THE BROOKINGS INSTITUTION

DATA ANALYTICS AND WEB DASHBOARDS IN THE CLASSROOM

Washington, D.C.
Tuesday, September 4, 2012

PARTICIPANTS:

**Moderator:**

DARRELL WEST
Vice-President and Director, Governance Studies
Founder, Center for Technology Innovation
The Brookings Institution

**Panelists:**

PATTE BARTH
Director, Center for Public Education
National School Boards Association

KAREN CATOR
Director, Office of Educational Technology
U.S. Department of Education

JOSE FERREIRA
Founder and CEO
Knewton

* * * * *

P R O C E E D I N G S

MR. WEST: Good afternoon. I'm Darrell West, Vice President of Governance Studies and Director of the Center for Technology Innovation at the Brookings Institution. And I'd like to welcome you to our forum on education data analytics.

And we are webcasting this event, so we'd also like to welcome our viewers from around the country, as well as outside the United States. And we've set up a Twitter hashtag at #TechCTI, so people can post comments and ask questions. And we will, in our Q&A period, take questions both from our audience here in the auditorium, as well as our webcast audience.

Schools suffer from several limitations right now, in terms of assessment. They provide little immediate feedback to students. They require teachers to spend hours grading routine assignments, and they fail to take advantage of innovative new technologies designed to improve the learning process.

And these problems are unfortunate, because data-driven approaches make it possible to study learning in realtime and offer systematic feedback, both to students as well as teachers.

The so-called big data allow educators to mine information regarding student learning, and these techniques can analyze what students have retained, and what pedagogic approaches are most effective for particular students.

Today, we're putting out a paper on recent advances in education analytics. There's a copy out in the hallway. If you didn't get one on your way in, you can pick it up on your way out. This work was supported by the Bill and Melinda Gates Foundation, and we're very grateful to it for its financial support.

And in the paper, I examine the potential for improved learning

evaluation and accountability through data mining techniques and data analytics, as well as web dashboards. These approaches make it possible to mine learning information for insights regarding student performance and learning approaches.

For example, there are schools in 16 states now that are employing data mining techniques to identify at-risk students. They use prediction models based on truancy, disciplinary problems, changes in course performance, and overall grades to identify students who are at risk of dropping out of high school.

For example, the school district in Charlotte-Mecklenburg County, North Carolina uses a risk factor scorecard to identify who is at risk and who is in need of special attention.

In terms of higher ed, we're also seeing some interesting applications. Arizona State University, for example, has an e-advisor system in which freshmen choose one of five broad areas of study, such as arts and sciences or science and engineering as their designated course of study, and if the students perform poorly in a required class, or if they miss a course in a particular required sequence, the software identifies them as off track, and sends them to an advisor, to hopefully get them back on track, so that they can find the area of interest that is best suited for them.

There also are examples of where we're starting to get into the details of actual learning, where, when students are learning through computer modules, there's software that can basically track how quickly they're picking up on key components, what their proficiency is as they read materials or solve math problems, so that teachers and professors can keep track -- not just in terms of, like, giving them a test once a month, and then saying, "Yeah, you got an 80 or a 90 here," but really looking at learning in a very nuanced way, and providing feedback based on that information.

So, there's really been an explosion of new technologies and new

innovations that we think are very valuable.

To help us develop a better understanding of this subject, we put together a distinguished set of speakers.

Patte Barth is the Director of the Center for Public Education of the National School Boards Association. The Center provides practical information and analysis about the successes and challenges facing U.S. public schools.

Prior to joining the National School Boards Association, she worked at the Education Trust as a Senior Associate focused on standards assessments and accountability.

She's the author of several reports. A few months ago, she and her colleagues put out a report on virtual learning and charter schools.

Karen Cator is Director of the Office of Educational Technology in the U.S. Department of Education. She works to create the best possible learning environment for students.

Prior to this position, she directed Apple's leading and advocacy efforts in education. She has great expertise about the connection between education policy and emerging technologies.

Her office put a report earlier this year, entitled, "Enhancing Teaching and Learning through Educational Data Mining, and Learning, and Analytics."

Jose Ferreira is a founder and CEO of Knewton, an adaptive learning company. He and his colleagues use a cloud-based platform that analyzes concept-level data to personalize learning, and really get into the nitty-gritty of the learning process. This then helps educators tailor their content to the needs of specific students.

The company was named a technology pioneer last year by the World Economic Forum at Davos. It also has a partnership with Pearson to work on digital

higher education products in North America, which, by next year, will allow them to reach over 10 million students.

So, the format of our panel is, I will pose some opening questions to our panel about the uses, the possible benefits, and the barriers and obstacles to data analytics, then we will open the floor to questions, both from our live audience as well as our webcast audience.

So, I'll start with Karen. So, you have worked extensively on virtual learning, on data mining, and on learning analytics. How are schools starting to use these types of things? What are the most promising applications? And what does your experience tell us about data analytics?

Yes.

MS. CATOR: Hello. Thanks for having me here today, and I'm looking forward to this conversation.

So, we have been looking a lot at not only the challenges that schools have, but the tremendous opportunity that schools have now, as we move into this digital world, as we begin to have a personal learning environment where students are working through materials at their own pace. They're going to have differentiated access to interventions or strategies to help them understand, gain concepts. They're going to have increased interaction with other people, and will be able to manage and look at some of this data online, to understand not just kind of what you know about things, but also, who you're interacting with, and that kind of thing.

We're going to begin to have tremendous opportunity to understand so much more, not just about -- we'll understand so much more about who you are as a learner, and what kinds of things will help you progress. But we'll also begin to learn more about how people learn, what's the nature of learning progressions, you know, what

are the varieties of ways that people go through the various learning standards, and that kind of thing.

So, there's a tremendous opportunity, and it is kind of because we're flipping to a digital world. We have been, as we say, kind of data poor. And I know some people sort of don't necessarily believe that; they feel like we've had a lot of data in education, but we really haven't. We've had test scores. We've had grades, you know, attendance, you know, administrative data, but not a lot of data about kind of day-to-day management. And I know Jose will be able to talk very specifically about the kinds of things that we'll be able to do.

So, we're going from sort of a situation where we've sort of been data poor to a situation where we're going to be very data rich. So, as we begin to think about the trends of move to mobile, much more digital content, much more digital assessment, much more social interaction online, we will get to this space of having what we call big data.

So, this whole world of learning analytics kind of revolves around the fact that we will have these big datasets, and looking at the various techniques that have been applied in other sectors -- potentially the consumer sector and other financial sector -- other sectors to understand how people look at big datasets, and what they do with them. So, things, for example, like data visualization -- being able to take, you know, great big sets of data, and only when you present them in a visual format can kind of humans be able to make judgments and interact with that data in a meaningful fashion.

I'm not going to say too much more, because then we have a lively discussion to ensue here. But what I would say is that the ability -- there are many opportunities. There are some barriers. There are some things that we have to laser-focus on to make sure that we don't kind of lose the opportunity as we move forward.

And I look forward to the conversation.

MR. WEST: Okay, thank you.

Patte, could you address the different audiences for data analytics, in terms of students, teachers, parents, and policymakers? I mean, some of these people are used to dealing with data. Some of them are not used to dealing with data. What are the particular challenges, as well as the opportunities for the different audiences?

MS. BARTH: Yes, certainly. Thank you. And thank you for inviting me. I'm just really very honored to be here at Brookings.

Yes, I mean -- and we're going to hear a lot about the classroom level, and the student level, and what teachers can do with that, and that's very exciting. But there are different audiences, as Darrell said, for using all this data that we have. And I'm going to pull us up a little bit, and talk about what it means for a school district and these different audiences.

We have had data in schools for policymaking for a long time. I love this phrase "data poor." The problem is, the data wasn't always very good. It was flat test scores -- you know, NRTs, SAT, ACT, attendance maybe, graduation rates, maybe college-going. The big problem is that mostly what we had were overall average scores.

And I don't have to tell this group what averages can hide. As one of my colleagues likes to say, if you have your head in the refrigerator and your feet on the stove, on average, you're very comfortable. And yet that doesn't really describe what you're going through at that moment.

And that's what the averages have been hiding. We know this -- you know, that many districts -- once we started disaggregating data, high-performing or districts that thought they were doing pretty well -- in fact, there were some achievement gaps that was hiding in the averages. Even something like attendance -- you can have,

you know, 85 percent, 90 percent attendance rates, but maybe that 10 percent is chronically absent, which is a real early warning sign of students in trouble.

So, now technology has enabled us to not only collect all this data, but to be able to organize it in ways that we can look at a more complete picture of what is going on in a school. And we'll probably be talking about a lot of those as the conversation goes on.

Some of the problems, though -- the abundance of data has problems of its own. And that is, people in schools -- whether you're a school board member, or you're a classroom teacher, or a principal in the central office -- not many of them are statisticians. And they haven't necessarily been trained to use data.

So, what do they do, now that they have all this data? How do you find what it's going to tell you -- what is going to answer the question you have right now? Where are you going to be able to see where your needs are, so you can start pushing resources in those directions? It can be overwhelming.

The need for professional development is very, very urgent and necessary.

The other issue -- access. You know, who has access for different levels of data? The kind of data that Karen referred to, and what Jose is working with -- very important for teachers. You don't necessarily want your school board looking at that data, right? So, how do you provide the right access so people are getting what they need, but they're not becoming micromanagers?

And the improvements in the technology and data dashboards do a lot of that work for you. Some of the best ones out there -- I'm just absolutely wowed by the Colorado Department of Ed. I don't know if you'd had a chance to look at it, but really, really a very friendly, attractive display of taking a lot of data points, putting them together

in a real -- I call, like, a happy display -- that even the most math-phobic person can look at that, and get the information they need.

And, you know, that is creating a huge contribution to helping educators use data better -- and parents, as well.

One issue I want to raise right now -- and I don't want us to lose sight of it -- but all of this data has brought more transparency into the conduct of schools, which, in general, is a very good thing. But at the same time, it has made a lot of educators very nervous, because everything's exposed right now. And I think we have to keep the human factor in mind, as we talk about using data, and making it available.

This is really calling for strong leadership at the local level. They're the ones who are going to have to provide that support for teachers, make them feel comfortable. Something when I talk about this, I use a data caution meter, based on -- remember, we had the Homeland Security color levels -- and, you know, based on stakes.

If it's low stakes, it's a low level of caution. You know, people can get comfortable in it, get used to it, start making it useful for them.

But as the stakes go up, you've got to be aware that the fear level goes up, too. And so school leaders need to be mindful of that, and make educators feel comfortable, help them to trust the data, which they don't necessarily do right now, and they'll eventually see the real power in using this.

And along with that, parents and community need to be brought into this, too. That data is out there. It's out there for them. And if you don't involve them, they're going to see that data anyway. I think it's much better to have them with you at the get-go than to have them come back at you later. So, bring them in. Have these data conversations throughout the community.

And again, build up that trust, keeping in mind that what all of us want is to see our kids do well in school, graduate from high school, ready for their next steps.

MR. WEST: Thank you.

Jose, you and your colleagues at Knewton have really gotten into the nuances of learning, and through your software platforms, can really track learning in very detailed sorts of ways. And I think a lot of people don't realize exactly how far the technology has evolved even today. So, can you give a sense of what some of the possibilities are today?

MR. FERREIRA: Sure. Well, thanks for having me. My name is Jose Ferreira. In case you're wondering, it's Portuguese, but it's spelled like Jose.

And I guess my role on the panel is to talk about the future of what big data can do. You know, the data we've collected in education up until now has been grade book, and attendance, and things like that. And that's not a lot of data per user. Per student, that's not very much data. That's what Karen means by "data poor."

On aggregate, we get a lot of data at a district level -- or it seems like a lot, because there's so many data points. It's not very much per user, but we try to tease out what, you know, what we can.

What we can do going forward is quite a bit more powerful if we can get it right. What we can do is, take advantage of the fact that students are increasingly accessing educational materials online -- smartphone, iPad, laptop. And that's going to increase, whether it's supplemental products, it's their new online textbook that they just happen to be reading on an iPad instead of in print. And what that means is, we can suddenly capture lots of data if we've set the products up right.

So, what my company does is work with publishers. They tag all of their content to this one set of standards, and they tag their content down to the sentence, in

some cases down to the word. They tag every little bit of their content, which means they tell us what it's about: This sentence is about this concept. This practice question is this difficult. It's a word problem. It's a whatever. And they tag it down to the atomic concepts. They tag it down to a level below which you can't divide any further, it's so granular.

And what that means is that, whereas in other big data platforms, like Google or Facebook, they might produce in the tens of data points per user per day -- where other educational platforms today produce in the ones, maybe the tens of education -- of actual data per user per day -- for my company, we're producing in the hundreds of thousands -- and in some cases, the millions of actual data per student per day.

So, what that means is that Knewton actually gets more data about our students than anybody else in the world gets about anybody, about anything, and it's not close. We know so much about our students. Within a few weeks, we know to the percentile what their proficiencies are, at every concept in the course. We know how they learn best. They learn math best in the morning, we'll know that. If they learn science best in 45-minute bite sizes, because at the 47-minute mark, their click rate always declines, we'll know that. If they learn something best with a video clip instead of text, or in addition to text, we'll know that. If they never retain that 35-minute burst they do at lunch, we can tell them, "Don't bother. Go hang out with your friends. You learn that stuff best in the morning."

We can tell them everything about what they know and how they learn best.

We can use this to pair them up with online study partners. We're rolling out a feature next year called adaptive tutoring. We'll have, like Darrell said, 10 million

Pearson students alone next year -- probably a lot more.

We can let you ask a question, type it into a search box, tag the question. Then we can go find everybody who's online right this second who absolutely, positively knows the answer to that question, because we know exactly how well they're doing -- the top three percent in the nation at those notes, at those concepts.

Let's go subdivide. Let's find the people whose learning style is just like yours, right? Those are the people who can probably explain it to you the best. Let's subdivide again. Let's find the people whose learning style is just like yours, who are absolutely masters at material, who learned it the easiest. They had the easiest path to mastery. Maybe those are the people who can say, "Oh, for people like us" -- they wouldn't put it this way, but, "for people just like us, here's what works the best. Go do that," right?

And I can take the combined data power of a network of tens of millions of people, data mine it, take the wisdom of crowds, and apply this concept-level of adaptive intelligence to it, and find the perfect 10 people online right this second to answer your question for you.

That's what the big data in education is about to start doing.

MR. WEST: So, it's clear from listening to each of the three, there's very exciting innovation taking place.

I had a question for -- anyone on the panel can jump in. Each of you did identify certain problems. Karen, you mentioned education is data poor in general, unlike some other areas. Each of you alluded to various policy barriers. There are seat time problems, issues of transfer credit. There are technology issues in terms of interoperability. A lot of school districts still silo their data, and then it's hard to get the different IT systems to talk to one another. And then there's a question of privacy and

access, and who should be able to see various parts of this.

So, given the range of problems that we have, how do we overcome these? What are examples of how school districts are starting to address these types of issues? Any of you want to jump in? And don't be shy -- you're among friends.

MS. CATOR: I'll jump in. I mean, I think there's work being done at multiple levels, right? So, you listed a lot of the challenges, the things to keep in mind, the things to think about -- and, you know, absolutely right, and we probably could come up with more or whatever, but it's just starting even with those.

First of all, we need sort of a new capacity of learning data scientists. You know, the kinds of people who understand, you know, statistics, plus machine learning, you know, maybe psychometrics. I mean, and I think probably Jose has a few of those. You probably would like some more, to find those people. The places that I know that have found folks to come into their organization to help them with this, they're finding them in the financial sector, right?

So, people that understand big data are not coming from our schools of education, or the like. So, that's the first thing -- we need more data scientists. We need to ratchet up the understanding of space. We need other kinds of research. So, there's a lot that we need, sort of in the research space.

In the commercial sector, we need much more design and development, like what Jose is talking about. There are several companies that we know about, that are working on platforms or environments that are going to leverage big data, that leverage the kinds of data that we're talking about -- the click stream data, to the outcome data, to the who you're connected with data -- you know, as we say, all of the data about you as a learner. So, I think we need that.

On the policy side of things, we definitely need to understand much more

about the kinds of policies that are going to keep very close in mind things like privacy and information security, so we need to pay very close attention to those things while we are making sure that the people who need information have information.

So, actually, like, part of the conversation is, stop, you know, moving from talking about data to talking about the information you need to make decisions.

One of the things that we've been working on is thinking about, the student is actually -- you know, should be the keeper and the, like, the audience for much of this information. As we can begin to help students, and parents, and teachers know much more about how we're progressing and how you're learning, that's going to be very empowering.

So, there are sort of research kinds of things, and preparation kinds of things. There are commercial sector kinds of things. There are education types of things. And then there are really end user understanding about this data -- how to keep my own data safe -- and this is across multiple sectors, but in education, as we move to this, helping students and parents understand what this data is, what it means, where it came from, what you can do about it. And there is more.

One of the things I will say is, I'm hopeful that we can move from a situation where we're trying to get educators to be data analysts to a situation where we can provide the actual actionable information to educators based on the data.

So, in the past, what we've been doing is saying, "Look at this great data dashboard. Look at all this data. You know, now we'll spend a few days with professionals. I'm going to teach you what to do about it."

And what we need to get to is the point where the platform actually tells you what to do about it so that you are much closer to the action end of things.

MR. WEST: Patte, you want to jump in on how we overcome policy and

operational problems?

MS. BARTH: Well, yes, actually. And I agree -- it is an issue that has multiple players, and, of course, multiple solutions to it as well. There's a lot of work that has to be done on a lot of levels. I think the design issue -- very big. And I'm so optimistic at what is happening right now, that that's a problem that can be solved.

The interoperability, you know, between the state and the district, trying to get that data back in a timely fashion, data in different places -- we made references to silos. It's important to solve that problem, but when we solve that, we want to keep in mind that right now, we do have data systems. But they are so varied. You have it at the state. You have some districts that have fabulous data systems. You have some districts without any data system. You have some with not very good data systems, but they're there.

And one thing all districts are right now is broke. And so when we unleash these designers, one thing I hope they will keep in mind is, "How can we do this efficiently and effectively?" You know, it's that cheap, easy, effective solution. And I think they can do. We saw some of it in Georgia, where they were able, without a lot of investment, to develop code where the districts could import the state data very effectively. You know, those are the kinds of things that would be a huge help in breaking down those silos.

MR. WEST: Jose, how do we overcome these barriers?

MR. FERREIRA: So, I think one of the biggest barriers is, the whole model of education historically -- and up until now in the United States -- has been a task-based model. It's been about hours in seats. And, you know, like, when we were in school, "Did you do your homework?" "Well, I read the chapter, and I did the questions, so I guess I did my homework." Well, I may not have understood any of that stuff, right?

What if someone didn't do any of the homework, but understood all those concepts? Did that person do the homework, right?

We're moving into a world where education is going to be about proficiency. And we're -- Knewton, my company -- is moving us into that world, and so are others. So, you mentioned Arizona State. They're a big Knewton customer, and they've wrestled with this problem pretty aggressively, because we're telling them things like, "Hey, you know, this student can get an A on your final right now. You know, it's two weeks into the course. You can keep her in the course if you want. That's what you always did. That's what everybody always did, but it's kind of pointless. It's alienating for her; it's a waste of your resources, right?"

So, we've had students finish courses at ASU in 14 days. All right, we've had others that needed two semesters to finish the entire course. So, there's a path to success for everybody, but what happens when you shift from a task-based model, which is about hours and pages of reading, to a proficiency-based model, which is just literally, "Do you know it? I don't care how you know it. I just want to know if you know it and how well."

Because the whole world of education is going to shift to that model. That model never existed before, because we could never get the data out. We never could tell if they knew it. Now we can tell. We're going to be able to get the data out, and the whole model is going to shift, because all these proxies we used to use, like hours in seats, those were just proxies. That's all they ever were, and those proxies are going to go away, because we've got the real thing.

And so the whole regulatory environment -- I mean, you know, ASU, they had to jump through all kinds of hoops to satisfy creditors that the students who weren't doing enough hours in the course actually should be able to get a grade in the course.

These students were, like, straight-A students in these courses.

So, there's a lot of arbitrary regulatory framework that wasn't arbitrary before now, but is now outdated, that is going to have to catch up.

MR. WEST: Okay. Why don't we open the floor to questions from the audience, as well as our webcast audience? So, if you could raise your hand, give us your name and your organization -- and we'd ask you to keep your questions brief, so we can get to as many people as possible.

MS. MILLER: Sorry. My name's Ann Miller. I work for Frontier 21. I've been a teacher for two years.

MR. WEST: Oh, and we have a microphone coming over to you.

MS. MILLER: All right. My name's Ann Miller. I work for Frontier 21. I'm a researcher, and I'm helping roll out iPads into the classroom.

My question has to do with the proficiency. You know, we hear the bad things about teaching to the test and whatnot. Obviously, we'll have a set of criteria that will determine whether a student is proficient or not. Can you talk a little bit about, you know, how do we walk that line between teaching to the criteria, and a student actually understanding the concepts and the linkages behind the actual -- yeah, you know what I mean.

MR. FERREIRA: Yep. So, totally great question. Thank you, Ann.

So, I would say that I don't really care what the criteria are. Every school or college should be -- or professor or teacher should be -- continue to be free to make their own -- I have no opinion on that. They should make their own criteria, still, set their own standards -- or if they make those standards at the school level -- other people can make those choices, and they can be the same people who currently make them. I'm not an expert in who should make those choices.

But whoever's making those choices, and whatever the criteria are, I'll still be able to tell people, "Give this student the final right now -- whether the final is an essay or the final is whatever, she's ready." So, I mean, it obviously doesn't make any sense that 100 strangers or 30 strangers are all going to start at one starting point and end at the exact same starting point. Like, that's obviously wrong, and we can now tell you when they're going to end.

MS. BARTH: Mm-hmm.

MS. CATOR: Can I say --

MS. BARTH: Yeah.

MS. CATOR: Oh, go ahead.

MS. BARTH: Go ahead.

MS. CATOR: I was just going to say, it's a really important question, and the important point to remember is, we don't have good assessments necessarily right now, and so we absolutely -- it's another sort of thing we need to -- as we move to a competency-based learning model and we say we're going to have more data, more information about how people are doing, we need way better assessments. And there's actually an opportunity to create much better sort of performance assessments that will give us more information.

If we went to a competency-based model and used our current set of tests at the end, I think we would leave a lot of very important learning on the cutting room floor, because all of the interactions, the kinds of things that students learned, potentially serendipitously or along the way, as they were learning how to answer those specific questions on the test, would get left behind. So, we need really interesting, sort of way more compelling performances -- you know, assessments.

And, you know, so if you think of a triangle, right, and you think about the

criteria -- what people need to know and be able to do -- if you say, “That’s going to be publicly available” -- be able to articulate -- and we have, in many cases -- what people need to know and be able to do -- whether it’s to be a statistician, whether it’s to be an electrician, whether it’s to weatherize your house, whether it’s to, you know, be able to write this essay -- if we articulate that.

If we, in the other corner, we say, “There are lots of ways of learning this,” and today, there are expanding and just exploding opportunities to learn things from other people online, from books, still, from your teachers, still, from all sorts of new courses and environments that are popping up online. So, how you learn that stuff -- lots of different ways to do that.

And so what we’re talking about is this other corner, that is now, “How do we know you actually learned it?” That’s going to be the really interesting -- and, I think, the space for tremendous innovation and tremendous sort of new work in the coming, you know, year, couple of years, is really figuring out those performance assessments.

MS. BARTH: Yeah, I would just -- I think what you raise is so important, because that reminds us of, what, really, are we after? It’s what kids know and can do.

And yeah, that’s why we’re here. The technology helps us get there. The assessments help us get there. I will admit that we don’t have the greatest tests, but at the same time, I think we do have some pretty good ones out there. The technology is going to propel what we can do with assessment, the formative that Jose’s talking about, the day-to-day, and even the summative at the end of course -- really, truly be testing worth teaching to.

MS. CATOR: Right.

MS. BARTH: And when it is public, that people can easily see, “Oh yes, this is exactly what our children should know, and can do.” So, it works together, but the

first question is -- was your question, Ann, that, what is it -- you know, what is it they should know? What are the criteria?

MR. WEST: So, Ann has set a very high bar for asking questions. Like, everybody has praised -- but this means we have to praise all the other questions, so people don't feel badly, like they asked a stupid question or something.

Other questions? At the very back.

MS. BARTH: It's a competition now.

MR. WEST: In the very back, on the aisle. Yeah, there's a microphone right behind you.

MR. WILLIAMS: Hello. My name is Alex Williams, and I work with STEMconnector. And we focus on creating public/private partnerships between corporations and organizations.

And just the conversation so far has focused on, let's say, the K through 12 and the university space. What could -- or the potential be for ed tech in, let's say, retraining lifelong learners? There are a ton of manufacturing jobs, just for an instance, out there, and there is just a shortage of labor that just knows how to use it.

So, can we just maybe talk about how ed tech can be used, maybe, for later stage learners?

MR. WEST: God, that is a great question. What do you think?

MS. CATOR: Yes. I mean, yes, it can be used for learners of all ages and stages. I mean, I think that's one of the really interesting things that this move to digital will actually provide for us, is we now sort of separate people out -- like, "You're a fourth grader, and that's what fourth graders do. And you're a sixth grader. You're, you know, a community college student," and the like.

And I think what we'll be able to do is have lots of opportunities to learn

things in a variety of ways online, and together, and that kind of thing. So, I think it absolutely has tremendous application for people wanting to learn, like I said, how to weatherize your house, how to become an accountant, how to be, you know, some of the -- you know, nursing or whatever.

This is absolutely not saying that the face-to-face interactions, that it replaces those, but it scaffolds those. It augments the interactions that we have live, and in our classrooms, and with other people.

So, it's just, again, this opportunity to learn lots of different kinds of things. So, back to the previous comment -- you articulate what you need them to be able to do, whatever it is, at whatever stage you're at. You figure out all the different places that you can learn that, and then you figure out what the performances are.

In the later stage, when you're looking to perform or demonstrate performance so that you can get a job, then again, that corner of the performance is going to become more and more important -- or more and more valuable, I should say, because it will be more than saying, "I took these five courses." It'll actually say, "I can actually do this stuff. I can demonstrate. I have demonstrated. I have my, you know, certificate, my badge, my, you know, whatever it is that you would get at the end of a performance assessment."

So, huge opportunities for all ages and stages.

MR. FERREIRA: If I might just jump in quickly and say that there are two things that need to happen for the world that I think you and I would like to see happen -- happens. Okay.

MR. WEST: That's using the same word in one sentence, by the way.

MR. FERREIRA: I know.

So, first, there has to be a lot of online materials, so that people who

want to be retrained for career reasons, what have you, have the ability to do so, right, because, you know, Karen's right -- I can't hire enough great data scientists. I can't even hire enough great programmers.

I mean, our -- Knewton's starting salary for a programmer out of college is, like, $80 or something thousand. I'm not even sure, but, you know, when I was in college, if someone told me I could just study computer science instead of philosophy and make an $80,000 a year living, I would have done that. I mean, I didn't really care. I mean, I did a little, you know.

Like, there's -- we have an incredible shortage of programmers in this country right now. Software engineers -- an incredible shortage. You know, like, I think we probably have 3 million too few, all right? And those are really good upper middle class jobs, so people should be retraining for those.

Anyway, we need two things: We need a lot of online material, so we need the ability to retrain. But then who's going to trust the materials, right? We need some sort of vetting, so that's where big data comes into it.

And I'll tell a funny story. A friend of mine, Tom Pinckney, is an entrepreneur in New York, and he cofounded SiteAdvisor, and then Hunch. Tom didn't graduate from high school. He was a dropout. When it came time that he began to think about going to college -- because that's what all of his friends were doing -- he wrote a bunch of code and sent it to MIT. He didn't send them his transcript, his SATs, or anything; he just sent them code. And he got in. He went to MIT, and he's a successful entrepreneur.

So, we need to make it much more possible for people to do things like that, through -- and data can help that happen. When we'll be able to go to companies and say, "I know this person didn't do X, Y, and Z, but this person is off the charts at

these skills -- we know that for a fact," then you'll see companies hire those people.

MR. WEST: So, you mentioned we need more online material. How are content providers retooling content for this new digital world, if at all?

MR. FERREIRA: Well, there's, you know, a mundane and an elevated answer to that. The mundane answer is, HTML 5, not Flash, you know, because of iPads. And the elevated answer is, don't have them read a PDF; that doesn't make any sense. The whole point is, when you read a book online, you may as well do a lot more good stuff with it, right?

I mean, Knewton's whole point -- what my company does -- I don't even think I explained it -- is, we take textbooks or course materials, and we dynamically generate the optimal bundle for each kid each day. So, actually, instead of everybody having the exact same textbook from day one, starting on day one with Knewton, everybody has a unique -- it's not even a textbook anymore; it's a textbook, plus video, plus game, plus whatever -- but it's unique on day one.

And that can work online. You can't do that in a bricks and mortar environment. You can give every single person a unique syllabus on day one -- not arbitrary; optimized for each kid, down to the concept, based on what he or she knows, and how she learns best.

So, that's what you can do at the high end, but it takes a lot of work to wire it up that way.

MR. WEST: Okay. Back in the corner, there's a question.

MR. REBELLO: My name's Mario Rebello. I'm the head of policy for VMware Corporation.

Question for Karen -- based upon the study that Darrell West issued today, what are the policy barriers to the Department of Education, as well as state

education committees, as well as governing bodies, to change those policies with respect to sharing of data and sharing information? And what's the timeline that you see the Department adopting the policy, or encouraging policy to be modified, whether the federal, and state, and local level, to make these realities of what she was talking about a reality, so that we're not waiting five or six years?

But given the obstacles on information sharing and privacy issues, how likely and when will the Department make those changes?

MR. WEST: Great question.

MS. CATOR: Right. So, yes, very good questions -- positive reinforcement.

And I'll tell you, you know, after working in government, I -- time, you know, is a whole different universe. So, I actually won't make any predictions about time.

But what I will say is, it's a really interesting space, that I feel like I am just sort of getting my head around all of the nuances about data, and about privacy.

I would say that the top line is that we need to make sure that whatever we do, we are very cognizant of maintaining student data privacy and teacher data privacy, as appropriate, right?

So, there are so many, you know, things that could happen. And a lot of people say, "Oh, you know, in the consumer space, in the online world, like, you know, privacy's gone or whatever." We need to make sure we maintain privacy.

So, a couple things that we're working on: One is this MyData Initiative. So, as -- so what we want to do is, we want data to definitely go to the end user. So, we don't want any policy barriers to say that, "I'm sorry; you can't have your data."

But if we could get everybody -- everybody who has student data, so whether it's the Knewton platform or the, you know, the whatever platform is out there;

whatever you're using. If you're working with students and interacting with students, put a MyData button on there that says, "Sure, student, download your own data in machine-readable format so that you can do things with it. You can learn from it."

And this actually comes from the play that the Veterans Affairs -- you know, they did about health data. They said, "Veterans have the right to have access to their own health data." So, they began to create a blue button, which was this MyData button for veterans.

So, if we think about the same thing -- if we say, "Students should have access to their own data," there are not necessarily policy barriers. There are, you know, technical barriers, and there are thorny technical problems associated with that, but that is -- you should have rights to your own data. So, that's the first thing.

The second thing has to do with moving data from one system to another. So, this is sharing data across systems. And to do that without putting everybody to sleep in the middle of the afternoon, I'll just say that there are -- there's a legal framework that needs to be in place. There's a policy framework, and there's a technical framework that needs to be in place. And we're working on putting that together, so that people can begin to analyze it, and make the judgments about privacy, make sure this framework that's been put together from a technical standpoint actually maintains student privacy. There are definitely ways to do this.

There also are -- there's a lot already that's possible. There aren't specific policy barriers associated with data that's anonymized, right? So, data that is anonymized, and for research purposes and the like -- that's another thing that we're really interested in -- the better and better ability to anonymize data, to make data available, to make data transparent, so people can do things with it that we haven't done.

So, another thing that we're doing is working on looking across the

Department at datasets that could be published, open online, for people to have access to, and potentially mash up with other forms of data.

So, when you come upon a very specific policy barrier that you see, that you think that we should either know about -- or maybe we do know about -- definitely let us know, so that we can begin to, like, make really, like, sound, you know, informed -- as informed as possible -- judgments about all of these kinds of things. We want to move fast. We want to absolutely empower every, you know, researcher, and educator, and also the commercial sector, to build better and better things, so we need to analyze the policy barriers that you see.

So, as you come upon those, definitely let us know. So, we're doing a lot of work on different parts of it.

MR. WEST: Here, in the front row, we have a question.

MR. HERSHEY: I'm Bob Hershey. I'm a consultant.

When people go for MyData, or researchers go online to see the data, how will you explain to them the math involved in the data, and what they can use the data for?

MS. CATOR: That's a teachable moment. Yeah, I mean, I don't have an easy answer for that. People absolutely need to begin to understand more and more about their own data. I think that we as a country, in this society, we need people to understand, and we need education. We need to put tutorials right there with it.

And we came upon this even when students, you know, have access to their own, you know, financial data, or their loan data. Like, what does this data mean? How do you think about it? What can you do with it?

I think we need good examples of people's use of data, and people need to understand the unintended consequences. I think early on, you mentioned, you know,

people sometimes get nervous about open datasets, because what if someone does something crazy with the data? It's something we need to pay attention to, and I will just say, we need a better educated populace. We're calling it data literacy. We need a populace that is data literate. And it's students, it's teachers, it's parents, it's policymakers, it's government, it's everybody.

And it's a new world. It's a nascent space. And so, like, now is the time to build much more data literacy across all segments.

MR. WEST: If I could follow up on that point -- because I think it raises a very interesting question, because, like, if we're just talking about student achievement data, like the test scores on an annualized basis, and all of the controversies over data analysis, data interpretation, and so on -- like Jose is saying, we're moving from kind of one data point a year to possibly, to -- did you say millions per day?

MR. FERREIRA: Yep.

MR. WEST: I mean, isn't that creating a data quagmire?

MR. FERREIRA: See, that's interesting. So, I actually have the opposite take, which is that with more data, it actually becomes easier and requires less analysis by regular folks, right? Because if you've got all of the datasets you're looking at now at a district level, and you're kind of teasing through it to find patterns that are actionable, that you can do something with -- we tell students stuff like, "Hey, you're going to fail at your homework tonight. You know how we know that? Because you're struggling with some concepts that are building up to the concepts you're going to be taught in your homework tonight. So, if you don't know the prior concepts, you're not going to learn these very well. Or because the things that you're learning -- you know, your reading passage next week is highly correlated to concepts you've historically always struggled with. So, we have a high confidence you're going to struggle with that."

So, those are very actionable things. And I think with more data, it actually becomes more obvious, and easier to action. There, I just made "action" a verb.

MR. WEST: Patte?

MS. BARTH: I -- that's very fascinating, you know, at the student level. And that's great, and I'm eager to see that new world. But we still do have responsibilities as districts to put teachers in the classroom, and make sure that the students are taking advantage of all these wonderful new tools.

To your question, how can we do this? Public education, part of it -- both what we're teaching our kids -- but I know there are a lot of reporters who are here. The more you can write about data -- and when you're writing about schools, and use the data, and use that kind of analysis -- you are educating the public as well.

And I'm going to go back to the design issue -- that there are ways of designing -- and I have seen examples of data systems, data dashboards, that are available to the public, and to any of us, that begin that analysis. Now they make choices, based on what most people will want to see.

But through that, you walk through it, and you can drill deeper and deeper, and the more comfortable will you become. And we're getting better at that. I think that's a whole new opportunity there in helping any of us learn new systems. I mean, I tell everybody, I was an English major. That's how I started out life. And here I am, a data geek. You know, it can happen to anyone.

MR. WEST: Only in America, though, right?

MS. BARTH: Pardon?

MR. WEST: Only in America, though. Other questions? Back there's a question. There's a microphone right there. Yep.

MS. CARL: Yeah, Diana Carl, U.S. Department of Transportation.

We've talked about -- I'd like to address the tools that are possible to use. With -- outside of the realm of formal education, there are others who are doing a lot of examination of how people process information, how they learn best.

For example, Microsoft and Google do this. They have tools that are readily available, and I'm wondering what is being done now to see what can be done to marshal those tools from private enterprise, so that at least we begin to have a naturalistic understanding of how people learn, and then where the categories of learning are, of individuals are, to really process information, and move that forward into a formal structure of information.

MS. BARTH: Can I -- if I think -- if I hear your question correctly, I -- you're actually raising something that we haven't really talked about, which is the accountability for all these new opportunities.

And keeping in mind that the individuals who are, you know, putting their skin in the game are students -- so we need to offer these, we need to innovate, we also need to monitor it. And fortunately, the data is there, you know, to monitor, to make sure what we're doing is working -- and if it's not, to make adjustments. Is this the question -- you're talking about, you know, how do we know?

MS. CARL: I'm really talking about, perhaps, how private industry, such as Google, is learning how we, as consumers, learn from information, and then mold our, tailor our own learning. And then how could those kinds of data be used in order to better the way that people educate, and also allow for more individualization of education? Is there something beyond what the public school sector is doing that, perhaps, could be marshaled to that end?

MS. BARTH: I see, yeah. And that's kind of where I was going, is the research side of it. The research function, that, when we do things, what can we learn

from Google? That's a research question. How is it working? You know, sometimes it works; sometimes it doesn't. I mean, when I go to Amazon, and they make recommendations for me, I sometimes look at it and go, "What?"

You know, so it's a great system; it's not a perfect system. And, you know, so to be able to learn from them how they modify it, when -- and they watch it, and track it -- what lessons can we take from it? But we have to be very careful, when we are trying this out on students, that we are also monitoring it, and tracking it, and learning from it, and making improvements.

MS. CATOR: So, I just -- I think it's a tremendously interesting time right now, because I think that what we're seeing is entrepreneurs coming into education from other sectors. So, people who never have been interested in necessarily creating or building something interesting for education because it's been a very manual, non-digital process -- and so we're seeing entrepreneurs from other sectors come into education. It's a very cool time, lots of opportunities.

What we want to do is make sure there's really solid collaborations between entrepreneurs, and practitioners, and researchers, to really -- and that's not necessarily three different people, but it's those three that the deep knowledge of education researchers, the deep knowledge of data and analytics, from whatever sector, and the deep knowledge of practitioners -- bring this together to begin to design, and build, and dream up new abilities.

And I think we have a lot to stand on from other sectors.

MR. WEST: Jose, you're actually doing this.

MR. FERREIRA: Yeah.

MR. WEST: How are you doing it?

MR. FERREIRA: Well, so we do some of the things Google does. A lot

of the things they do aren't applicable to us. Google does a lot of AB testing and multivariable testing, which is transferable, in principle.

So AB testing is basically the habit of measuring what works best for usage, user experience analysis statistically measured. So, you know, they actually measured how many pixels should be in the G. Should it be 49 pixels or 50 pixels? Who comes back more? How long do they stay? They're tracking things like that, based on how many pixels are on the G. I'm not sure that they're getting any interesting data at that point, but that's what they -- you know, they do it anyway.

They have so much data that they can do stuff like that. You know, so we can track things like, well, if we present this kind of user experience for this type of student, do they learn more things? Do they spend more time in the system? Do they hit more material, and try more lessons, and learn at a higher level of proficiency? We can measure that.

And so we have different user experiences for different types of students. Some students get a very kind of Spartan user experience, because they're advanced students, they're dedicated, and that's the most efficient way through the material. Other students get -- you know, it's kind of like the happy, shiny version of the user experience, you know. It's got more badges, and points, and games, and game-like elements.

And over time, we can actually measure what works best for what type of student, and slowly turn their user experience into what works best for that particular person for that particular subject matter.

So, a little bit of what Google does, we'll be able to do -- except armed with a lot more data.

Now in terms of Amazon, obviously, we're a recommendation engine, my company, for education. So, the big difference, and what's so exciting about being a

recommendation engine for education versus being a recommendation engine for Amazon -- or for Google. Google's a giant recommendation engine -- and as much as we love Google, Google is largely -- their product mostly fails.

I mean, how many of those links do you click on? You click on three or four of them, right? There's 10 pages of links. Most of them are garbage. You know that. That's okay; their product still works great, because you know how to use the product. But, you know, there's something about that product as a recommendation engine that's failing, and we don't want to replicate that part of it in our recommendation engine. We want all of our recommendations to work.

Fortunately, we have a much easier problem than Google, because nobody's tagged all the world's web pages down to the sentence for Google. But if they had, there would be no interesting correlations between any of those pages anyway. They're all just independent stuff.

And everything in education, every concept, is, to some degree, predictably correlated with every concept, and that's noble in advance. And so if people tag all of their stuff to us, we can produce recommendations that don't fail -- or virtually never fail. And when they do fail, the engine can learn. It can teach itself, and it cannot make that mistake again. And that's what we do.

MR. WEST: Okay, Christine has a question from our web audience, if we can bring a microphone over, sir -- or excuse me -- Stephanie, and she has her own microphone.

STEPHANIE: We have a question from Lawrence Swiader, who works with Digital Media for Learning and Behavior, and what he asks is:

"The promise of realtime feedback in education seems to inch us closer to a mastery learning model. How will grading change?"

MR. WEST: Interesting question. How is all this going to affect assessment and grading?

MS. CATOR: I think Jose kind of addressed that earlier, but I think what happens is, this notion of knowing once a semester is, you know, potentially going to completely evolve. I mean, some of you heard me talk before about this notion of a learning positioning system, right? The notion that you could have a system that is like your GPS -- you're driving along, and it knows where you are, it knows where you're going, it's giving you recommendations about how to get to where you're trying to head.

If the same thing, you could do that for, say, the domain of mathematics, right? So, here's where you are, here's where you've been, here's what you've learned, here's where you're going, here's what we recommend your course be. You know, make it -- say if you turn, and go back over there, and learn this stuff again before you continue on -- I mean, there are a lot of sort of -- we could take this a long way.

But, you know, that, I think, is partly -- in that case, the notion of a grade that somebody assigns to you that's an external assignment becomes maybe less necessary. I think there's always -- I don't know always -- there's still definitely a place for, you know, some sort of a person to, again, observe your performance, and see what you're doing, interact with you.

But I think that this whole notion of kind of grades is potentially -- could move to this -- much more of a notion of mastery and performance, and letting you know where you are, and where you've been, and where you're going -- again, busting out of this kind of, "You're in fourth grade, and you do this," but rather, "You're on the field of mathematics, and where are you going next?"

MS. BARTH: Probably, you know, instead of a grade for a course, we're going to see more scoring against individual standards or concepts, however they're

defined. And some of the data systems existing now already have the capacity to drill in and link student performance to individual standards. They're building those systems. So, I think the reporting of that and the recordkeeping will evolve. You know, parents will need to be used to it, of course. They want to see that A, B, C, or D, but it will happen.

MS. CATOR: And I think --

MR. WEST: Actually, my doctor is currently doing this on health data. Like, I go in and get my cholesterol test, and I get a readout saying, "Okay, you're 10 percent above the norm for my patients," although I don't know who his patients are. Like, is it a bunch of 75-year-old guys with high cholesterol?

MS. CATOR: That's where privacy comes in. They don't want you to know.

I'd just say -- so back -- just one sentence of this -- is that then you can move to proficiency. So it's not about, "You got a C, but we're moving on, because that's over," it's about, "You have a little more work to do on this," and you stay in that space, and don't really leave it until you can actually be proficient. I think that might be what the -- asking the question was about.

MR. WEST: So, there's a lot of hype about education and big data. So, if we flash-forward five years from now, which of the things that we're currently talking about are most likely to have been implemented on a widespread basis? Because, you know, scalability's the big challenge in all of K to 12, especially.

MS. CATOR: I think personalized learning. And I think all of this -- where we're going with all of this is personalizing the environment. And to personalize the environment, we need more information about the person. The person needs more information about themselves. The teacher needs more information about all of their people, all their learners in their classroom. Parents can do better when they have more

information.

So, all of this leads to this opportunity to personalize what's happening, and bring in not just different pace and different interventions, but also your own stories, your own languages, your own interests, to really create an environment that is much more personal.

So, I think that we will see that within the next five years. I think we will have sort of every person with their own notion of who they are as a learner. And I think student agency is going to be hugely improved at that point.

MR. WEST: Jose, what's the most promising thing that will be much more common five years from now?

MR. FERREIRA: Well, I'm going to agree with Karen, and say personalized learning.

And so think what that means. You know, in the entire education system that we have -- and it's always been like this -- shoot, was it Winston Churchill who said, you know, "Capitalism's the worst system in the world, except for every other system," or was it -- it was Churchill, right? Or was it Truman?

MS. BARTH: Quick, somebody Google it, yeah.

MR. WEST: I think it was democracy.

MR. FERREIRA: Democracy -- I've seen it used for both, yeah -- democracy.

Anyway, so the current education system is the worst system in the world, except for every other system. You know, it was built in the 1800s, and it's a factory model. It's an assembly line model. Everyone has the exact same thing. Like, they're literally -- students are just widgets on an assembly line.

And that sounds really impersonal and awful, but, in fact, it's only

because we use those assembly line efficiencies that we drove cost down to the point where the western world could institute mandatory K-12 education. And every single thing you enjoy today in the modern world is a result of that, so it was a pretty great thing.

I happened to hate it. It was really bad for me. And it was bad for me because it's awful, at some level, to ask every child in the world, "You should figure out, all by yourself, this monolithic bureaucracy, full of arbitrary laws and perverse incentives -- arbitrary rules and perverse incentives, and you should just figure out how to survive in that, and thrive as best you can." That's a crazy thing to ask a child, and that's what we ask every child.

And personalized learning is going to end that. The system should adapt to them, and it will.

Now here's what it can actually do: a unique study plan, a unique path forward each day, optimized for that kid. In some cases, it'll be easiest. In some cases, it won't be. In some cases, we'll learn about the child -- that actually, this exercise over here is actually a little -- this kid will struggle with it a little bit more, but it's better for long term attention, so that's what the kid's going to get.

But whatever it is, it's going to be the deepest long term for that kid. And there's going to be a lot of other ancillary benefits. Who's your optimal online tutor? You know, what are your optimal study habits? What should you eat in the morning? You'll be able to keep a diary. You know, "Here's what I ate every day for a semester. Turns out when I eat scrambled eggs, I do the best that day cognitively. I learn the most concepts the fastest, at the deepest level of retention." We'll be able to tell you things like that eventually.

We'll be able to tell you, "Hey, you know, you're on track to get a B- in this course, you know, based on the way this teacher's taught it for the last four years.

But if you work another 30 minutes an afternoon for four days a week, you'll bring it up to a B+."

We'll be able to tell you an incredible amount of stuff.

MR. WEST: Right here -- near the front, there's a question.

MR. SY: Hi. I'm Gary Sy. I was a former teacher for five years, two with Teach for America. So, I mean, we do a lot of data performances in the class, and I think the key difference for a lot of teachers is that it takes a lot of time to measure that data.

And we also have to kind of recognize the split in this conversation -- where Knewton is talking about data outside of the classroom, whereas I think you guys are talking about data inside the classroom.

And so you guys are right in that there is this kind of trend in personalized data and analytics for the both of you guys, but more specifically, like, where are you guys -- what -- I guess, where do you see hybrid learning models taking off? We have people at New Classrooms, School of One, Education Elements, who are trying to personalize education, and it's hard to scale that, because data in the classroom is not very granular.

MS. BARTH: It's messy, isn't it? And I think one of the complicating factors is that, to many Americans and their families, school is as much a community place and a social place as it is a place where their children learn.

And I think that brings about some tension -- not just with teachers, but with parents, about, you know, how much individualization do they really want -- you know, that they like the interaction of the classroom and some of these traditions.

You know, I think that will happen, and I think a lot of it will be driven by the students themselves, because they're very savvy, and they bring that into the classroom. And I also think that, you know, the school leadership can send messages

through their policies, by trying it out, and monitoring it, and supporting it, and allowing the teachers to see the value in that -- and the parents and the students as well.

You know, nobody is going to be able to say, “We’re going to do this,” and it will happen. It will take some time, and it will happen in varying degrees in different places. But it will happen. It’s inevitable. I can’t imagine anything stopping it at this point.

MS. CATOR: I’d just add to that, to say two things.

One is, I think that -- I’m speaking for myself -- I’m not talking about in school or out of school; I’m talking about learning. And it takes place a lot of different places. And as we can begin to way better connect in school and out of school learning, and not say, “This is where you learn, and this is the data we care about,” but rather say, “Here’s who you are as a learner, and let’s begin to collect and understand who you are, based on lots of kinds of data that are going to be available to you.” So, that’s one thing.

The second thing is that this absolutely -- this kind of learning is fully participatory. So, nobody should go away thinking that, “Oh, this is about students, headphones on, online, working through something so that we can collect a bunch of data, and we can tell them where to go next.” That is not the visual that you should take away.

The visual should be about a very participatory, very engaging, very personal environment, whereby you are connecting with other people. You’re working on complex projects. You’re solving complex problems. You may be working on a team with students from other geographies. You might be working outside of school, inside of school, accessing the tutor that a system tells you is the best possible tutor in this next 10 minutes that you can possibly access.

So, lots of parts and pieces -- very participatory, very social, very

interactive. At the same time, all of these things generating, and helping you by providing to you lots of data and information.

So, the notion of blended learning is funny term right now, I think, because classrooms have always been blended, right? They're a blend of, you know, individual work, and group work, and teacher-directed work, and reading a book, and all sorts of things. Now we're just adding another element to that, and, say, there's a lot of digital -- there's a whole digital environment as well -- so we can blend that in now as well to the classroom.

And that provides us a lot of new opportunities that we just did not have before. So, I think that's the interesting thing about blended learning.

MR. WEST: There, on the aisle, about halfway back.

MR. COFER: Hi, I'm Todd Cofer. I'm the cofounder of a learning analytics startup based here in D.C. I've been doing my graduate work at Georgetown on big data and education.

And I'm interested to hear about how you envision parents getting involved now, as we move from this reactive, you know, two or three times per semester feedback loop to the more proactive, realtime approach that I envision Knewton and others pursuing down the road.

MR. WEST: It sounds like parents will be able to give grief to their students on an hourly basis, as opposed to once a semester.

MR. FERREIRA: Right, exactly.

MS. BARTH: Yeah, and just what they want.

MS. CANTOR: It would text them and say, "Pick up the pace."

MS. BARTH: Yeah.

MS. CANTOR: "Pay attention."

MS. BARTH: Well, I don't know. We're already seeing some of that in early stages. There are portals in a lot of districts that parents can monitor their students' grade, they know if they turned their homework in the day before. It's nothing nearly as sophisticated as where Knewton is going, and we can see in the next few years.

But that process of parents at least getting accustomed to that is already beginning. So, I think it will be more of a gradual growth. It won't be all of a sudden, you have all this information available to you. They're already getting feedback, many of them already getting feedback every day, if they want to.

Of course, there's -- that's not true in every district, you know, and that's something we always have to pay attention to --

MR. WEST: But there --

MS. BARTH: -- that those resources aren't available everywhere.

MR. WEST: But there's kind of an implication in his question, that students are not going to like this --

MS. BARTH: There's a good chance.

MR. WEST: -- like, either a company monitoring them, or the teachers monitoring them, or parents having the potential to monitor them. Like, is there a risk of backlash from the students?

MS. BARTH: There's a risk of backlash from the parents as well. When I hear -- we -- when you talk about homework -- I don't know how many parents are out there, but I hear a lot of parents complaining about a lot of homework. So, there could be a little bit too much --

MR. WEST: That's only because they can't do it, you know.

MS. BARTH: That could be part of it, but --

MS. CATOR: I think -- yeah, I -- oh, sorry.

MS. BARTH: Go ahead.

MS. CATOR: Well, I was just going to say, this whole notion of parent engagement is really interesting. Parent and family engagement in the past has been, "Let's figure out how to get parents and families to come to school, because that's where learning happens, and we want to meet you, and we want you to see what we're doing, and we want to talk to you about what's going on."

Now we have this opportunity to send learning into the home, through these digital means. So, when a student comes home, and the parent can't help them with their homework, they can get online and help. The parents also can get online, and, like, figure it out, and then help the student.

The whole notion that the information can flow to the parents wherever they are -- it's a huge opportunity. The -- you know, moving learning into the home, moving the education experience into the home should be -- should exacerbate the opportunities for parent and family engagement in a really positive way.

MR. WEST: There's a question right back there. Yeah.

MS. ROBINSON: Thanks. I'm Alison Robinson. I'm Director of Learning and Development Programs at the Human Rights Campaign.

I'm really interested in your thoughts about how this cycle works -- this cycle of, you know, data gathering, mining, analysis, interpretation, and then application to the learning experience -- how that works for skills-based learning.

So, the context here is, you know, we teach -- we do cultural competence and diversity inclusion training in all kinds of organizational contexts -- and say that cultural competence is about more than having a body of knowledge; it's about developing a set of engagement skills.

So, how do you measure that? How do you analyze it? And how do you

-- what's -- how do you gather that data, and what's the usefulness of it?

MS. BARTH: There are -- there's a lot of work happening right now in developing ways to measure things like cultural competence. A lot of the 21st century skills -- you know, collaboration, and, you know, creativity -- it's somewhat -- it's not in its infancy; it's in its toddlerhood at this point.

But they -- there are a lot of really good minds looking into ways to measure that with validity, and with the kinds of performance that technology is able to capture. You know, so it's -- so they're very rich assessments, but it is information that you can trust. You can see what it looks like, and when you can see what it looks like, it makes it more -- much easier for a teacher to teach it.

I think we're going -- some of that is being embedded in -- certainly, a lot of the 21st century skills are being embedded in the common core assessments that they're working on right now. So, I'm really optimistic at what we'll be able to accomplish in filling in all of those skills areas.

One example -- and actually, I'd love Jose to weigh in this, and -- is around -- and this isn't the example you used, but something that's hard to measure is persistence. So, we know persistence, grit -- you know, whatever you call it -- is -- you know, people starting to talk about more and more, about how important that is to kind of success in life. Like, you need to, you know, be able to struggle with hard things, and persisting, and go at it.

And so, you know, one of the next policy briefs that we're doing is to say, "How do you measure this? What are the emerging ways of measuring those -- you know, something like persistence?" So, stay tuned. Hopefully in the next couple of months, we'll have a paper like the one we did on educational data mining, focusing on the evidence around persistence and grit.

But as such -- I don't know if I can ask a question of Jose, but I would love to know kind of -- can you tell from your data -- like, what are the kinds of things that you look at that will help you understand the notion of persistence, and help students get better at it?

MR. WEST: That's a really good question.

MS. BARTH: Thank you.

MR. FERREIRA: Well, so we're in early days still, but we're doing some things now -- and we have high hopes for the future.

The things we're doing now are, we're measuring overall activity and effort. So, we can measure how much people are trying. So, when students are struggling, right, are they struggling because they're just not trying, or are they struggling because they're trying a lot, but it's all at the last minute, or are they struggling because they're trying a lot, and they're struggling anyway, right?

And those are all very, very -- like, obviously different groups, and with different conclusions. And so we're able to give back to the schools -- you know, kind of like a metric around, you know, "Here's their proficiency, but -- and here's how much they worked, right?" So, you know, didn't do any work and not very proficient is a lot -- in some ways, less worrying than isn't very proficient and did a lot of work.

And so certainly, they're candidates for different types of intervention. The one is a candidate for, like, immediate kind of, you know, surgical tutoring intervention, and the other's a candidate for kind of motivational intervention.

What we hope to be able to do in the future is just get much more sophisticated about things like that, and be able to tell things like, so to what degree does confidence impact persistence, and other things like that. And so we can probably tease out things about confidence with time.

So, for instance, an example: You give a student a math question. It's algebraic, and it's a hard question -- top 14 percentile. Only 14 percent of the population get it right. This student gets it wrong. You give her the exact same question, the exact same concepts, but now it's in a word problem format. Or you give her the exact same question. You give her a couple of warmup problems first. Now she gets it right.

Well, that tells you is that she never had a conceptual problem, because she could get that concept right at that level of difficulty. The problem was a confidence problem, right?

And so that's really useful information. Can you imagine -- going back to the parent question, imagine telling a parent, "Hey, your daughter's better at math than she thinks she is. She has a confidence problem. You should know that, right? She should know that."

And to what degree do people opt out because of confidence issues? Like, "Oh, this problem's too hard. I hate math. I'm getting discouraged. I'm just going to stop, right?"

And maybe some people don't, because of persistence. But maybe -- I'm just as interested in the persistence measurement as -- well, the reason I'm interested in persistence measurement is because I want to be able to figure out how to fix it -- you know, how to encourage people who lack it -- through these kinds of analyses.

MS. BARTH: I just want -- because you asked specifically about cultural sensitivity -- and, you know, a low tech way of getting at that is a really well-constructed student survey. And some of the -- actually, some of what the Gates Foundation has been uncovering is that student surveys can be pretty accurate assessments of what's going on in a school.

MR. WEST: Okay, I think we have time for one more question. There's

a gentleman right there with his hand up.

MR. DULL: My name is Frank Dull. I'm an international consultant. I wander around the world, trying to advise governments how to improve their educational system.

This is all fascinating, but it would have nothing to do with the reality I'm looking at in third world countries.

But to put you right on Churchill, being a Brit --

MR. FERREIRA: Thank you.

MR. DULL: Churchill actually dropped out of probably the most prestigious school in England in its day. And of course, he came from a very rich family, so he could do anything he wanted, whether he dropped out or not, and he was fairly successful, as we know.

But let me get you to the point that I'm trying to make, having given -- shared that anecdote. And the point is this: The big missing element in all of this, if we're rushing into new technologies -- and I was part of the system's approach to education in London many, many years ago that didn't work -- educational TV and radio was going to transform the classroom, and give us all a marvel.

We're moving into -- very fast into new technologies that are fascinating for those who play with them, but unless they can be brought to scale, and unless we actually deal with the real issue in society, which is the -- what I call the poverty doughnut hole in society -- that is why many, many students drop out and don't succeed -- because they come from very poor backgrounds.

How would you say your technology would deal with some of the issues that we're facing there? And those are perennial issues in every society. I'm not sure that technology's come along to help us deal with those issues. And if we look at any

kind of statistics at the moment in education -- certainly in this country and elsewhere -- we'll see that that is an important contributing factor to performance -- performance in learning, performance in achievement, in all the things that we're all about, when we talk about measurement, and assessment, and so on, and so forth.

So, how will this get us around that real problem? Because there are socioeconomic issues. These are class issues, in every society, and I'm not sure we're getting around those with new technologies. In fact, we're actually leaving this particular group behind by jumping ahead with new technologies.

I'm wondering whether -- by throwing that into your discussion, we might not be able to get to some of the issues that are really, really operant in our society at the moment, and that we aren't dealing with very quickly or very well.

MR. WEST: Thank you. Good closing question here.

MS. CATOR: So, you ask an incredibly important question. And I would say first that technology is absolutely not a silver bullet, but education is.

And so to the extent that technology can be put in support of a much better education opportunity, that's where we need to go, and that's where we're going.

The reasons technology supports a better education opportunity is, number one, access. So, we've talked today about people who may go to a classroom where their teacher isn't necessarily the best at teaching this particular concept, but there are all these other scaffolded supports for understanding something, because now you can access things that you wouldn't have had access to. You can access courses that you wouldn't have had access to otherwise. You can access explanations, and environments, and simulations, and models, and visualizations of complex concepts that you wouldn't have had access to otherwise.

If you're blind, you don't need a special book; the technology can support

your access to what's on the screen. So, the accessibility features support a better opportunity to access education.

So, as we -- feedback loops. That's another thing, right? So, technology provides for more rapid and more frequent feedback loops based on a lot of this data that we've been talking about today.

So, without that technology, students wait to be told what to do next, and they wait for the teacher to -- as their only feedback point, in many cases, in many classrooms without technology.

So, we are not in favor of technology just for technology's sake, but we're in favor of technology to the extent that it can vastly improve the opportunity to learn for all Americans, and that is specifically important for those students who don't have access outside of school.

So many children today don't have access to technology outside of school. We like to say, "Oh, kids are digital natives. They all have access." That's actually not true. And there's a growing gap between what people do with technology.

And people who learn to use technology for personal empowerment, to help themselves learn, to access information, to access government services, or health information, or the like -- that's an empowered use of technology. And then there's a gap between those people and people who use it strictly for entertainment and maybe light communications.

So, education is the place that we're going to move people towards, using this sort of new world of highly accessible networked infrastructure, content, materials, tools, and the like to support that opportunity to learn. It's a great question. Equity is unbelievably important.

MR. DULL: Of course, to do all of that, you need more resources. We

barely have the resources that we need in order to run the systems that we have. And those resources are limited, budgets are going down.

We don't have enough teachers -- or at least, we don't have enough of the right sort of teachers to teach the right -- in the right sort of way, the sort of subjects that we need, so that we can give the next working population the skills they need to be able to meet a changing world.

So, if we don't have that, how are you going to be expected to do what you're going to do, when you need an enormous layer of expertise and supportive resources in order to be able to do that?

This is what really worries me.

MS. CATOR: Sure.

MR. DULL: We're adding one hurdle on top of another hurdle, without even solving the problems that we have now. We need to solve those basic problems first, before jumping ahead.

And technology is fun. Yes, I love it, too. It is fun, but it isn't fun for people who never access it, who could never access it, and who probably don't have the resources, or the time, or the incentive, or the motivation to access it.

MR. FERREIRA: I'll jump in. Patte, do you want to --

MS. BARTH: Well, I was just going to -- I was going to agree with Karen, but also, resources are an issue.

But let me -- in addition to extending the talent of the teacher -- which we've heard how technology can do that, by helping to provide an equal opportunity to learn -- absolutely.

Does it require resources? Absolutely. You know, and that's something -- that's a decision we have to make as a society.

At the same time, another thing technology does provide -- and it's where we started this conversation -- and that's the data. And once we have a policy that all students are going to learn to this level, and we know what that -- we have defined those standards, and we now are able to monitor students more closely, to see where they are in that continuum -- which means it's harder to -- for kids to fall out. And it's because we can pay attention, and we can intervene when we see these early warning signs.

We can accelerate when kids come to us in kindergarten, lacking the skills that their classmates have. You know, when we have that data, we know where the children are who need help, we can then get them the help. And we can monitor what we're doing to make sure that what we're trying to achieve is actually producing results. If it's not, try something new.

MR. WEST: Jose, we'll give you the final word on technology and poverty.

MR. FERREIRA: Thank you.

So, there are exactly two things that information technology does. Every online company you've ever heard of, every software company does one of two things: distribution and personalization via data mining. That's it. Every dollar created by Amazon, everybody else -- distribution, personalization -- that's it. Some companies do both. Many just do one.

We have -- my company does personalization, but we actually do it because we have a strong social mission to increase distribution. In fact, Knewton is a double bottom line company. We're trying to do well enough in our commercial businesses that we can just give it away to the developing world.

So, what is the "it"? The "it" is the distribution of the materials. We're

encouraging as many people to tag content to us as possible -- not just the publishers who pay us and the schools who pay us, but practitioners.

In fact, we're producing an open platform, which we expect to launch late next year, which will be entirely free for the developing world to use. Anybody can go take any content that they own -- or Wikipedia, YouTube, EDEX -- any content that's available online.

And by the way, if you haven't ever done it before, go Google some academic concept, and then click on page five, and see how much free open content you get from teachers and professors. It's all unusable, because it's, like, a purple font and, like, you know, green background. But they copy. They'll be able to copy/paste that for free to us, to our platform, and make it adaptive. They'll have the full power and functionality of everything we do for free -- on not just the content that they put in there themselves, but in any content they find.

It's like -- it'll be the world's -- you know, it's this huge treasure trove of free content. Now all you need in the developing world for students who have no access to school at all is an iPad and broadband.

And I know the team in Google who's providing broadband for, like, all of Africa. So, people are solving the broadband problems, and there's going to be cheaper and cheaper tablets, you know.

Online education is going to be a godsend to the developing world. Online education has a chance to deeply impact poverty globally, because education has been, like, the unfair advantage the western world has had, because the infrastructure on education is immense.

Now think about how the developing world went right to landline telephony. Why? Because -- I mean, to cellphone telephony. Why? Because landline

telephony is expensive.

Landline telephony costs nothing compared to the infrastructure of education. So why does only 78 percent -- I mean, why does only 22 percent of the world complete high school, you know, or 54 percent of the world complete sixth grade or equivalent, right? It's because education infrastructure is expensive.

Now if, in the short term, developing world countries can skip right to online education and get kids who don't have any education at all, the best teachers in the world on archive video -- or in some cases, live video -- and the best software in the world, and you can measure what content is the most effective for kids just like that, and give them that content, well, that beats the heck out of nothing.

And if you blend that in with, you know, they still go to the local school one day a week, or two days a week, or whatever they can afford -- the country can afford, right, and, you know, you've got a very strong education system that grew up, and that just obviated the whole unfair advantage the western world had.

And I believe online education is absolutely -- it is the only thing that will solve the global education crisis -- access crisis, and that is the key to solving global poverty.

MR. WEST: Well, we're going to close on that very optimistic note.

And I want to thank Jose, Patte, and Karen for sharing your views with us.

Thank you very much.

* * * * *

CERTIFICATE OF NOTARY PUBLIC

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.

Carleton J. Anderson, III

(Signature and Seal on File)

Notary Public in and for the Commonwealth of Virginia

Commission No. 351998

Expires: November 30, 2012