they've benefited, as well, from that stimulus investment in what is truly the next build-out of the interstate highway -- that absolutely great analogy, the state highways and the national highways. And so we'll see, I think, in the coming months as these state and regional networks and various entities have been hard at work in building out these networks, we'll see more and more capacity starting to be turned up, these new circuits that were laid, new fiber cables will actually be brought online in the next year as the broadband technology and opportunity programs, the top grant monies actually start to bear fruit.

MR. FINGERHUT: And, of course, we've been focusing on STEM in this conversation.

MS. DAVIS: Right.

MR. FINGERHUT: As the build-out of the broadband continues in the schools, this is going to be a boom for all sorts of education. Languages, right, in Ohio, sort of just the Chancellor university system in Ohio, we were already talking about how do we get, you know, the teachers from Mandarin in our universities to be lecturing to all the rural schools.

The Senator mentioned the arts, right. I'm sure people in this room or listening have seen a lesson where a virtuoso in some other city is playing along side a high school orchestra and can do that only because of the capacity of the Internet -- of Internet2. So these are just explosive opportunities. And again, to the Senator's concern about rural education, it's particularly of benefit to those rural communities where, you know, we're not going to get the scientists from the labs into every rural school, but we can certainly get them connected up to work with the scientists directly.

MS. DAVIS: Well, I would argue that urban schools have the same --

MR. FINGERHUT: Absolutely, no question.

MR. WERLE: I love a specific application, kind of building on that STEAM comment, the arts and the potential gain of the network once we've got it in place to take us kind of to the next level of distance education.

There's a technology that was developed primarily in Europe, there's European higher ed institutions, but in partnership with research and education networking folks called LOLA, and it simply stands for Low Latency, it's an audio/video technology that does enable this kind of real time simultaneous live musical performance across great distances over research and education networks, and this, of course, has I mean pretty profound implications for music instruction in K12, and this isn't, like I said, this isn't just about science and technology and math, it's also about arts and other performing arts in the United States. Education where you actually now have gotten to

the point literally where this technology has enabled 35 -- the performance and space between these two who may be living in different continents is now what it would simply be, say, 35 feet.

MR. FINGERHUT: But I do want to say on the STEM field, which again, to the senator's point, we are still behind. The scientists in our public and private laboratories, they want to help, but they also have day jobs, right. So we manage the Department of Energy labs, and the Department of Energy expects that they're going to do research and they're going to deliver on the, you know, on the outcomes, but they're passionate about education, they see what needs to be done in the urban and the rural schools that we're talking about, and so if we can, between the Internet connectivity that Internet2 works on and the curriculum scripting that the STEM networks are making possible, if we can make it possible for the laboratory scientists to reach the students, they will do it in droves, and they want to.

MR. WERLE: Make it dead easy for them.

MS. DAVIS: Right. One of the things that I think is a big issue for schools and districts out there is the issue of this all sounds incredibly cool and I would love to do a lot of the stuff, but does it really improve student achievement. And I think there's been a lag time in research, and I know the Senator said there was research into the particular program he was citing, but I think there are concerns and districts don't want to take risks because they don't want to invest time and money and their teacher's efforts into something that is cool but may not really have an impact on students.

MR. FINGERHUT: So there's no question in the STEM fields that it has an impact on student achievement. I'm not an expert in all of the academic fields, but there's no question it has an impact. We know research is clear that it is the integrated approach to learning STEM fields, it is the project based approach, I mentioned already,

you know, the internships and costs relating it to real life projects that is turning kids on to be able to see how what they're learning is connected.

It's also, you know, we all know the research about learning differences and learning styles, the ability to deliver the same content in multiple different styles is enabled by the technological interface.

One school can't have eight different teachers for the same subject with different areas of expertise, but they can have a teacher who knows how to connect to, you know, to those areas. So there's absolutely no question that it is having impact.

I also would just mention, because your question didn't directly say it, but it implies it, you know, the whole movement towards common core standards, and I'm sure folks who are listening know that the next major product is the next generation science standards which hopefully will also achieve the same level of acceptance at the states that language arts and math have, is all about creating a common benchmark that allows us to innovate in how we achieve that benchmark.

It's the opposite of creating rigid, you know, rigid approaches that allows us to achieve these standards in a lot of different ways. So I think that we will see the connection to achievement.

I know there's concern and worry, right, if I don't just, you know, if I don't just measure these things, but even look at the college board with the APA exams, they've completely rewritten the science sequences, biology, chemistry, physics that are going to be introduced over the next few years to be more project based, more talking about the scientific method, more inquiry based, less just reciting the facts out of the, you know, out of the science book, so that's the direction of standards, that's certainly the direction NGSS is moving, that's the direction AP is moving, and I think the schools now have the opportunity through these technology platforms to open up their curriculum

more than they have before.

MR. WERLE: I'm really hoping with the new standards that they roll out with will provide teachers with a collective sigh of relief that they can now --

MS. DAVIS: Not yet, I don't think.

MR. WERLE: The message you're sending I think with this is, you know, we trust you, we trust you to do what, you know, you're called to do in life, which is, you know, capture a student at that point, guide a student to the point where learning can occur, and by whatever means you think is best, you know, we trust you to do that, we give you the flexibility to utilize the technology in ways that enable them to, you know, best guide students.

MS. DAVIS: And do you think the fact that the assessments need to be done online are going to sort of speed this process along of getting all of these things to schools?

MR. WERLE: I guess it sort of depends on what an assessment actually looks like online. If it's a bubble sheet, you know, that suddenly just, you know, let's you text and you're punching a button here with your mouse or punching a button there, that's probably not a terribly, you know, bandwidth intensive activity, but it does require a great deal of assurance and identity, and so identity and access management issues to come to the floor and something like that. If that's what an online test looked like, it's not a bandwidth issue. But if you enrich those tests with, you know, multi media, or, you know, other kinds of technology that are bandwidth intensive, perhaps it would drive --

MR. FINGERHUT: And I think it's real important, Michelle, for us to say we think we're at the beginning of the development of the curriculum and the assessments and the tools that will be available on the technology. I mean the senator started going from the pager to the iPad. We're at the pager stage of what can be taught

on these tools that are being made available.

Our point here is, between the technology that James represents and the teaching networks and school networks and advocacy networks that I'm trying to make sure people know about, that if you're out there thinking I can invest time and energy and resources into a better way to offer these assessments and to a better way to deliver online learning, go for it, because it will be connected, and we don't think we're anywhere near the end of where this development of materials are.

MS. DAVIS: Well, I think we're going to take some questions now. Just make sure to keep your question brief and state your name and your affiliation. And we're also hopefully going to take some questions from the people who are watching on the web, so all of you out there submit some questions, as well. I'm just going to start with her in the back.

MS. CRANDALL: Hi, my name is Courtney Crandall from Communications Daily. I completed two years of my undergrad degree through distance learning, so I've experienced both the benefit and the pains of online education. And my question is in regards to funding for these new programs for the schools.

Where did the funding come from for the programs that have already been established, and where will the funding come from for future programs?

MS. DAVIS: Who wants to tackle that one?

MR. FINGERHUT: Well, I'll start quickly on the curriculum and innovation side, and then James can talk about how the Internet2 stuff is funded. But it comes from everywhere, right. The 13 state networks that form STEM X, the combination of local sponsorship, foundation sponsorship, corporate sponsorship, governments at every level. So it's a, you know, it's a real collaborative effort, and we need all the help we can get and all the support we can get.

And we haven't talked a lot about the role of the business community. I mentioned it in the context of internships and co-ops, and project based activities, but one of the things that is behind this urgency about STEM education that the senator spoke about is where we have the work force of the future. And, you know, there's two different pieces of that. One is where we fill specific jobs that the businesses need, specific technological needs; that's always a challenge. Technology is always changing. We're always going to have to keep up. But the second is where we have a work force that has a broad based technological capacity sophistication to adapt to the changing environment in every work place.

I mean if you've been in a financial services, you know, industry setting lately, it's all technology, right. Banking and finances, all technology. And retail is all technology. Manufacturing is almost all technology. These things that we've taken for granted that, while there are STEM jobs and then there are non-STEM jobs, it's just collapsing.

So business has a strong interest is my point, and in each of the states that we've been fortunate enough to work is very strong business partnership financially and otherwise, and at the national level, major companies are supporting it. So in addition to government, we really do need to get business engaged.

MR. WERLE: In terms of the funding -- the technology -- the circuit, the actual connectivity piece I echo a lot of what I think Eric is saying, it's a mix and for connectivity, of course, the big source of funding particularly in K12, is the E rate program. So as we continue to strive to make that program more efficient and find additional resources within that fund, within those funds, ideally we add to the pot, if that's possible, that will help drive schools' ability to afford getting to that next level of connectivity.

When I mentioned that LOLA technology, we're talking about 100 megabits dedicated connectivity just to do black and white performance, the performance to each other, black and white. If you're talking about in full living color, 500 megabits of dedicated bandwidth. That's for that one instance of collaboration between the master and the student, or between two performers. And so to get us to that next level with possible distance learning, it's going to take a lot of bandwidth, and that bandwidth isn't free.

MS. DAVIS: Let's take another question. The woman right there in the white.

MS. LITTLE: Hi, I'm Allie Little; I'm with the Children's Defense Fund. I'm also a college student, so a lot of this feels really relevant to me. I've grown up using the Internet, I use Skype all the time, and I've had some classes that really integrated some of these components, nothing quite as cool as some of the things we've heard about.

But also, some of my best classes have actually been with professors who completely prohibited us from using laptops. You know, they had a PowerPoint, but it was very simple, they didn't really use any of this technology, and that's kind of shown me that there's no substitute for a really great teacher and a really strong learning community in a classroom. And I guess how do you seek to integrate all of this great innovation with understanding some of the qualitative limitations of technology in the classroom?

MS. DAVIS: That's a great question.

MR. FINGERHUT: So obviously I think it's both. You know, I spoke about this a little bit before. I mean, what the Internet capability allows you to do is to access expertise and excellence that you could not get in every school in this country.

By the way, it's also true at the higher ed level. Not every school has access to, you know, to all of the opportunities, but certainly we've been talking mostly about K12 and rural schools and urban schools.

So that also frees up the teachers in the classroom to be better facilitators, to be more focused on the learning of each child. It's a little bit of a specialization, if you will, that enables us to do better overall. And simply put, there are too many schools in this country that do not have access to quality STEM teaching because they don't have access to teachers who have either the subject matter knowledge or the ability to relate it to something that students can access. And there are lots of efforts out there to generate more science teachers, but anybody who's been involved in that can tell you that we're not going to get there fast enough, we're going to lose a whole generation of kids, and so these are the opportunities to reach those kids.

MS. DAVIS: James, what do you think?

MR. WERLE: Well, to me, this is also an opportunity -- there are a tremendous number of teachers that haven't given up. Maybe they aren't digital natives, but they see through their younger colleagues the power and ability to educate -- technology helps enable properly used as any tool if you can apply it to the job at hand correctly it yields results.

And so I mean perhaps we can use that same technology to help distribute the expertise within the profession more effectively and so you can have the young mentoring some of the more experienced teachers with more years of development, having had much time with the technology, so there's how you can use the technology in so many ways in that respect.

MS. DAVIS: And I will just also say that I've done a lot of reporting about online learning, and I think, you know, the research shows you have to be a good teacher

first before you can be a good online teacher. And there are states that are starting to think about requiring teachers who want to be online teachers to have additional certification or additional training to become a full-time online teacher. Another question? How about on this side?

SPEAKER: (off mic) National Federation of Training and Development Organization. My question was triggered by the remark that the federal government had a strong role through the recovery program to do the laying of the -- what do we call it?

MR. FINGERHUT: Broadband.

SPEAKER: Broadband, okay. My question comes at this time in our history; we seem to have a dialogue going on between the unimportance of government in the future. Now, if we are moving towards less government involvement or the devaluing of government, how will this affect the effectiveness of moving ahead which indicates a business and government partnership?

MR. FINGERHUT: Well, let me just say quickly and then turn to James, I think there are two roles of government in education. One of them is essential and the other has been occasionally been problematic. The essential part is the investment part, as James pointed out. We wouldn't have the broadband connectivity in my state. In Ohio, when I was chancellor at the university system, we received $130 million out of the Recovery Act to connect up schools, and we couldn't have done it without it, absolutely essential. On the other hand, we also do have a regulatory environment in education that often restricts us from being innovative. So what government enables by connecting us to broadband, they have been making it hard for us to take advantage of by opening up student experiences in a way, you know, in a way they should.

And this isn't just federal, this is obviously state often, you know, K12 in this country is more heavily regulated by the states than it is at the federal level. So we know

that with money comes accountability and responsibility, but also we need more flexibility to be able to innovate in this area.

MS. DAVIS: Do you want to add anything, James?

MR. WERLE: Just -- yeah, there's no question in my mind, I think most people would agree that -- well, I shouldn't say that, we're in Washington, but, you know, the federal government throughout our history has played a role, and if you define -- at least in terms of the infrastructure. If you define this as an infrastructure build, then I think most people would align, yeah, there's some role for the federal government, as it always has -- there always has been in our country's history for going -- just looking at, you know, electrifying rural America. Did the government play a role there? Obviously they did or it wouldn't have happened if just left to the private sector. So just make sure we frame this in terms of the infrastructure effort and not -- as the senator said, there are some -- as a social service, broadband is a social service.

MS. ORCHOWSKI: Again, Peggy Orchowski with a Hispanic outlook on higher education. There's been a lot of news the last couple of days on the University of Virginia joining this --

MR. FINGERHUT: Corserra.

MS. ORCHOWSKI: -- yes, Coursera, which doesn't do revenue, there's no revenue involved. It assumes I guess that everybody in the world has a high tech computer that they're going to be able to catch these courses on. I mean this seems a little bit really stepping out of the box. What do you see the advantages of Coursera to university, to higher ed learning? Some of the articles I've been doing are showing that these online courses, at the end, there's zero completion rates.

MR. FINGERHUT: So I'll be Pollyanna. I think this is the most remarkable social development certainly of the last few years. I mean, one of America's

greatest products is our higher education system. It's an extraordinary, world class, world leading higher education system, and we are opening it up for free to people anywhere in the world. And with all respect, you'd be amazed how many people in the world have broadband connectivity that didn't have access to a University of Virginia course, or a Stanford course, or one of these other great courses. And there are, in fact, people all over the world now that are accessing for free that which only an elite, small number of people could utilize.

So we talked about Coursera, I'm a little more familiar with the Audacity, because Battelle has a partnership with Audacity. So Audacity sprung out of this professor at Stanford, Peter Thrune who opened his computer programming class to the world, just put it online, and 160,000 people signed up, 30,000 finished, 10,000 took an assessment that showed that they had mastered.

The most famous story is this kid in Afghanistan who was dodging mortar fire and had connectivity for one hour a day and finished the course. I'm sorry, maybe I'm just not cynical enough, but I just think that is such an extraordinary gift. And certainly at some point it'll have to be monetized, and at some point there will be fees, you know, associated with it.

But the fact that our great universities are racing each other now to, you know, to open up their curriculum to anyone in the world, not just the, you know, student who's lucky enough to get into Stanford or lucky enough to get into UVA, I just think only good can come of it. And I will tell you, so the partnership with Audacity that Battelle has is back to K12. So we partnered with them this summer to invite high school students to take college level courses.

So we're sponsoring teams. It's a competition. You can go to Eudacity.com, you can still up I think. And so teams of high school students are signing

up. We have something like 350 teams the last time I checked to take Audacity courses online. These are Stanford level computer science courses online, and the team that takes the most courses and has the most students complete it, we're going to fly out to California, they're going to go to the Googleplex, they're going to get to ride in the Google self-driving car, and put on the glasses and all the cool stuff that Google is doing and get awards.

I mean this is how you can build excitement among high school kids. And talk about your rural kids or your inner city kids, they didn't have this chance, you know, before this technology came along, before the universities opened up. So is it perfect, is it open, you know, is it accessible to everybody? No, it's not perfect yet. We're at the beginning. This is the stone age of this development. But it's an exciting development, and it's changing the world. One of the number one finishers of the Audacity course was a 40 year old nurse in Ireland. I mean these have people being discovered, you know, brilliant people all over the world who have a chance now to access the greatest education in the world. So, again, I'm Pollyanna, but I think it's fabulous.

MR. WERLE: I'm equally as Pollyanna. I mean I was a Peace Corp volunteer in Africa, in Malawi, and it's an extremely poor country in Central Africa, and I mean the kids that I taught physics to, I had a piece of chalk and, you know, a chalk board essentially, and these kids, some of them were the brightest kids I've ever encountered in my life. They just happened to be born, you know, in one of the poorest countries in the world. And they would walk for miles every day, literally, and I don't know how they did this, but they kept their shirt clean, and it was pressed every day. And I mean this is the sort of thing that we're enabling these kids. Yeah, I mean --

MR. FINGERHUT: And it's early (inaudible), too. I mean a professor at

MIT Media Lab and her colleague at TUFTS got funded. They did an experiment where they dropped iPads into Sub-Saharan Africa that only had English reading lessons on it. They didn't tell them how to use the iPad, they didn't give any instruction, and these kids, within a month, were speaking English and reading English because they figured out how to turn on the machines and they figured -- so it's an extraordinary revolution that we're about to see in education.

MS. DAVIS: Well, we have time for one more question. Let me just --

SPEAKER: I'm (inaudible) and I'm a guest colleague at Brookings from India. I just want to applaud what you just said, because coming from a country where most of the population is a rural area, and then we're struggling with trying to reach quality education. We are trying everything we can with technology to get there. And I'm hoping the infrastructure will work fast and so that we'll be able to access all the wonderful resources that I think universities have.

My question was that in India, the Internet has -- we don't have broadband everywhere, but the mobile phones have been everywhere, so is there something that they're doing with mobiles here, mobile phone technology that we could use and how does one access that.

MR. WERLE: Sure, I mean, yeah, there's tremendous daily improvement if we just hit video conferencing, for example. More and more of the desktop video conferencing vendors are making their products available in the mobile platform and developing codex that can deal with dodgy connectivity through the mobile networks all the way up to (inaudible) or whatever. And there are amazing opportunities over mobile. Yeah, so I mean that's a profound vehicle by which you can push this stuff out.

MR. FINGERHUT: And just to point out again, this is an area for further

development. There's no question that we're not yet where we need to be on the use of mobile devices in education. But as the broadband builds out, the opportunity now for creative developers and innovators in this field to, you know, to do a better job than what exists, you know, come on, bring it on, we need it, we need better tools to, you know, to educate over mobile devices with students, there's no question.

MS. DAVIS: And I'll just add, I just recently did a story about the Memphis School District in Tennessee, and they have -- even though their state doesn't require students to take an online course for graduation, this district put that requirement in place, and they are having trouble getting all their students access. Not all the students have laptops at home or were connected at home, but every student, their parent had a mobile phone, so they adapted this online course for mobile phones, and now the students can access it through the phone.

So I just want to thank everyone for a great discussion today and thank our two panelists. Thank you very much for coming today. Thank you. Thanks for coming.

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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