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A NATIONAL DIALOGUE:

THE SECRETARY OF EDUCATION'S COMMISSION ON THE FUTURE OF HIGHER EDUCATION

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CONTENTS

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William Berry	Rick Stephens
Nicholas Donofrio	Sally Stroup
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P-R-O-C-E-E-D-I-N-G-S

8:45 a.m.

CHAIRMAN MILLER: I'd like to call the meeting to order. As the first and maybe most important order of business, could you please turn off your blackberries and let your cell phones vibrate. We feel better silently. It affects the sound system quite a bit, so we'd appreciate that. We're trying to record these things for other people to be able to see in other places. So we'd like that, if you don't mind.

We had part of the agenda for remarks by Secretary Spelling. She's off doing the duty as a result of some of the initiatives from the President's State of the Union. She regrets not being here. She was really looking forward to hearing these panels. But I think we'll be able to do good work, and then give her a report.

We're ready, unless any of the Commission members has something they need to ask or say, for the panel. So if we could ask the panel to come up.

I want to announce that in the May meeting -- we scheduled a mid-May date -- we're going to meet in Washington, DC. We've done a good geographic dispersion, County of Seattle meeting next week, and a Boston meeting in March, that we've been

in other parts of the country. Most of our commission is centered in that part of the universe. We have lots of capacity to communicate there, and get to and from. And the staff is mostly there, so we're going to make the convenient decision to have that meeting.

That would be one that would be more in the format of a retreat, although it could be right in the heart of the city, in the sense that we'll have mostly Commission members communicating and debating each other, and less input from outside sources perhaps. By that time, we'll have done a lot of written work. That would give us the time to look into the summer for hashing out things where we need to, or improve it. We might then have a final meeting for some types of votes or approvals in mid July, for example, sometime before the August 1 deadline, maybe without a physical meeting necessary.

UNIDENTIFIED MALE SPEAKER: Do we have a date in May?

CHAIRMAN MILLER: Yeah, there's a date set aside.

EXECUTIVE DIRECTOR OLDHAM: The 18th, 19th.

CHAIRMAN MILLER: It'll be a Thursday/ Friday format like we've done each way, I believe.

MR. DONOFRIO: We're still on for

Indianapolis?

CHAIRMAN MILLER: Yes. I beg your pardon. There's an April meeting in Indianapolis. We hadn't set the May location. Thank you.

Would you please start in order and introduce yourselves.

MR. OTTO: Yes. I'm Rollie Otto. I'm head of the Center for Science and Engineering Education at the Lawrence Berkeley National Laboratory. I guess you'd like me to proceed.

CHAIRMAN MILLER: Yes. Thank you.

MR. OTTO: First of all, thank you for this opportunity. I'm going to largely restrict my comments today to the science, technology, engineering and mathematics pipeline as it relates to innovation in higher education. Berkeley Laboratory is a multi-program national laboratory. It's operated by the University of California for the United States Department of Energy. It's -- we have at the laboratory several thousand scientists and engineers, a total staff of about 4,000 people. Many of them are graduate students and post-docs. Many of the graduate students come from UC Berkeley. We have probably over 200 staff at the Berkeley lab who are faculty on the campus. However, the laboratory is -- the director of the laboratory reports directly to the University of

California President.

I just wanted to say that my comments today are my views. They don't reflect the Department of Energy, the Lawrence Berkeley Laboratory or the University of California.

I saw in my e-mail this morning a press release from Secretary Bodman that in fact the Department of Energy, Office of Science, budget will be increasing significantly. The Department of Energy's Office of Science is the single largest supporter of physical science research in the nation. This research is carried out at its ten national laboratories and 300 universities. More than 19,000 researchers utilize the world-class facilities at the Department of Energy, Office of Science Laboratories. The Department of Energy in total has 17 national laboratories and 55,000 scientists and engineers.

Why do I tell you this? Well, I think we're here today because the nation's education system has not kept pace with our advances in science and technology. DOE has been one of the major science agencies to lead those advances in science and technology.

The role of the Department of Energy, it will in fact be a major player in science, technology, education, mathematics in preparing the next

generation of scientists and engineers. And I can say that with confidence because it has since its beginning when it started as -- largely maps back to the Atomic Energy Commission.

Largely that traditional role has been for graduate students and post-docs -- thousands and thousands of graduate students and post-docs have been trained in the DOE's National Laboratory system. Since the 1960s, thousands of undergraduate students have had access to those same facilities and the same education and training.

The role of the DOE National Laboratories and the Department of Energy, and the Office of Science in particular, will complement higher education and partner with K-12 schools, colleges, universities, and the private sector in science and technology. The connections to the private sector are already in place. For example, at Berkeley Lab, typical of the Department of Energy National Laboratories, in the last ten years, we have had ten R&D 100 awards. Many of these have been licensed. There are 20 startup companies that are based on Berkeley Lab technologies, and capitalized at $1.9 billion.

The DOE Labs stand apart from the universities and the private sector. We bring

students into the laboratory and provide for their education and training and professionalization, but we don't offer degrees. In the private sector, we develop technologies and transfer those to the private sector, but we are careful not to compete with the private sector in that process.

Now, I had prepared my remarks and submitted them to you, but there was another story I wanted to tell. I'm going to kind of get to my point for my presentation today, and I'm going to use the alternative story. I hope that it works well for you.

I came to Berkeley Lab 31 years ago as a post-doc to work with Glenn Seaborg as a nuclear scientist. I spent a number of years doing that. What happened after that was that, even though I didn't continue in nuclear science research, I followed in the footsteps of Glenn as a mentor in his role in science education. Similar remarks were made yesterday about the success of the reform in science and math education as a result of the Sputnik era in the 1960s.

Glenn Seaborg was the Chairman of the Department of -- of the Atomic Energy Commission -- excuse me -- back in those days. He had just left being Chancellor of the University of California. For those of you who might not know who Glenn Seaborg is,

he's one of the great scientists of the 20th Century, discovered plutonium, remodeling of the periodic table, and many, many other contributions. But he had often talked about the fact that, in those days, he would get together on a regular basis with the top science administrators -- NASA and NSF -- and they would just talk about K-12 education and what they could do about it, and sort of divided up the landscape, and began funding efforts to bring about a change in the way students were prepared throughout our entire education pipeline.

Back in those days, the Department of Energy began sponsoring thousands of undergraduate students to do internships at its National Laboratory systems. Eventually -- well, what happened is that, when I went to Berkeley Lab, after a few years, Glenn Seaborg got involved in the Nation at Risk Report and played a major role in the language in that report. He was really quite adamant. I heard Secretary Spellings speak about the Nation at Risk Report, calling for three years of math and science in all high schools in the nation. He was very much an advocate of that.

As a result of that report, the Department of Energy began to expand its role in what we could do in the science, engineering, technology pipeline. So

we began working with teachers. We began working with the K-12 system in schools. At one point, by the mid 1990s, this role expanded. We had thousands of teachers who were coming to National Labs in the summer doing research doing research internships on the idea that many of our high school teachers in science and mathematics had never actually been in the enterprise. We found that this was making a huge difference.

By the time we had the budget cuts in '94, most of the support for the extended outreach of the Department of Energy was largely cut out of the budget. That had a sort of a ripple effect. But since that time, in the last ten years, that's been rebuilt. Today we have centers, such as the one I head at Berkeley Lab, for science and engineering education which are utilizing the resources of their National Laboratories to impact and improve the quality of math and science education wherever they can and as much as they can. Largely this is done through partnerships with K-12 schools, with universities -- colleges and universities, and we are attempting to address the critical issues that we all know well in our education system, and really having those students be prepared to step into the workforce.

Now, typical -- back in the 1980s, when

all of this started, we set some goals for ourselves. These goals, you'll recognize them, because they really respond to the existing problems we have still today in our science, technology, engineering pipeline. These goals have stood the test of time as something around which we needed to find innovative approaches, again, utilizing the resources of the Berkeley Lab, to address these problems. The goals are to promote equal access to scientific and technical careers for all students -- that's not the case today -- improve quality of science and engineering teaching and learning, increase the number of U.S. students who become scientists and engineers, with an emphasis on those students' groups historically under-represented in scientific and engineering enterprise, and to promote science literacy.

So one of the things I'd like to focus on today, based on our experience and my experience over 20 years of doing science and engineering education in a National Laboratory setting, is to focus on, what are the essential elements of student learning experiences in high education that will prepare them to enhance the science and technology -- and this is a quote -- "enhance the science and technology enterprise so the United States can successfully

compete, prosper, and be secure in the global community of the 21st century." That comes -- a quote from the gather of "Rising Above the Gathering Storm."

So what are we preparing students for today? I'm going -- not being the laboratory director, and being held responsible for this comment, I'm going to say that the next several decades will be marked by an explosion of technological innovation and scientific discovery, and it will be largely in this nation. Now, how can I say that? Well, it's been my experience at Berkeley Lab that what's happening at Berkeley Lab today is what's going to be happening in the future. Therefore, by extension, as we look at those -- at what's happening today in science and technology, we have an understanding of the skills and knowledge today's stem students will need.

I give a number of examples of some of the things that are happening today. But why is it -- why could I make this -- or what is happening in the system today that's different than what happened ten years ago? Our research today can be characterized by the integration of core competencies to solve key problems facing humankind in areas of energy, health, materials, and the very structure of our universe and structure of matter.

We are bringing together the knowledge

that we've gained through, for example, the Human Genome Project, and the investments of the Department of Energy and NIH and others have made in that area, with scientific tools that were unimaginable a few years ago, and computational capabilities. When you bring -- when these three things converge in the hands of your scientists and engineers today, we are able to make advances that we couldn't have envisioned 20 years ago.

I give a couple examples. Remember that the Department of Energy largely funds physical science. But the convergence of these tools is opening doors in the health sciences, for instance. I'm just going to bring out one example of something that is a convergence of a tool. The nanoscience has resulted in little nanostructures that we call quantum dots that literally light up when you shine various forms of light on them. They're so small they can be attached to single molecules. These single molecules can be chosen to find their way into the nucleus of living cells, and you can literally track the pathway of a single molecule in a living cell as it goes about its metabolic functions. We've never been able to do that before. Again, it's that convergence.

We have at Berkeley Lab an advanced light source that's the brightest source of ultraviolet and

x-rays in the world. It's allowing us to do protein crystallography today in a matter of days and hours. Just a few decades ago, it was months and years that we could do that. So we can not only know what the genes are in the human being, we can know the structure of the proteins that are expressed. And beyond that, we can actually look at the complex mechanisms that are actually -- that the proteins are involved in.

So what skills and knowledge will students need in this kind of advanced technology, innovative technology and advanced science discoveries? So with no apologies -- and I know there's been a lot of studies -- this is my own list. I would say a solid foundation in the basic concepts, principles and theories of all fields of science. Ideally this science literacy level of knowledge would be taught in high school in four years of science courses.

As a result of my involvement with Glenn Seaborg over the years, I became imbedded and intricately involved in the setting of the California science standards, in the writing of the science framework, in the setting of subject matter standards for science teachers.

So a second thing is professional level of knowledge of skills in one field of science,

engineering, technology or mathematics. This is the traditional view of undergraduate preparation, and it's still essential.

Ability to recognize and make connections between what they are taught and real-world applications. What we see when students come to us, and are surprised by how frequently undergraduate students miss these connections. The real essence of what they're being taught and its importance is not really apparent to them until they have to apply that knowledge, which they do largely through our primary method of providing internships and access to advanced equipment.

You notice how readily high school students take the knowledge that they've gotten, and they put it in little mental compartments, and nothing's connected. That's another aspect as we reach down to the high schools.

They have to have an understanding of the broad relationships between science, technology and societal issues. They should have an understanding of the nature of scientific inquiry and an ability to apply scientific investigation. They should have math concepts and an ability to use advanced computational tools. They should be able to communicate and collaborate using technology. They should have a

willingness to learn and integrate knowledge from outside areas of their own expertise to solve complex interdisciplinary problems.

One of the things that -- and the last is persistence and willingness to work. Whenever Glenn Seaborg gave a talk, he would always end, work hard, that was the key to success. I think being a scientist or engineer, one of the things that you've got to have is that inclination.

So who should we be preparing? Well, the short answer is all students. We need a scientifically literate population to support the science and technology advances we're making, or we'll basically erode the base. But then we should also have a system that allows people access as long as possible through the education system to not be eliminated from choosing the option of being a scientist, engineer or technician. Not everybody should be a scientist or engineer, and not everybody wants to. But we're not providing a system that provides for making that choice all the way through the system, or entering the system later in life. This is particularly true for those who are impacted by socioeconomic issues related to the quality of their education, largely extending to under-represented minorities.

So it's been our experience that programs

designed around mentored research experiences using scientific tools can address most of the barriers and challenges to developing the skills and knowledge students will need to contribute to the 21st century workforce. It's a powerful strategy and effective for capturing and preparing students who have been historically under-represented. The strategies described have -- that we've used have been built around the principle of mentored research experiences and access to scientific tools. These strategies motivate students to consider stem careers and advanced degrees, they calibrate students to the skills and knowledge they will need, and provide for their professionalization. These strategies provide teachers and faculty with experiences that update their knowledge and transform their view of teaching and learning.

In short, these kinds of experiences should be supported and encouraged, and I would encourage the Commission to develop its recommendations to be sure that these are recognized as an important contribution to the education of the stem work force.

I give a list of activities that we've been doing. I want to just mention one that is kind of interesting, and that's our connection with Laney

Community College. We were encouraged to develop an advanced technological education grant in concert with Laney as a result of the partnership between NSF and DOE. We found that our Building Sciences Group, which was envisioning a major savings of building energy through building energy efficiency was faced with the fact that it was developing new digital-based technologies, and that the community colleges, our local community college, was not preparing students to work with these new technologies. So it became integral to the research program to have a base of an education system that would prepare students for the future. And so that grant is doing that, and it's a wonderful grant. We have a high school component with that in which students are learning physics by building refrigerators. It's amazing how many students -- and they get concurrent enrollment both at the community college and at the high school -- and -- and how many students are interested in doing that.

So my recommendations -- how are we doing on time? Okay? Are we doing all right on time?

CHAIRMAN MILLER: You're doing fine.

MR. OTTO: Okay. Great. Thank you.

My recommendations are to increase support in federal science and technology agencies for research internships for high school and college

students and faculty. Recognize mentors, as the partnerships need to be the colleges and universities, the private sector has a major role to play. I think some of the things we're doing and some of the other things you're going to hear today are models for that. But we need to recognize our mentors, and recognize this form -- aspect of preparing the next generation of scientists and engineers.

We need to track our participants. Oftentimes we're supported to implement our programs, but the resources -- and get as many people into the program as possible -- but we need to be tracking students into this pipeline and through this pipeline, not so much to do a lot of number-counting, but to know where they are, and keep the mentor/student relationships going.

There are some wonderful things happening at minority-serving institutions. I was just at Jackson State University two weeks ago. Out of necessity, to address the issues of persistence at the university into the graduate school levels, they've developed some strategies that are aligned with the idea of providing students with access to advanced scientific equipment. Industry partners and the federal agencies can help these universities attain this kind of equipment and the latest state-of-the-art

kind of thing, so that the students get early access to these. Freshmen coming in can actually be assigned to research groups to work on -- with scanning electron microscopes and scanning tunneling microscopes. I actually would suggest that some of these strategies that are being done out of necessity, and successfully done at black colleges and minority-serving institutions, be looked at as strategies in some of our major research institutions.

Encourage the private sector science and technology businesses and industries to partner with schools and colleges and universities, high schools, and so on. Help them find ways to do that effectively, and feel comfortable doing it, and put their resources in those directions. I think you're going to hear some more about that today. And then fund -- there are successful stem science, technology, engineering, mathematics pipeline programs out there. But oftentimes funding is three years to five years. We really need a much longer investment in those places that are doing the job well, and develop some criteria for longer than five-year support.

Then I think that one of the most important things we can do is to take this concept of mentored research and access to advanced scientific equipment, and push it as far down in the pipeline as

we possibly can. It's amazing. I was speaking with the -- well, the superintendent equivalent of the Oakland Unified School District -- state-appointed -- and I said I was from Berkeley Lab, and I was a scientist. And he said, oh, our kids don't know many scientists, there's not many of you around. And I said, well, I've got about a thousand where I work. So he's very enthusiastic about making that contact between our scientists and engineers, technical staff, and his school system. And we need to find ways to do that. He basically opened the door to do it. But most people don't have interactions with the science and technology workforce, and know very few people.

We're taking advanced equipment out into the schools all the way down to the fifth grade. It's amazing. You don't have to teach a fifth grader how to use a multimeter. You know, our kids today are getting -- have at home technologies that are so much more advanced and that they're used to just using on a daily basis than those available in the schools today.

Finally, the broad picture, to encourage public, private university school partnerships for mentoring and access to science tools and equipment is the final message in the overall message that I bring to you today.

CHAIRMAN MILLER: Thank you.

Dr. Reed.

MR. REED: My name's Charlie Reed. I'm the Chancellor of the California State University.

First of all, thank you for the opportunity to come today and speak with you. I also want to commend Secretary Spellings for creating this Commission. My colleagues around the country and I don't spend enough time thinking about the future of higher education.

Some of you know me, and I'm going to take a risk now and get into your business and say, I have high expectations for you. I would really like to see the intellectual and experience power of this Commission come forward with only three or four big ideas. And I think you can do that. We've got a lot of little ideas in this country, but what we need in higher education are three or four big ideas.

I've submitted my full testimony for the record, so I'm going to proceed as quickly as I can today. The California State University is the largest four-year system in the United States. We have 23 campuses, a little over 405,000 students, and 44,000 faculty and staff.

Over half of our students receive financial aid. Many of our students are the most needy students in California. Fifty-four percent of

our student body, those 405,000, are students of color.

The California State University's mission is to provide high quality, affordable education to meet the ever-changing needs of the people of California. It costs approximately $2800 per year for tuition. We try hard to keep our costs down. The Governor of California just bought out a fee increase of eight percent, which cost him $57 million in the California State University.

The California State University plays a critical role in preparing candidates for jobs in California, and to keep California in its leading position around the world. We work for California every day.

The California State University produces more than half of all the Bachelor's degrees in California. If you take all the privates and the UC, we produce more Bachelor's degrees than they do. And we produce about one third of the Master's degrees in this state.

We play the most pivotal role in preparing the state's diverse workforce, providing more than half of the undergraduate degrees granted to the state's Latino, African-American, Native American, Asian Pacific Islanders, Vietnamese and Eastern

Europeans.

Why public/private partnerships are important: I have believed for a long time as a chancellor in Florida, and now California, that public/private partnerships are the vital life for higher education, and to infuse what we need into the economy. In fact, the future success of our economy and our country are directly linked to the educational attainment of our students.

The California State University recently sought to measure our impact, economically and otherwise, on California's businesses and communities. This study found that our campuses had an economic impact of over $13.6 billion. We were responsible for economic activity that supported over 207,000 jobs, and we think we paid more than $760 million in state taxes to help support this state.

The study further cemented our belief that CSU's work is tightly bound to that of our local communities and economies in these partnerships. Essentially, the California State University sees itself as a bridge-builder between communities, the economy, businesses and the workforce, and improving the quality of life in our communities.

Partnerships now -- our most important and biggest partnership is with the public schools of

California. Given that over 90 percent of our students come from California's public schools, it's important for us to make the public schools as good as we possibly can. We spend a great deal of time doing partnerships and bridge-building with our K-12 partners. And believe me, they have got one big job.

But what we want to try to help them do is to prepare students to get ready to succeed in college. Sixty-five percent of today's K through 12 students in California are students of color. Fifty-four percent of the students in the California State University are students of color. This Commission must pay attention about the future of this country in educating students of color, recent immigrants that have come to this country, because that is changing fast, every day and every week around this country. So I say, we've got to figure out how to do that, and to prepare those students to get Baccalaureate and Master's degrees, and prepare them for the workforce. Preparing them to be ready to go to college, and preparing them to have the tools to go to college is important.

Three years ago, we were trying to figure out, how can we impact every high school? California has more than 900 high schools. At the time, we were in 120 high schools trying to uplift the preparation

of students for college, and we wanted to be in all 900. So we went to the State Board of Education, and we asked them if we could imbed in the California Standards Test for the 11th graders--our placement exam. We call that the Early Assessment Program.

This past year, we tested more than 220,000 11th graders throughout California in April and May. We test them in two ways, in mathematics and in English proficiency. We created this testing program because we wanted to give 11th graders a snapshot as to whether or not they were prepared to come to the California State University. We wanted to give them a chance to get prepared before they got to us.

So we try as hard as we can to turn around our testing results and send 'em back to every high school in California by the 1st of August. And then we ask that high school, will you get with those students, share that information with the students and the parents and your counselors, and change their 12th grade life. In other words, we want them to take algebra II again, or trigonometry, or geometry, or calculus. We want them to take English, English writing skills and reading comprehension in the 12th grade.

I think this Commission knows this, but I

can tell you the 12th grade is the biggest wasteland in America. Very little happens in the 12th grade. So we want to have an early wake-up call for these students, and say, if you want to go to college, here's what you need to do, and do it in the 12th grade, because the resources are already there to do that.

Now, one of the things that I like to do is walk around. I walk around in schools to see how California State University-prepared teachers are doing, and talk to students, and talk to parents. And I do that on my visits to the campuses. Well, about five years ago, it was like, duh, it occurred in talking to these people, when you think about this population that we're trying to serve, their parents have never been to a college or university. They have never thought about what it takes to be prepared to go to a college or university.

So I came back to the office, and I said, we need to get the word out to the public schools. It's our responsibility. Because they're coming. They want to get a Baccalaureate degree. So what we did is we built a poster, and I have distributed more than a half million of these posters throughout California on how to get to college.

Now, if your brother and sister or your

parents have never even been on a college campus, let alone thought about what you have to do, it's scary. We're scary. So what we did is we pushed this down into the sixth grade. Down this side, it's six, seven, eight, nine. And down this side, it's 10, 11 and 12. Down through the middle of this poster it says, here are the tests that you need to take, in addition to these courses. Here are the scores you need to get.

And you can get financial aid. As I said, more than half of our students can get financial aid. We provide 25 percent of our students full financial aid if their families make $60,000 or less. But they don't know when and how to apply for that.

Now, when you think about our population, we printed this in Spanish. I made a mistake the first year. I asked somebody to translate this into Spanish, into proper Spanish. Well, do you know, there is no such word in Spanish for "scholarship"? So we went out on the street and redid this and printed it in street language so parents could understand it. I have had citizens come up to me and say, I'll send you a check because I want every kid in the seventh grade in Ventura County to have one of these posters for their bedroom.

Well, since this time, we've formed

another partnership with our Boeing friends. With Boeing, we've printed another half million of these, and we have been asked this past year to print these in Korean, Vietnamese and Chinese and Mong languages, because those parents are comfortable reading it in their native languages, and they can really help their kids.

Now, outreach is the key to working with our partners, the business of California. So we took an economic study that we had completed and identified the eight largest businesses, and identified the populations -- the ethnic populations that are coming through the CSU, and decided that we wanted to go listen to the businesses and to the ethnic population about how the CSU's doing, and what we needed to do. Now, that's difficult in higher education because most of us talk all the time. So I asked the presidents to come with me, and the deans, and the provost for those programs. The biggest businesses in California -- agriculture, the science technology, aerospace, information technology businesses, the movie, television, entertainment business, hotel/restaurant management business, biotech -- all those businesses -- we invited between a 100 and 150 of the most influential business leaders to come. And as I said to the deans, we are not talking; we are

listening. And we want to listen about what higher education needs to do for the 21st century.

Now, what was really interesting to me is we said to ourselves, let's meet with all these people and hear what they have to say for a change. And we did. Whether it was the ag. industry, the biotech, the movie industry, the entertainment, hotel, restaurant, the engineering, Silicon Valley, the information technology, they all said the same thing. Number one, they're looking to hire graduates that can communicate in writing and orally, because everybody makes presentations today.

Number two, we want you to teach these students to work together in teams, because our researchers and our marketing people, or our accountants and our sales people, have to be able to understand each other.

Third, they said, your students need to be able to and willing to accept change, because our field is changing so rapidly.

Next, they said, your students need to understand how to use technology. The ag. guy says, you know what? We milk 10,000 cows a day. Nobody touches those cows anymore. It's all done with robots and computers. The guy that plants the lettuce that we probably had here last night, he said, you know, we

do that with the computer. We decide where we're going to plant it, how much fertilizer's gone in there, when we're going to cut it, how long it's going to take to grow, and we have ordered the truck to back into the warehouse to pick it up to take it to the East Coast. With one push on that button, all that happens.

Next, they said, we want you to teach students more than one language, because California is in a global world economy. Students that can only speak one language aren't very important. The guys in the ag. industry simply said, if you don't teach 'em Spanish, we can't hire 'em, because that's where our workforce is today. The movie industry said, you know, we sell more movies in Asia and Mexico than we do in the United States.

Now, we also heard that they want our students to be aware of the globalization and the larger world. Finally, they all kind of end up saying, and we want students to be willing to do the grunt work when they start, not be in charge of this company at the end of the first month.

(Laughter.)

We have since formed task forces of all of our deans in each of those disciplines. Those deans have to report back to me, and I have to report back

to those businesses and industries about how we're doing. But you know what? They want to help us reform what we're doing because they want to hire our students so that they will be more competitive.

I can tell you that in the ag. industry, we went to the Governor and said, the applied research need is great in California for the applied area of ag. The industry has said to us, if you can get some money from the state or the federal government, we'll match it more than two to one every year. That partnership has worked now for the last five or six years.

We went to the biotech industry. As you know, the stem cell effort and the bonds -- well, we're still waiting for them to be sold, but there's $30 billion worth of work out there. Well, that industry and our colleagues at the University of California and Stanford have the researchers, but they need the workforce in those labs to be successful. So we have formed a partnership with the biotech industry.

Some of our most important partnerships are with the communities. As we met with business and industry, we also have met with the communities and the ethnic communities. For instance, I have spent a lot of time in Southern California and the Oakland

area meeting with the African-American community. We have done that through their churches. The West Angeles Church is the largest church in Los Angeles. They have about 20,000 members.

The bishop has invited us to be his partner. On February 26 -- and this is after about five meetings -- the black churches of Los Angeles are having what they call CSUPERB Sunday. Myself and my colleague presidents are going to be speaking at all the services on February 26th in the Los Angeles Basin. And we're doing the same thing in Oakland with the African-American community, again, focusing on what does it take to go to college? How can we, through our outreach programs, get into those homes?

We're doing the same thing with the Latino community. We've formed a partnership with a group called PK, where we are going to adopt 125 elementary schools as partners, and teach the Latino mothers -- the Latinas -- how to manage their children and to focus on what it takes to go to college, to see if we can be successful there.

But the same thing with the Korean, the Chinese, the Vietnamese, the Mong communities. We have met with all of them, and we want to continue to meet with them throughout the year.

Now, with these experiences, what can I

recommend that this panel consider?

One, think about federal programs that can incentivize and help fund model business and industry partnerships.

Two, look at an increased federal emphasis on applied research that trains students to have practical knowledge about what it takes.

Three, incentivize partnerships between universities and communities. I am very proud that California State University students, the most needy students in this state, contributed last year 34 million hours of service back into the community -- tutoring, Meals on Wheels, senior citizens. But those students got a better education because of that community partnership. Think about incentives to get universities to build partnerships with high schools to better prepare students to go to college.

I think all of these partnerships, and many others around the country, are working, but we have got to continue to focus on the future of higher education. And the future is tied to a lot of under-served students and families. Many are immigrants. Many are the first in their families to ever have a chance to go to college. That's who's coming to higher education in this country.

Thank you.

CHAIRMAN MILLER: Thank you, Dr. Reed.

MS. POINDEXTER: I was about to start clapping.

(Laughter.)

CHAIRMAN MILLER: We save the applause until the third presenter.

(Laughter.)

MS. POINDEXTER: Well, good morning. My name is Monica Poindexter, Associate Director of Diversity and College Programs for Genentech. This is a very, very kind of personal testimony for me in many ways, because this panel, at least for me, I didn't know what they were going to be speaking about. Listening to the comments this morning, I'm a product and a native of Oakland, California. I went to UC Davis, and I participated in under-served minority programs that are no longer being funded in the State of California. I know without my participation in these programs at an early age, in elementary school and in high school, and in college, I would not be sitting before you today. So if you ever want to know the reality around what public programs can do for under-represented minorities in academia, let me be an example.

So today I'm here to really talk about creating and maintaining effective partnerships. This

presentation here has just pitched me up perfectly. So thank you for setting the stage for my presentation. The title is "Bridging the Gap Between Government, Academic and Industry."

Many of you know that at Genentech, we are the first biotechnology company in the world. We were founded in 1976, which means that we are now getting ready to celebrate our 30th year anniversary since we opened up in 1976. We develop and manufacture drugs for medical unmet needs.

Progress involves change. Progress involves taking risks. Progress involves doing things differently so you have a different outcome. As the Secretary of Education Commission, what is being done to do things differently in education? When you look at high-growth industries like biotechnology, we are rewriting textbooks, medical textbooks, technology every day. When we look at the education work- -- our future workforce, based upon the curriculum that is being designed and developed in the education system, is it current? Is it relevant? Is it going to produce the diverse workforce that we need in industry?

Some examples that I'm going to be talking about are some of the industry demand-driven partner-ships that we at Genentech have developed out of a

need and out of relationship. And I think you've heard here in many ways that the success of industry demand models have been based upon seamless partnerships with our communities, with academia, as well as finding a way to integrate government in how we do our business and how we direct funding to under-served population, but also to programs that are going to be progressive, and design curriculum that will meet our needs in a just-in-time workforce environment.

When you look at manufacturing and having to get products out to the end patient, if we do not have a qualified workforce at the entry level that understand the basic skills of math, science and oral communication and written communication, that all affects where we have to go for our pool of talent. The State of California, the education system, is a huge link in that. If we do not have students that are being prepared, or even introduced to what biotechnology is until they get to high school or until they get to college, it's a little late.

When you look at the enrollment of students going into the UC systems or into the California State systems, it is showing a diverse workforce in population. But how is that translating, and why is it not being reflected in the demographics for industry? There's a disconnect. So the challenge

is, how do we bridge the gap? And when you talk about changing, it's going into uncharted territory. These examples that I heard here -- working with the churches, working with the communities, working with the under-served population -- that's uncharted territory. But that takes risk, and it takes everybody being out of their comfort zone.

I think now, in many, many ways, industry recognizes the need to get out of their comfort zone. Academia is recognizing the need to get out of their comfort zone. And government, it's time to recognize to get out of your comfort zone, as well.

I'm here to talk about the Genentech-Skyline biotech model. This program was actually designed and developed with our partners, with Skyline Community College, as well as with the County of San Mateo Workforce Investment Board. This partnership was actually designed and initiated out of the need from 9/11, when the United Airline workers were hit very, very hard from the 9/11 incidents, when they were not able -- when they were actually laid off. We needed to look at, really, how can we tap into an under-served population that was hit by such a tragic incident, and provide new training skills and utilize their transferrable skills in the biotechnology industry?

Out of that, we had Genentech employees that actually are professors at Skyline Community College develop an articulated biotechnology certificate program that is based upon Genentech's manufacturing needs. This baseline program has been able to take these airline mechanics, train them on Genentech's manufacturing procedures, bring them through a three-month intensified training program, and then we provided paid work experience internships for them for six to nine months, and then brought into our manufacturing areas, where we were actually able to then convert them into full-time Genentech employees after nine months.

This program started off with 9/11. It's now gone into under-served communities. It's gone into schools in the Fremont area, Ohlone Community College, Solano College, and this has served as basically a model that the State of California is now looking at to replicate on many, many levels. Last year, we were actually pleased to be able to receive an award from the Department of Labor for being able to design a model that actually made it work, and we could prove that industry, academia and government, that we know how to work together. We know how to work together when there is an industry need and demand. But it's really looking at, how can we bring

these entities together in a progressive environment, and not make it in a silo effort?

So at the Department of Education, instead of having to do things on a piecemeal basis, how can we look at models and replicate them, not just in this state, but nationwide? Because when we look at bio-technology, and we look at Genentech just overall, it's a high-growth industry. This model will not just hold true for biotechnology. It can hold true for the other industries that Charles Reed talked about -- the agricultural, maybe the petroleum industry. So it's really teaching academia, government and industry how to work together.

I think that if there are some conversations on a national level that can start to take place to teach people, to teach faculty, how to think differently around partnering with industry -- because at the end of the day, we need a just-in-time workforce in any state. And if we don't have the workforce, then you're going to start to see individuals recruiting people outside of their own natural states where they do business.

I don't need to go through my entire model that we have here, because it is in your handouts. But one of the things I wanted to call your attention to is the Genentech-Bayer corporate gateway to biotech

model. Because when we look at preparing a workforce, what does that mean? You will look, and it's actually the little colored -- the pretty colored map one here -- if you can turn to that, because I can tell you that, when you look at the biotechnology industry -- Rollie Otto talked about a scientist, and sometimes you hear individuals say, well, we don't know where we can find under-represented minority scientists, you know, as if they don't, quote/unquote, exist.

Well, I think that when we look at trying to develop and identify program models that will actually be inclusive of under-served populations, that you will start to learn and see that minority under-represented scientists, they do exist, and they can be developed. But part of the challenge is that we have to be comfortable going to the places where minorities are, and how to reach out to them within the educational realms of the education system, whether it is with the historically black colleges and universities, whether it is not cutting funding for programs like the MESA programs, like the SAGE Scholars program, like A Better Chance, like the Young Scholars program. These are all programs that I was a part of that helped me get connected into the UC system, into the California State University system,

that helped expose me to higher education. But when we cut these type of programs in higher education, then you cut out the programs that will keep under-represented minority future scientists in the higher educational institutions.

So when you cut the programs, then you're cutting off a diverse future workforce for industry, which now means that now we have to rebuild organic partnerships by going into the churches, and funnel them into the education system, because we cut out the very programs that were initially designed to keep them into the education system.

When you look at this model here, this is industry speaking here. We are now looking at trying to start off our future workforce at the eighth and tenth grades so that they can get exposure on what biotechnology is. That means that we are targeting youth, neighborhood residents and disadvantaged adults, targeting individuals -- people in the Oakland Bay area, going into those under-served communities.

I think you all hear a theme here. Between academia and industry, we are recognizing the need for us to change how we do business by going to the communities in which we need to partner with, because we recognize that they're not all enrolling into all the educational systems or programs that are

now being cut out of the education systems. So now we have to go to them. There's a gap there.

Then taking it from the eighth to the tenth grade on up to the college and career, building into -- and actually I didn't even know your presentation, but I have Laney in here, as well, because we know that Laney is a community college that serves an under-represented minority population. So what do we want to do? We want to bridge and bring a biotechnology certificate program to Laney. Why? So that we can develop a diverse workforce at that level, provide them opportunity to get jobs within the biotechnology industry.

Taking that on up to the biotechnology manufacturing training model to the Skyline and Ohlone model that we won the awards for from the DOL, as well as from the State of California, then they go on up to a three-month paid internship, paid tried out employment for us to be for us to be able to assess their skill sets, and for them to be able to assess if this is the environment or career they want to be in. After that, it's the full-time placement contingent upon our business needs.

So, you see, here you have industry now developing programs for our specific needs, but it's really a true -- it's -- the time is now to have the

true and real dialogues around industry, academic and partnerships, especially for high-growth industries.

Recommendations -- as if I haven't provided some already. But some of them are business and industry partnerships, creating legislation in the process that makes it easy and efficient to partner with academia. Now, I can't tell you -- I've been working on this partnership for the past four years. I've been at Genentech for six years, and I have learned so much in the process of what it means to work with government and what it means to work with academia. And I'll just leave it at that.

(Laughter.)

The other piece that I'll add here is that, when we look at training the future students, there's another missing link. The missing link are the faculty. How skilled are our faculty to be able to train and teach on biotechnology? Who said internships were only for students? We need internships for faculty.

When we look at a just-in-time workforce, if we want students to be able to articulate the core competence skills that we're needing in an entry level bioprocess manufacturing technician, do the teachers even understand what a bio- -- who a biomanufacturing technician is, yet alone to be able to teach on it?

We have to connect the dots. So what do we do at Genentech? Well, we have had some faculty actually go through a rotation program so that, with the biotechnology certificate model, they can know first-hand what their students are expected to know, so they can take that articulated curriculum and that experience that they had at Genentech, and bring it right back to the classroom.

Department of Education, what are we doing to retrain and to upgrade the skill sets for a high-growth industry for the students and for our faculty in a consistent and replicated model?

Direct funding -- direct education funding to progressive programs that industry already supports. Don't keep putting money into programs that are not progressive, and whose curriculum are out-dated, and who have not proven a return on investment on being able to produce well-qualified and educated students that can contribute to the workforce. Change your funding streams on where you put your money.

Invest in direct money and grants and initiatives that support low income and under-served schools so that industry can ensure a diverse work-force. It's always the chicken before the egg syndrome. How are we supposed to have a diverse workforce if the education system is not funding low,

under-served communities to provide the access to education so that we can even say, oh, you know what, we have a population of under-represented minority students at Stanford, or at UC Berkeley, or at Cal State East Bay.

Invest in a faculty internship or skill training for high-growth industries. When he talked about -- who was it? -- Charles Reed said, find three big ideas that you can work on. You got three of 'em right here. One of them is to really focus in on being able to identify programs that will be able to focus in on faculty development skill training specifically for high-growth industries -- specifically for high-growth industries, aligning curriculum to ensure that it is vibrant for a just-in-time workforce needs. That has to be a must. We as an industry can't keep going piecemeal, you know, trying to go to ten colleges and say, okay, you know, fix this curriculum here. It has to be system-wide.

Then the other area is your diversity and range and scale of partnerships as far as for immediate kind of recommendations. I think you had some examples here of being able to do things differently so you have different outcomes.

And I'll stop here. Thank you.

CHAIRMAN MILLER: That's good.

(Applause.)

CHAIRMAN MILLER: We'd like to take a little time to ask -- get some questions answered. Members of the panel.

MS. NUNLEY: Chairman Miller, could I ask a question to Monica?

MS. POINDEXTER: Yes.

MS. NUNLEY: I was looking at your success data in your report.

MS. POINDEXTER: Yes.

MS. NUNLEY: I just wondered -- I see that 162 people have been interviewed, 37 hired at Genentech, and 16 by others. What happened to the rest of them?

MS. POINDEXTER: Some of the students did not complete the program, or some students are currently still doing internships at our companies. There are partnerships with Bayer, with Kiron. As you see, like at Genentech, we've interviewed quite a few of them, and so those that maybe did not actually kind of fit the actual skill or profile level once they completed the program probably did not receive offers, or received offers from other companies, and/or are still in the six and nine-month internship program with the possibility of converting. The longer the students are in the internship program, it gives them

more time to be able to have exposure on the manufacturing floor, with the higher probability of being converted.

MR. DUDENSTADT: Chancellor Reed, the State of California is perhaps the best model of strategic approach to higher education with a master plan of the 1950s that responded to the changing nature of the state. Once again, this state is changing very, very rapidly, in demographics, in economics, and so forth. How is the system kind of rethinking its expansion? I was quite struck at a strategic meeting that occurred at UC Santa Cruz a year or two ago when the concern about how there will be sufficient growth in higher education to serve the changing needs of this state, and whether the old model of the community colleges, the Cal State system and the UC system really would respond adequately to that changing paradigm. What's the thinking about how that future's approached?

MR. REED: Well, the thinking about that, number one, is figuring out our responsibility to have students better prepared to go to college. That includes focusing on rigor, especially in the high school disciplines.

Number two, frankly, we have a broken system as far as the master plan goes in the transfer

from community -- from -- from high schools to community colleges, and to the California State University. I am spending a lot of time and effort to try to fix that, because I think California -- and I love my friends in the community colleges -- but it kind of lost its way. It became all things to all people, a place where you're supposed to go find yourself. Well, we don't have time or enough money to find ourselves.

MR. DUDENSTADT: Which part was that placed, the community colleges or --

MR. REED: The community colleges. And then it's become a runaway set of general education requirements that are different between the community colleges and the universities. We need to get those aligned.

Now, third, Jim, with the master plan, one of the things that I've tried to do is to look out ten years to see if we can serve this tidal wave of students -- different kinds of students, immigrant students -- and I think we can. But our behavior has to change, and we have to become more efficient. We're not going to get a lot more money, but we have to utilize our facilities the year round. We've got to use them more hours of the day. We have got to schedule differently. We've got to use technology

differently. In other words, I can see us having students meet instead of twice a week, once a week sitting in a seat and the other time on the web getting the information. And some of it can be delivered better there than in the classroom. So those are some of the kinds of things.

We've got to provide incentive systems to our faculty to develop their course ware in different ways, and then go from there.

MR. DUDENSTADT: Amen.

MR. SULLIVAN: Mr. Chairman?

CHAIRMAN MILLER: Please.

MR. SULLIVAN: I'd like to, first of all, commend all three of our panelists this morning for very productive, very interesting and very challenging presentations.

I think all three of you show the power of outreach into the community. One of the -- and -- and certainly the common theme all three of you emphasized, the need for resources to support these programs. That's a given, and I think we need to address that.

My question or comment is as follows. One of the issues, in my view, is that many under-represented minorities don't feel welcomed into the higher education system. One of the challenges we

have is really saying to these communities that higher education is for them and for their future and for their families. That's a major challenge.

I'd like to ask, in your outreach efforts -- and certainly Chancellor Reed working with the churches, which I agree certainly in the black community, very important institution is the church, and I commend you for your outreach there. I'd like to ask, are there ways that your activities help address this issue? Because in many low income communities, with the alienation they feel from the higher education system, they don't prepare. And those students who often want to become a scientist are really discouraged by their peers. So are the things that you're doing helping to address that cultural divide?

MR. REED: I hope so. One of the ways you have to start is you have to show these communities that you look like they do.

MS. POINDEXTER: Thank you.

MR. REED: I am proud of -- we -- we have 23 presidents in the California State University, and I can represent here, we are the most diverse university system in this country, led by diverse presidents. And when I can take five or six African-American presidents to the African-American

community -- frankly, I'm the only white guy sitting up there -- they are more comfortable. I chose West Angeles because it's the biggest church. But the other six presidents that are going to be there are going to be African-Americans talking to African-Americans, making them feel safe, comfortable, have within our university their communities, and then show them the opportunities that are there for those communities.

We're going to have Latinos teach Latinos in those elementary schools on how to manage their children and prepare. I'm convinced that it starts -- we don't have nearly enough diverse faculty members. That is the hardest thing that we're trying to overcome. You know, faculty hire faculty. It's just natural that they reach out to the people that they know. So we're trying to say, you know, reach into these other communities and get into the pools that come before us people that look like our students. And so we've got to continue to do that.

One of the partnerships -- and Monica said this -- we're asking business to loan us some people that look like our students. That really works well for our students because it gives them a leg up on those companies to get jobs. But it also brings to our faculty much more realistic expectations that

these people have.

MS. POINDEXTER: I would like to add, as well, that when we look at outreach into the community, just from an industry perspective, that's important, as well, because I know that when we go into the communities, the students want to see under-represented minority professionals. When they think of corporate America, they automatically think of a white man. They may not think of a black female in a position of influence. And so when you look at the outreach, and when you look at also providing and bridging the gap, it's also developing programs that are going to be going directly to those communities.

I think the flipside of it is that it's access to information and the comfort level. So when we look at the comfort level, a lot of people, especially under-represented minorities, or even low income individuals, may not feel as if the higher education represents where they would be comfortable. So sometimes it might take the education system to kind of reshape or redevelop their image to make it more inviting for individuals that may not have that exposure to what higher education is all about.

The other angle of it is that we also have to be comfortable with actually going into the communities. That's where, when you look at Charles

Reed, when you look at, you know, him going into the churches, when you look at industry developing specific programs like scholarship programs for minority students, and then providing an internship, that's saying, you know what, you guys have -- as maybe the Genentech Scholars program -- that program is targeted for students -- under-represented minority students pursuing degrees in the sciences, providing internship, and hopefully a full-time job. So when they see programs like that, it's, you know what, that's an organization or a company that embraces diversity and that has created an environment for me to feel comfortable in.

Mentorship is another. It's outreach.

Rollie.

MR. OTTO: I would respond by saying that one of the important challenges we have is to diversify our teaching force, particularly at the high school level, to accomplish the goal that you have laid out to encourage students to consider higher education. Yes, it'll take a while, but one of the important partnerships that's been developed around this is the Department of Energy's Office of Science supported a pre-service teacher program. We then got the National Science Foundation to say that they would allow any teachers in the programs called Excellence

for the Preparation of Future Teachers -- I think I didn't get the name just right, but it was an NSF-sponsored program. One of those centers was at California State University Fresno. As a result of that, we were able to leverage our dollars and bring five teachers in for every one that the Department of Energy sponsored.

Many of those teachers were coming up through the system as undergraduates out of the local community colleges. They were under-represented minorities who had already gotten the vision that they needed to be part of the -- or many of these pre-service teachers needed to be part and represent their communities. They were oftentimes the first in the family to get degrees. But they had the desire to bring their communities into the college-going greater rates, and they were going to do it by being in the K-12 system.

Coming to Berkeley Lab as an internship gave them the confidence that they were able -- as well-prepared as any of the other teachers that were going into our system in California because they were -- they saw the frontiers. So programs, partnerships that really diversify our teaching workforce should be encouraged.

MR. REED: I just want to share one

anecdote with you that I'm really proud of. In the Central Valley, the San Joaquin Valley around Fresno, they have a huge Mong population -- there and Minnesota. I can't tell you why they settled there, but -- because of farming. But I was there last spring because we had funded a leadership program for the public school leaders, the principals of elementary, middle and high schools. I think I can represent this. The first Mong in America who got a Master's degree and became a principal, in the Fresno United School District. That meant so much to that community because those children had somebody to look up to. I went out to that school, and she's doing a great job. But what it did for the community by seeing some of their own people being in a leadership position probably meant more than anything that we could do.

MR. VEDDER: Thank you, Mr. Chairman.

CHAIRMAN MILLER: Sure.

MR. VEDDER: I just love this panel. Getting away from the diversity issues for just a minute, and into the efficiency issues that Chancellor Reed raised, you raised it with regards to year-round schools and so forth. But one statement that you made struck me, because it's one I've heard several other times, and no one wants to talk much about it. You

said the 12th grade is a vast wasteland. If that is the case, why aren't we doing more in terms of national policy, and perhaps even at the state level, to make the secondary and post-secondary educational experiences more seamless, integrate them more, maybe cut out for some students that 12th grade which is a wasteland, and have them go directly either to the community colleges or four-year Cal State colleges or whatever, and use the resources that are freed up from kids that used to be sitting doing nothing, and put 'em to better use? Do you think we ought to be doing more in that? Do you think, as a nation, we somewhat have a problem in this area?

MR. REED: I think you're getting close to one of those big ideas that you could come out with. Yes to all of what you said. Some of the students ought to be dual-enrolled at community colleges or universities. Other students need this extra work, but they need to find out that they need this extra work. Maybe you all could come out and say, we don't need the 12th grade anymore for what it's doing, which is very little, and here's what we need to focus -- the partnership with the community colleges and the universities for these kids that are coming out of the 11th grade, and whether or not they're prepared for college work.

You know, when I say "prepared for college work," I mean this: It is the same thing -- prepared for the workforce, prepared for college. If you take those two high school curricula, kids are going to be ready to go to work in the workforce just as well.

MS. POINDEXTER: I just want to make a comment on that, as well, that maybe -- that -- that's one point of view, but the other is looking at the whole perspective and notion that's been lost, which is trade. When you look at maybe utilizing the 12th grade as an opportunity for students to actually look at specific trades, like maybe being able to pursue or receive a certificate their last year in partnership with a high school diploma. For some students, college may not be the actual next step for them. However, the bridge that the Department of Education could do or could provide for them are some options on receiving certifications in high-growth industries that will allow them to -- that will articulate or translate into nice paying jobs in industries such as biotechnology, or agricultural, or the Boeing area -- industry -- what is that? -- aeronautical? -- aerospace. You guys know what I mean.

CHAIRMAN MILLER: Avionics.

MS. POINDEXTER: Right. Thank you.

But looking at another option, which is

the certificate option, in conjunction with their diploma, so that even if they may not have an actual four-year degree, certificate can also be a leg into the workforce area. So, you know, looking at things differently.

CHAIRMAN MILLER: Thank you.

We have a big idea bucket. We're ready to receive any of those in writing or personally. We thank you very, very much for a very enlightening presentation.

(Applause.)

(Recess from 10:09 a.m., until 10:18 a.m.)

CHAIRMAN MILLER: Thank you for joining us. I think we'd like you in the order listed on the program. I'd be pleased if you'd introduce yourself as you speak. Tom.

MR. MAGNANTI: Good morning. My name is Tom Magnanti. I'm Dean of Engineering at MIT, and proud to say a long-time educator. In fact, as you can tell by the color of my hair, a long-time educator. Thank you for the opportunity to speak on a topic that is so important to all of us.

There's much we could talk about today concerning higher education, especially science, technology and mathematics education. We could, for example, discuss higher education in the innovation

economy, exciting developments in engineering and technical education, those elements that have made higher education in the United States the envy of the world, including size, scope and variety, the confluence of instruction, in research, universal accessibility, and the free-flowing access of information on education and research.

In recent congressional testimony, I offered broad recommendations that spoke to some of these topics and some of these elements. I'll refrain from trying to repeat those recommendations today. But before starting, I'd like to endorse the recommendations made by the Council on Competitive Innovation America report, and also the Rising -- or the Gathering Storm report.

So rather than speak to those today, I'd like to focus on a simple proposition. Technology and openness make a difference in higher education. Technology and openness make a difference in higher education. To tell you why I feel confident in making that statement, I will share some experiences and data from my home institution's continued experiment in open sharing, MIT OpenCourseWare.

A high school computer science teacher in Arizona, a physics teacher in Toms River, New Jersey, a home schooling mother in rural Illinois, a

management instructor at the University of Idaho, an MIT freshman from Michigan -- this seemingly disparate group of people all has two things in common, first, the singular motivation to seek the best in learning and teaching, and second is OpenCourseWare.

Our prior panel asked about big ideas. I think that OpenCourseWare is such a big idea, a bold initiative of the MIT faculty to share or give away the content of an MIT education to anyone anyplace in the world for free.

In higher education, technology helps us to assemble and codify knowledge, improve instruction and learning, and provide unprecedented access for learners everywhere. With OpenCourseWare, we are providing open access to our entire curriculum to the entire world.

First, what is OpenCourseWare? OpenCourseWare is not a distance learning program or a certificate or degree-granting program. It is a large-scale web-based publication of educational material that supports an MIT education. Imagine, if you will, having the lecture notes, the PowerPoint slides, the syllabus, the homework sets, for a course, after you've assembled a course and taken a course.

But we even offer open access to our laboratories through a program called i-Labs. Think

of sitting at your computer and operating the MEMS testing device, or a wind tunnel, or a chemical engineering reactor, and integrating that with an education, again, in an open access environment. Educators use OpenCourseWare materials for curriculum development, while students and self-learners draw upon the materials for self-study.

How about some data? Currently at MIT, there are 1250 courses from 34 different academic disciplines now available, more than two thirds of the way towards our goal of publishing the entire MIT curriculum of 1800 courses. The response, at least it seems to me, has been overwhelming.

Some assessments in metrics of success. In three years, more than 17 million unique users have visited the OpenCourseWare site -- 17 million unique users. Eighty percent of the users indicated that OpenCourseWare has been extremely positive or a positive impact on their educational initiatives. Ninety-two percent of self-learners have told us that OpenCourseWare increases their motivation and their interest in learning. Ninety-six percent of educators report that OpenCourseWare has helped them or will help them improve their courses. And 51 other OpenCourseWare projects now offer open access to a diverse array of published courses at institutions in

the United States, China, France, India, Japan and Vietnam.

But there's a lot more than data. Other voices speak to the power of OCW much better than I. Elizabeth Rose, a self-learning from North Dakota, writes:

"This is so overwhelming I want to cry. I know OCW doesn't take the place of a degree, but what a great way for me to get used to formal learning materials again in hopes that I'll be able to pursue graduate study."

And Coretta Jackson, an MBA student from New Jersey, shares:

"When I first came across MIT's OpenCourseWare, I pinched my web browser to check if it was functioning properly. The free platform of OCW is fostering a measure of educational parity in higher education by offering access to premium content in course materials otherwise reserved

for MIT's full-time student population. I hope I live to see the day when every university will launch and promote its own version of OpenCourseWare."

As you can see, OpenCourseWare speaks of the themes this Commission has identified. At MIT, we have demonstrated an OpenCourseWare model that is an affordable, accessible, scalable way to transform education. Our global audiences of users hold MIT accountable to create and share high quality materials.

We believe there are tremendous positive implications to open sharing of educational materials for the U.S. workforce. The challenge is simple. Can we leverage what is happening at our college campuses to the benefit of all Americans, and close the educational gap that we are discussing here today? History has proven that education and discovery are best advanced when knowledge is shared openly, and the promise of OpenCourseWare is an opportunity, I would argue, we should not miss.

Let me close by two recommendations, the first, which, again, I think and I hope you agree, is potentially a big idea. Let's launch an OpenCourse-

Ware for secondary education, a website focused on science, engineering and mathematics, that would help close the achievement gap in science and engineering in the United States that concerns us all. Let's do so by creating a government-industry-educational partnership to develop and sustain such a project.

My second recommendation: Let's create incentives to catalyze the development of OpenCourse-Ware projects at universities and colleges across the United States, enabling the open sharing of educational materials from a variety of institutions, disciplines and educational perspectives. Such a portal could serve as the leading resource for teaching and learning, and would address issues of accessibility, affordability and accountability, and I would add scalability.

I believe both these recommendations could be instrumental in supporting the administration's goal of training 70,000 high school teachers to lead advance placement courses in math and science, and bring 30,000 math and science professionals to teach in the classroom to help students struggle with math.

Thank you.

CHAIRMAN MILLER: Thank you.

MR. SMITH: Good morning. I want to thank the Commission for the opportunity to present --

testify in this dialogue. I know how grave the charge is that the Commission has, and how important this testimony is. But my fellow Pittsburghers would be disappointed if I didn't say for the record, go Steelers -- with apologies to Seattle.

(Laughter.)

CHAIRMAN MILLER: We're going to meet in Seattle next week.

MR. SMITH: We'll send towels.

In terms of characterizing the big picture of what I have to say today, Jim Dudenstadt adumbrated it yesterday, and that is that we are not leveraging the results and the methodologies that come from the learning sciences, and in particular cognitive science, that has developed over the last 30 years for designing better higher education. This is an area in which e-learning can provide substantial help. But in order to explain how, I have to go into some detail. So forgive me if I dive into some pedagogical details this morning. I think this is a place where my favorite quote from Nees Vandereau (ph) applies, which is that God is in the details.

I explain that in these terms. If you ask me point-blank, is e-learning going to play a critical role in the future of higher education? -- I would say, yes, but not if we're doing it the way we're

doing most of it now. The problem is that e-learning has inherited a fundamental flaw in our current approaches to managing pedagogy in higher education. This flaw damages all kinds of education, but it is particularly fatal in e-learning environments. The flaw I'm talking about is that educational interventions, from classroom teaching, to textbooks, to e-learning tools, makes shockingly little use of what is in fact the best information that we have to improve education, and that is scientific results from research studies in the learning sciences, and I'll add research methods from the learning sciences.

We act as though the intuitions of educators and the intuitions of educational software developers are sufficient on their own to produce effective instructional environments. They are not. The general failure to apply research-based theory and to do scientific assessments of educational interventions is starkly illustrated in a single study that you can find on the excellent resource from the Department of Education, a website calls the "What Works Clearinghouse."

If you go to the home page today, you will find a report on 40 interventions that are available for adoption in middle school mathematics. The What Works Clearinghouse study reports that, of those 40,

only five supply any evidence whatsoever that they work. And of those, only three supply really rigorous scientific evidence that they work. What's wrong with this picture? How can we responsibly promote the use of educational interventions that offer no scientific evidence of their effectiveness?

Alternatively, we might hope that these interventions and other interventions are being designed using research-based results, well-confirmed theories from cognitive science, from the learning sciences. But the fact of the matter is they are not.

Even though I'm reporting about a K through 12 study in this case, the situation's even worse in higher education. Those of us who have taught in higher education know that when we walked in front of that first class, we were armed with what? We were armed with our intuitions about what was going to work in teaching what we were about to teach. We were not armed with good ideas from the learning sciences about what was going to work.

So my premise is -- or my -- my contention is quite straightforward. Unless we first design teaching and learning environments using well-confirmed theories from the learning sciences, and secondly, regularly test the efficacy of those interventions through sound scientific assessments, we will

not improve the future of higher education.

Now, here's one of those remarkable things where the tables are actually different than the way people most commonly characterize them. We often worry about, well, can e-learning be as good as traditional learning? And what I'm saying is that traditional learning is pretty much intuitively informed as opposed to scientifically informed. E-learning is actually something that can, if we pursue it properly, provide -- offer us an opportunity to meet the desiderata that I've described, but not unless we change how we do it.

So what I'm going to briefly describe to you is a project at Carnegie Mellon called the Open Learning Initiative, which is funded by the William and Flora Hewlett Foundation, that tries to leverage e-learning to produce really quality online education by doing the following: by basing course design on proven theories about how people learn; by iteratively improving courses through routine scientific assessment, and then appropriate modification based on those assessments; and using a team approach of content experts, cognitive scientists, human-computer interaction experts, and information technologists as the author of each of the courses. The project I refer to is called, as I said, the Open Learning

Initiative. And it has produced now exemplars of what we call cognitively informed online courses, which can also be interactive textbooks, which we frankly think are going to be the textbooks of the future.

These materials are completely different in kind, and have a completely different purpose than those available at MIT's OpenCourseWare site that Tom has described to you. The Opening Learning Initiative courses are not a compilation of course materials used in traditionally taught courses at Carnegie Mellon, the OCW model. Rather, they provide -- they're for a different purpose. They provide the complete enactment of instruction online. Although we believe these courses are more effective when used as an interactive textbook in what's called a blended model, we have -- our effort has been to make them so that a student can complete an entire course without instructor intervention.

The option of having no instructor is precisely the reason that the Open Learning Initiative courses must be informed by the best current knowledge from the cognitive sciences, and iteratively developed using formative studies of student use in order to make them effective. The development philosophy and process is what makes the Open Learning Initiative courses so different from hundreds of computer-based

courses that have been hyped over the last few decades, and failed miserably in use.

OLI courses are exemplars of online instruction that work. I have included in my testimony some of our summative evidence. And when we say summative evidence, we mean sort of the final conclusion about whether this worked or not, because we do a great deal of what's called formative study along the way in order to make them good courses. I've included from our statistics course a detailed summative study done last fall on our online statistics course. The comparison class was a very high quality introductory statistics course that has been worked on for years at Carnegie Mellon with cognitive scientists to make it better. And what we found, much to my pleasure, and somewhat to everyone's surprise, was that the students who took only the online course -- I'll emphasize with no instructor intervention, because we sort of sat on the instructor and said, no, you can't reach -- right? -- the students who took only the online course did just as well as the students that took the traditional course.

Now, the cost of delivery was significantly less. The cost of developing the course was quite substantial because of all the work that went into it. But if that were averaged over a large number of

students, what we would have is a less expensive form of delivery, even in a mixed model. And perhaps even more importantly, what you have is a course that was designed by a team of the experts that I described, which by and large is going to be better than many of the courses that are currently taught as introductory statistics courses across the country.

There's always a struggle with getting adoption of this, even in a blended model. But here is an opportunity where e-learning can actually help us get into what we do in the classroom the results from the learning sciences that I'm talking about.

I've included in my testimony further evidence we have about our online biology course. We're developing more and more evidence all the time. I'll skip that, and just make the point that -- if I can find it -- that there's a second aspect to digital learning environments that we can leverage to really improve the future of higher education. Digital learning environments can be instrumented to gather data about how well the course is working even as it is being taught, what I call action research. So you don't have to wait for all the research to be done. You can actually do the research on the fly. You can improve the courses and the Open Learning Initiative courses were are instrumenting to gather data.

For example, we have a virtual chemistry laboratory in our online chemistry course I'll talk about in a minute. And what we can do is look -- with the student's permission -- look at every step that they take in making decisions about how to solve problems in there, gather the data, call in the people from the data mining department, and say, help us figure out how to find the relevant patterns here, and learn where the students are having problems, and where they're not having problems. And by the way -- and the example from the biology course that's in my testimony illustrates this -- the professor can see the morning before he or she goes in to teach the class, well, what are they getting, and what aren't they getting? -- from all that data that has been gathered from the online environments. So they are armed with feedback. The students, as I will talk about in a minute, are armed with feedback from intelligent tutoring systems. So what we produce here is a massive set of feedback loops to continually gather data about what's working and what isn't working -- before it's too late -- right? -- before it's too late for the student, before it's too late for the professor.

Let me give you just sort of one example of a fundamental principle from cognitive science --

that has come from the cognitive sciences over the last 20 years that we implement in these courses. Educational interventions should provide instruction in the problem-solving context -- for reasons I'll talk about in a minute -- and give immediate feedback on errors. Now, you look at most online learning environments, and what kind of feedback do you get on errors? Correct, incorrect. That's useless feedback.

The kind of feedback that we've built into the Open Learning Initiative courses are based on intelligent tutoring systems. We're lucky to have 30 years of work at Carnegie Mellon in what are called cognitive tutors. These are intelligent tutoring systems that essentially are built on trees of novice and expert knowledge that can follow what a student is doing online, and individually tailor the feedback that they get, and give them meaningful feedback. For instance, the cognitive tutor that is in our statistics course might well say to a student not "correct" or "incorrect," but, "no, you seem to be confusing categorical variables with continuous variables in this case." That's going to vary from student to student, because it is an intelligent tutoring system.

This work has actually also produced some of the most effective online algebra interventions in

middle schools and high schools, which are now marketed by a company called Carnegie Learning, and are now used in thousands of public middle schools and high schools.

The point is that the students get individualized feedback immediately rather than waiting for the midterm, and that makes a huge difference in learning outcomes.

Cognitive scientists have also recognized something that Rollie Otto mentioned, that they refer to as inert knowledge. I would say that a great deal of the knowledge that we transfer in higher education remains inert. What this means is it just can't be transferred to the context in which it needs to be used.

The example I'll use is the standard introductory chemistry course. The problems in a standard introductory chemistry course, the way it's taught, is really as a sets of abstract mathematical skills. Students employ learning strategies to solve typical textbook problems, and perform well on chemistry exams, but they fail to see the relationship between the mathematics and the real world chemistry. And so when they walk into a laboratory, essentially they don't know what to do.

Well, how have we addressed this using

e-learning? Well, in what is one of the most remarkable pieces of software you'll find, there is in the Open Learning Initiative courses a completely open virtual chemistry laboratory. I have a graphic of it in my testimony that doesn't do it justice. You have to actually go and use it. But the point of developing this was not to replace the chemical laboratory, but was to change the nature of homework. The typical chemistry homework problem, many of you will remember, is something like, well, given ten moler -- given ten milligrams of one mole of substance-A, and ten milliliters of one moler of substance-B, calculate -- and the temperature went up by ten degrees when you mixed them -- then what is the heat of reaction between A and B? And I don't know about you, but when I was a student in physics, what I would do is I'd read the problem, and then look back through the chapter to try to find the equations to plug those numbers into. That produces what the cognitive scientists call inert knowledge. You can't actually use that when you get out to work in a chemistry laboratory.

In the chemistry course, this has been completely replaced. The problem that the student is given is, here's the virtual chemistry laboratory; construct an experiment that will measure heat of

reaction between A and B. That's an open-ended, ambiguous, typical difficult chemistry problem, and they have to learn how to solve it in this e-learning environment.

So the conclusion is that the Open Learning Initiative courses work, and we can demonstrate that they work by scientific studies, because they incorporate research from multiple literatures, including cognitive psychology, education, educational technology and science education that take very seriously the notion that research-based theories and assessment practices must be used to develop effective e-learning.

One might reasonably ask why. Most e-learning materials developed in higher education over the past 20 years have been developed by individual faculty members, many of whom are great teachers. Why aren't their intuitions sufficient in order to produce quality e-learning materials? Well, again, you won't be surprised to learn I have a research-based answer to that. The research that was done by Kettinger and Nathan, faculty at Carnegie Mellon, a rather surprising result, and that's why I usually include in presentations. It's about what they call the experts' blind spot.

What they did was they constructed a

middle school mathemat- -- a high school mathematics exam. They gave this high school mathematics exam to hundreds of students. They determined which of the problems on that exam were more difficult and which were less difficult. So they had a ranking of the problems. And then they gave that same exam to high school teachers, middle school teachers and elementary school teachers in mathematics, and said, please rank these problems on difficulty. As the graph in my testimony shows, the most expert teachers in the field, the high school teachers, did miserably on ranking the problems. Middle school teachers were better. The least expert, the most novice, the elementary teachers, did the best.

Now, this isn't limited to this area. I mean, I often used to talk to my students when I talk physics about what I call the Fineman problem. Those of you who've read the Fineman lectures on physics probably -- and know some physics -- recognize that they're absolutely brilliant and wonderful expositions of the field, as long as you're already a physicist. But the idea of trying to learn as a novice from those books, because of Fineman's expertise, you can see in so many places he has the experts' blind spot. Many of the people that we are sending into the classroom in higher education have this experts' blind spot.

That doesn't mean they shouldn't be in the classrooms, but it means that they need help in understanding this, and how to overcome it.

I describe in my testimony various ways in the Open Learning Initiative courses it's all the more important in e-learning. You must take this very seriously.

The human-computer interaction folks at Carnegie Mellon have this mantra. When designing an interface, you have to say to yourself over and over again -- you'll appreciate this if you've tried to use the latest software -- the mantra is, "I am not the user." And so what they do is constantly watch what users are doing with interfaces in order -- novice users are doing with the interfaces in order to understand how to build quality interfaces that are actually effective.

So the mantra we have in the Open Learning Initiative work has been borrowed from them -- and they're our partners in all this -- "I am not the learner." I have to understand where the novice learner is coming from, especially in developing e-learning environments, in order for them to be effective.

So I'll sum up my recommendations and the conclusions that I've given you. One, cognitively

informed design and scientific assessment processes should be the norm in education. They are not. We must recognize that solely intuitively informed designs suffer weaknesses, including the experts' blind spot.

Second, educational treatments, especially e-learning treatments, that can't provide scientific evidence for their efficacy should not be used. Digital e-learning environments provide us an unprecedented opportunity to widely propagate demonstrably effective, cognitively informed educational interventions.

Educational institutions should encourage the adoption of cognitively informed e-learning treatments, interactive textbooks, online courses, learning objects, whatever, recognizing that those kinds of treatments will be developed for the few by the many, like textbooks. This is the hard sell. Everyone wants to know how to do it for themselves. Everyone does not have the set of expertise necessary to do it. It will be developed by the few for the many.

The potential for e-learning environments to gather performance data to inform individual students, those cognitive tutors, and instructional designers about what works and what doesn't work

should be a high priority for criteria for funding of e-learning and purchasing decisions of e-learning tools.

So if I want to put one thing in the big idea bucket, that is that we need a lot more research on learning. Even more importantly, we need a way to engineer -- it's like the issue of the problem of having all of this research and engineering and management of the services industry -- we really haven't had much by way of engineering and management of the results from the learning sciences to move them into learning. They just sit there in the research journals.

In the final analysis, I always have to quote our dear friend Herb Simon. And in many ways, I'm channeling Herb today, who would gather the faculty and ask them how many of them had really any training in education, and very few would raise there hands. Herb was, if you don't know, the Nobel laureate polymath who spent most of his career with us at Carnegie Mellon. This summarizes the necessity of the marriage of learning sciences and technology to make e-learning tools effective. Herb said, "If we understand the human mind, we begin to understand what to do with educational technology."

Thank you again. I really appreciate the

opportunity.

CHAIRMAN MILLER: Thank you.

MR. WILEY: My name's David Wiley. I'm Director of the Center for Open and Sustainable Learning at Utah State University, and also an associate professor in the Department of Instructional Technology there. Thank you, Mr. Chairman, other members of the Committee, for the opportunity to participate in the dialogue. I have submitted written testimony, but I do want to go over the high points of it with you today.

I think we're at a rare moment in time, a moment in time in which the right thing to do is also the best thing to do. Those two things don't occur simultaneously too frequently.

Jim said yesterday that we should commit ourselves to a vision of providing all citizens with a universal educational opportunity and create the world's most advanced knowledge society. The Moral Acts and the GI Bill were mentioned as bold initiatives that changed the face of access. Today I want to suggest another such move in that same history that falls right in line with what Tom and what Joel have said. I want to suggest that it's not only the right thing for us to do, but it's what we have to do if higher ed. wants to remain relevant and engaged.

As have been detailed in books recently like The World is Flat, the world is changing a lot. Business is responding to those changes, and science is responding to those changes. By contrast, higher education has not largely responded to many of these changes. In the testimony, I outline six of those, and I'll cover them briefly here.

One is a move from things being analog or being in print to things being digital. We think about voice-over IP in terms of voice communications, electronic books, electronic textbooks, digitized newspapers, things like that.

There's an increasing move from closed to open -- open-source software, open access to data like weather data, astronomical data, research in the Public Library of Science Journals.

There's a movement from being tethered to one spot to being mobile. We have batteries in laptops. We have cell phones. We have wireless internet access. We're not tied to the wall.

There's a movement from being isolated to being connected -- e-mail, instant messaging. In terms of content, hypertext connects content to other content. Web services and other systems interconnect people, content and computers.

There's a move from being generic to being

personal. If you have bought a car recently, or a cell phone, or a computer, you can pick the interior of the car you want, you can buy skins for your cell phone, set the ring tones. And you don't walk into a store and buy a computer off the shelf. You get online and you say, I want this much RAM, this much hard drive space, this kind of monitor, and you get it the way that you want it.

There's also a move from consumption, finally, to participation. Things like blogs, podcasting and vodcasting, or video podcasting, let ordinary people participate in reporting news, in producing internet radio shows, and in making their own movies.

So it's quite a move. I'd like to tell two stories about a student that relate to these moves. The first story has the student in her dorm room, or at the student center, or in a coffee shop, or on the bus, doing some homework. This student connects to the internet using her laptop, which she does mobilely. She uses Google to find a relevant web page, which provides her a digital resource that is open for her to access. And while carrying out her search trying to solve her problem, she chats with one friend on the phone and another using instant messaging to see if they can help her.

In other words, she's connected to people, and she's connected to content. The content itself is connected to other content as she browses around the web, clicking one link to the next. She quickly finds the information that she needs, ignoring irrelevant material. So what she's looking at is personalized, it's not generic. Once she finds what she's looking for, she shares that with her friends by phone and by instant message. She participates in the process of teaching.

Now, that same student a few hours later in the classroom. The students are inside the classroom; in other words, they're tethered in one place. They're using textbooks and handouts or printed materials. They pay tuition and register to attend. In other words, the experience is closed to most people. Talking during class, passing notes to Joel or Tom, working with others outside of class even, is generally discouraged. In other words, this student is isolated, even though they're surrounded physically by peers. Each student receives exactly the same instruction as each of her 30 classmates. It's generic as opposed to being customized. And the students are students, and they don't participate in the teaching process. They're consumers of what the teacher is producing.

There's a disconnect here, and the disconnect is growing wider and larger. We could tell a similar digital, open, mobile, connected, personal, participatory story about an engineer, about a scientist, about a researcher, many of the kinds of fields that we've talked about wanting our students to go into here.

So as life, business and science drift further from where higher education continues to stay largely, where is the value? What's the value to the people who pour their hearts, their souls, their dollars, their tears? It's a question worth asking. And the answers, I think, may be surprising.

Once upon a time, if I may, the courses of our colleges and universities were the primary repositories of post-secondary content. Today, initiatives like OpenCourseWare provide content-seekers from around the world with other legitimate sources of post-secondary content. Once upon a time, the university library was the primary repository of research, like peer review journals and monographs. Today, initiatives like the Public Library of Science and pre-print services provide individuals from around the world with legitimate alternate sources of research findings.

Once upon a time, a college or

university's faculty was the primary repository and seat of technical and academic expertise within a community. Today, technologies like e-mail, instant messaging and others put seekers of expertise in touch with faculty at other universities around the world, as well as professionals, pro-am hobbyists and others almost instantly.

Once upon a time, the degree programs of our colleges and universities were the credentials most highly valued by employers. Today, certifications like the Microsoft certified systems engineer, Cisco certified internet work expert, and the Red Hot certified architect certificates are sometimes worth more to employment-seekers than a degree in computer science from a four-year academic program.

So to summarize, once upon a time, higher ed. enjoyed monopoly positions with regard to curricular content, research results, expertise and credentialing, but we don't anymore. Each of these monopolies has been broken in the recent past, but higher ed. hasn't done anything to respond yet.

Now, you might say, well, what about online classes? What about e-learning? Isn't e-learning the answer? As is highlighted in my testimony, I think e-learning only covers two of these six characteristics in that e-learning is digital and

it's mobile. I can do it from my bedroom or from the pub or wherever. It still remains largely closed, in that to participate in e-learning, you need to pay tuition, you need to register, you need a password. Online learning is notoriously more socially isolating than face-to-face courses. Students are provided basically with digital copies of the lecture notes that were given in the classroom, so they still get the same generic information that the other students get. And they're placed in the position now of just downloading stuff, so they're definitely still consumers.

This is very different from the normal life experience of today's undergraduates particularly. Their lives involve insumptions (sic) about instant on-demand access to multiple sources of information from multiple people via multiple technologies. If you walk into any teenager's bedroom today, what you will see is them watching a DVD, listening to music, surfing the web, talking on the phone, and instant messaging with a few friends, while doing homework, all at the same time. It should not be any wonder that these students cannot tolerate being talked to for 60 minutes. This is not the mode that they work in.

It's even worse online. Online is a

cultural and social space for them. There's a certain set of expectations there. When we take our e-learning into that social and cultural space that they're used to being in a certain way, and appropriate it to our own ends, it's a very shocking and disturbing experience for a lot of them.

Now, the name of this panel, which is "Innovative Teaching and Learning Strategies," might first conjure images of specific behaviors that we could ask professors to demonstrate in the classroom, things like, use a problem-based approach, or have students work in small teams. But the diversity of teachers' and learners' preparation and background, combined with the actual differences in the academic disciplines themselves, make it impossible for me to recommend these or any other specific teaching technique for application at all levels across all content areas.

But I think there is at least one innovative teaching and learning strategy that can be applied broadly to the great benefit of higher education and all its stakeholders, and it's openness. I think the movement toward openness, which has already been talked about in terms of MIT OpenCourse-Ware, Carnegie Mellon's Open Learning Initiative, the OpenCourseWare at Utah State and others, is really one

of the great innovations in teaching and learning that's happened in the last several decades. In the context of my remarks here today, I think that openness is the gateway to connectedness, to personalization, and to participation, and a broad catalyst for other kinds of innovation.

A few examples: As a faculty member, if I want to connect my course materials to prerequisite materials from classes students have already taken in order to either create review opportunities or provide remediation, I cannot do that if those materials are not open for me to access and point my students out. As a faculty member, if I want to personalize the experience for my students, or more importantly, if I want to empower my students to meaningfully personalize it for themselves, I and they have to be able to edit and customize the materials that we use. We cannot do that if they're not open. As a faculty member, if I want to engage my students in creating and contributing resources, tutorials and other study materials to a class, this is much more easily done when the course material repository is open and the students are able to put things in it and participate.

A few words about how openness connects to some of the higher level goals of the Commission. It might be surprising to hear that, at MIT, at Utah

State, at Tufts, at Johns Hopkins, at some of the schools -- at all of the schools where OpenCourseWare-type projects are going on and faculty are being invited to put their lecture notes, their syllabi, their assignments and things out into the open, it is not uncommon to have a faculty member ask for a little time to tidy up those materials first. Right? And why is that? It's because openness puts teaching in the same position that our scholarly work is, which is it opens it to peer review. That has an impact on quality.

Openness of this sort also provides an unprecedented level of transparency to all the stake-holders in education, not just the faculty and the students, but the parents of the students, who, being a parent of future students, if I could go and look at metrics about average student satisfaction with courses, or actually look at the courses themselves, read the lecture notes, see the assignments, I would much rather have that level of transparent access to what was going on in the classroom as a stakeholder.

Several reports already brought to the attention of the Commission, like "Innovate America" and "Rising above the Gathering Storm," have indicated the absolute urgency with which the U.S. must work to develop, recruit and retain the very best and

brightest students from home and abroad. Recent analysis of evaluation data from MIT's OpenCourseWare shows that, of students that knew about the existence of OpenCourseWare before coming to MIT in this last freshman class, 35 percent of those said that the existence of OpenCourseWare was a factor in their choosing to come to MIT as opposed to going somewhere else. That number's up significantly from last year.

The world's best and brightest students are already starting to see this strategy of openness as a catalyst for further innovation, and they're already starting to include this commitment to openness as a criteria in the places where they choose to go. The time will come -- as was requested by the quote that Tom read, I think the time will come when OpenCourseWare or similar collections of open access materials are as fully expected from every higher ed. institution as websites are today. Ten years ago, no one had websites. But today, if your child or the child of a friend was looking for a college, and you got online to look them up and see what they did, if they did not have a website, they would lose all credibility whatsoever in your eyes probably. In fact, you'd probably wonder if they'd gotten the name of the university right.

The U.S. can be a leader in this next move

into OpenCourseWare, or we can follow. There are already active consortia, as has been mentioned, in China, in Japan, and in South America of universities that are doing OpenCourseWare, as well as in Europe and other parts of the world. In terms of the total number of universities actively involved, the U.S. is already behind.

Our first move or advantage in this area, which is provided by MIT providing so many courses so quickly, will not last long when the China consortium has 150 universities in it. We have to broaden higher education's commitment to openness, and then start to innovate on top of that platform.

Now, one related remark. It's commonly said with regard to large sections of general ed. courses that everything past the fifth row of the auditorium is distance learning. Okay. And to a large extent, that's correct. The tried and true techniques for teaching a 30-student course deteriorate rapidly as the number of students grows to 50, then 100, and then to 300. The value of our best pedagogical tool seems to vanish completely.

What we will be amazed to find, however, is that the inverse is also true. There exist techniques for facilitating learning among extremely large groups of students that will deteriorate just as

rapidly as 10,000 students become 2,000, 2,000 become 200, and 200 become 50. Higher education is largely unacquainted with these innovative teaching and learning strategies, because before the internet, it wasn't possible to put a group that large together where each member of that group could communicate with each other.

There's much for us to learn, then, by looking at and studying the social, the linguistic and the political structures of very large online communities. These communities are a core part of the everyday experience of our students, and an increasing number of our faculty. This is just one area of innovation that I think could be leveraged by a commitment to openness in education.

Soon after the launch of MIT's OpenCourse-Ware initiative, my team at Utah State worked together with them to develop an online support area called Open Learning Support, where people using the MIT materials could form study groups to freely tutor and support each other. We've seen students from around the country and around the world freely and effectively answer questions in every topic, including linear algebra and physics. We've also seen faculty from MIT and from other areas participate voluntarily in these forums to support students.

So open access to educational materials, in this case, in turn opens access to peer support. Open access to educational materials also opens access to faculty support, because when the faculty aren't spending all their time lecturing in the classroom delivering what could've been delivered electronically, faculty are now free to do other sorts of things.

Edwards Deming said, "It's not necessary to change. Survival is not mandatory." I like that quote, and I think it's relevant in this context.

In summary, then, I'll say, I think that higher education is increasingly falling out of step with business, science and everyday life. In order to realign itself with changes in society and in its student base, higher education must find the will to innovate in the area of openness, and then in the areas of connectedness, personalization, participation and other key areas. But openness is the key to enabling these other innovations and catalyzing improvements in quality, through peer review, and accountability, through transparency mechanisms, and through affordability and accessibility, for obvious reasons.

The open infrastructure of the internet has enabled a huge number of innovations at a speed

and scale that could never have occurred if that infrastructure had been closed. I submit that content, faculty support and peer support are the infrastructure of teaching and learning. To the extent that we open these, we can speed the adoption of scale of innovation in the teaching and learning space.

So my recommendation to the Commission is this: Please set a bold goal of universal access to educational opportunity. It's the right thing to do for the citizenry. It's the best thing to do for higher education. And openness can play a large part in making that successful. Thank you.

CHAIRMAN MILLER: Thank you.

I'm awed. I have a hard time saying anything, for a change.

(Laughter.)

Rick.

MR. STEPHENS: Great presentation. I have some questions about OpenCourseWare and the business model of education. On one hand, we see the cost of higher education continue to escalate. Yet what you're proposing is an openness and essentially sharing of the intellectual property that universities have or colleges or higher education have. How do you see the OpenCourseWare approach playing out in the

business model that currently higher education has today?

MR. WILEY: Well, I think part of what MIT has demonstrated to all of us in setting an example through OpenCourseWare is that the intellectual property of -- how can I say it? -- the value of a university education is not in the content. That's not where the valuable intellectual property is. If the value of the university experience were the content exclusively, then libraries would never have evolved into universities. Right? I could walk into a library, I could check out textbooks, I could take them home, and I could call that a university education.

Of the many things that the university does -- and we've talked about some of them in terms of socialization and credentialing and those kinds of things over the last day and a half -- providing access to content is not the core value of the business model. Right? It's access to experts who will be dedicated to helping you when you need help. It's the credential that you receive. It's the social networks that you build while you're there, that later, when you go out to get jobs, you tie into. The primary, secondary, tertiary, none of those values in ranking are the content.

MR. STEPHENS: I guess I would say, though, that with a school like MIT, which has a large financial endowment, clearly the endowment is paying for much of the cost, and the tuition is not covering all that cost. So if in fact today 40 percent of students are 25 years or older, and are no longer living on campus, I suggest the model is changing. So again, over time, if that plays out, and there are fewer and fewer who actually have to show up on campus, then I'm trying to understand, again, what that model looks like. And again, if in fact we're seeing costs go up, what's going to cause it to turn around, to come back down? OpenCourseWare certainly looks like the opportunity, but I don't understand the dichotomy.

MR. MAGNANTI: Let me offer a couple thoughts on that. One is, I think, as David just said, we shouldn't confuse knowledge transfer with education. I think it's a mistake to do that. And this is knowledge transfer. It's providing access to information.

Our young people go to websites and download music for $1.99 -- right? -- they download a piece of music. Let's suppose that I told you you could access the curriculum at any one of our universities at a dollar an access -- dollar an access

point. That's about what we're talking about in terms of OpenCourseWare. Our funding basis comes from foundations. It's been on the order of about $22 million to put that in place. But we've had 17 million visitors. All right. So we're talking about a dollar to access that. Right? Compare that with a university education these days or 30, $40,000, whatever the university education is. This is scalable, it's affordable, and it provides access, I think, to the many. I think we've got to think of it in that terms.

But I would encourage us, don't confuse it with a university education. There's the socialization, credentialization, there's all that goes with a university education that OpenCourseWare is not about. It's about providing access in the way that I think that David has articulated so wonderfully.

MR. WILEY: Although I do think that when that content becomes open for people to use, then that opens up not the kind of socialization that happens on our campus, but another kind of socialization. And you can talk about whether instant messaging and e-mailing and all those kinds of things are legitimate kinds of socialization or not. You may call them illegitimate, but that's the way that a lot of our students are socializing now. So it does open it to

that, and it opens it for other kinds of entrepreneurial, innovative things to happen in credentialing and in a bunch of other spaces.

MR. SMITH: So can I respond? For our kind of content, the question you ask is a much more complicated question, because we are, as I said, creating the delivery of instruction online. And so the economic model of how you support that -- and that is not cheap. We estimate, of the courses we've created so far, although we're driving the cost down by creating the models for development and the infrastructure to support it, so it's probably now on the order of between $500,000 and a million dollars a course to make a really effective course. So it's not something we're going to support out of our endowment. We're also foundation-funded right now. And so we have to create some kind of mixed model, and we're committed to some kind of mixed model, where the content can be available, open, but there's some added value that people who will use the courses get, and students pay for. But again, I agree that this is scalable.

The difficulty is largely social. That is, if our statistics course -- let's say our statistics course cost a million and a half to build. You can do the math. If there are a thousand people

using it, well, it's fairly expensive. If there are 10,000, that's a pretty inexpensive, high quality course. But we've got to convince people that -- get them out of the "not invented here" syndrome and develop that kind of business model.

CHAIRMAN MILLER: David.

MR. WARD: I'd like to sort of ask a question a little bit about the sort of long-run of the history of higher education, because in some ways, you may be defining a break point, because historically we've reflected on the history of higher education from the middle ages, probably associating the invention of printing in a sense with the nodal points of higher education, and then various elements of change in the 19th century. In a way, we've been arguing that, like the church, in a sense, we've changed little. There's this sort of continuity that can accommodate structural and social change, and we change just enough to cope with it.

I think what you were talking about is something which cannot be coped that way, that we're facing institutionally a culture that probably has a lot invested in slow change or in the idea of preserving tradition, and that, therefore, we examine what should be preserved rather than what should be innovative. I think most of us who have run

universities sense a bicultural element in the faculty, the staff, the alums, between change and innovation. The change culture is very different from the preservation culture.

Your description, David, is that, in effect, we may redefine the architecture and the structural properties of an institution, and how -- what it will look like. In other words, we have a model which probably is close to that, and it may -- and that's going to be very hard, because I really think there's a certain pride in what I would call adjustment rather than innovation in how we've coped. So that would be my first observation. Do you think what you've described, unless we can change that culture, which weighs preservation so heavily, and conservation so heavily, then we are, for the first time, going to be obsolete because we can't change fast enough?

The second one is more -- perhaps the more difficult challenge, which is that in order to solve the dilemma of under-performance of American students, whether it be in college, high school, or before, there's a sort of a standards movement, and a sort of accountability movement, that places a great deal of emphasis on age -- largely age-specific standards. What I'm hearing again from you is customization, and

that in fact it may be possible for somebody at 15 to have the same sort of body of things somebody else may have at 20, and that in fact we are investing a great deal in standardized evaluations in which the average may have a great deal of variation in it, and that while we may raise the minimum average standards, we may inhibit the precocity of those who are well above that standard. Particularly as we move into high school, a high level of standardization may in fact have some problems for us in terms of innovation and so on, and how can we introduce customization into the standards movement? Two questions there.

MR. WILEY: Well, there is a role for standards to play, from at least this perspective: the history of the automobile and of being to mass -- not only mass produce, but mass customize automobiles. Right? And if you know six sigma (ph), the lean literature, then what I'm going to say is going to be repetitive. But it wasn't the assembly line that really revolutionized the production of large numbers of cars at quality. Right? It was the careful standardization of each of the parts that had to attach to each other. So instead -- in an initial case, when you'd get a part, you'd have to take it and file it and customize it to make sure you could snap it into the other part and put it together to build

the car. But when those parts were highly standardized, then it became quick matter to put those together and produce a car more quickly. Then once you knew what the standard was, if you didn't want the red one, you could take a blue one, and mass customization became possible also.

So there's definitely a role for standards to play, but I think it's in a different way than we tend to think about 'em, the kind of age-specific way, you know, all the way across, you know, every 17-year-old should be at a certain level. So I think it does require, again, a rethinking of the role of standards, not a rejection of standards, because standards are extremely important to make a lot of this happen, but thinking about them in a different way.

CHAIRMAN MILLER: I could add that there are efforts, and there are actually examples in K through 12, of doing exactly that, customizing the learning process individually by students. And there's technology available. The biggest hurdle isn't the testing or the standards part. It's actually the custom of how we behave in classrooms. And it's very hard for an earlier trained teacher over at a district that's not interested in change to adapt to those things. It's not that they're not available, and could be used actually fairly easily today. And

it's not the standards that intervene, it's the people in the system that, as you say, are change-resistant.

MR. WILEY: Again, the technology's never the hard part. The social part is always the hard part.

MR. SMITH: This is also a place that I would encourage the Commission to take a look at something like those cognitive tutors for algebra and geometry, because built into those are learning objectives. And students have what they call a "skillometer" that indicates on an individual basis whether they're acquiring the skills that are specified. They'll acquire them at different rates, and the students get that feedback about whether they're acquiring them or not. So it's not a single final test, but instead, it's an accrual of data on how that particular student is performing. Indeed those build a student model for that student, and you can look at that model for that student and what he or she understands.

So, I mean, here's a place where that kind of combination of cognitive science and technology can actually play a role in making interactive assessment of whether students are performing the way we need them to.

MR. MAGNANTI: I can't help but think of

your question in the context of textbooks. You think of a textbook not as providing standards, but as providing some core knowledge that we capture, and hopefully in a compelling way, and that we then customize. And we locally customize for our students locally at our universities. So we take a particular piece of knowledge, and I think in some ways we've got to capture some core knowledge that we agree is -- whether you call that standardization or whatever -- and then how do we customize that? We, I think, traditionally have customized that locally at our universities in our classrooms. I think as the panel is suggesting, there might be different forms of customization that's provided, I think, by the fact of this openness, or the students might do some of that customization, as well as the faculty.

MR. WILEY: If it's going to scale.

MR. MAGNANTI: Yes.

MR. DONOFRIO: Just a few thoughts, and somewhere in these thoughts there'll be a question. I'll promise you this. I am terribly encouraged by all three of you. Absolutely fascinating, very, very well done. And not only because I'm a technologist, but who you are and what you're saying, this gives me great hope, in all candor, given the academic institutions that you represent, to have such forward-

thinking ideas about pedagogy and how we really should be teaching our students.

Perhaps the best thought I have here is, you're quite right, David. I think this whole openness movement is being terribly underplayed. I think it's as much a social movement as it is a technological movement. Here's what my real worry is for us and for you. Industry thinks it needs something different than what you're producing, because it lives in that real world. The children that we are growing up here, the K-through-12'ers that we are growing up, they are changing at an incredibly fast rate. They are not what we have been putting into college. They are coming better prepared. They're different. They think differently. You're quite right; they live in an online world, for goodness sakes. You know, they got 17 windows open all at the same time. You talk about being able to multi-task. And that's the world they like to live in.

Then to exacerbate that -- to exacerbate that, of course, we're giving them more powerful machines every day to play their games with. You know, soon they'll have a terraflop's worth of computing in their hand, you know, playing all these wacky things that they do.

So you are absolutely correct, I think, in your thinking, all three of you, in terms of getting in line with this movement of change that maybe -- you know, people talk about often a silent crisis or quiet crisis. This may be one of the more silent crises that's occurring. Maybe they're not all as educated as we'd like them to be. And maybe there's not accessibility for all of them either, by the way. So that's a big issue in terms of the way the population in this country may be split, depending upon who you are and what your background is. But eventually, we're probably doing a pretty good job here in terms of getting everything wired up.

So maybe here's the question. I was going to ask you a whole bunch of things about overseas, but I'm not going to do that. How do you enact this blended model that you keep talking about? I mean, how do you really make some substantive change, to be candid with you, in what you teach at your institutions?

You know, in all due respect, Tom, I mean, so have you changed the way everybody is taught at MIT? It sounds like Joel is trying hard to do that at Carnegie Mellon. Although he admits he doesn't understand the blended model, and he doesn't have a handle on it, but he comes the closest to offering us

the ability to actually driving down the cost of educating someone.

Could any of you comment on, are we actually going to put this into work, or is this just going to just be a great corpus of knowledge here that we'll look back on 20 years from now and say, man, we should've done it because China did it?

MR. MAGNANTI: Well, first of all, thanks for the question, Nick. Again, we shouldn't confuse the OpenCourseWare movement with education, and it's not the totality. So I'll just give you a couple examples at MIT. I'm sure we could give others at the other places.

Our basic freshman course in physics now, which used to be a 300-person lecture course, is now taught in a studio format. So it's taught in a room with 13 projection screens around the room, students around tables. They've got desktop experiments, computers there. It's taught with mini-lectures. It's taught with little beamers in terms of conceptual questions, and they get histograms for those questions in a much more interactive, flowing framework.

Our curriculum in our Aero/Astro Department now is taught in a scheme which they call conceive, design, implement, operate, in terms of where they talk about conceiving of products,

designing products, implementing products, operating products. They're now teaching in a framework in which they use -- the instruction is conceptually driven. So they have students before the class actually do the homework and do the reading assignments, and they come into these classes and say, here's four conceptual questions. Let me give you a test on those four conceptual questions. Based upon that, I'll in real time do the lecture.

So there's an enormous amount of innovation, not just at MIT, but at all of our institutions, in terms of, I think, in some ways, we're seeing, I think, a seat change in terms of higher education in general. At many places, we've sort of created these research factories, and they've served the nation well. But now I think our faculty are stepping back and saying we want to think seriously about education. And I'm seeing that not just at MIT, but at lots of our institutions. So I think we're actually seeing those kind of changes.

This OpenCourseWare provides, I think, materials for the faculty to use, and the wherewithal to make some of these changes. And so it helps to facilitate some of those changes. But this is not -- OpenCourseWare by itself is not going to change education.

MR. DONOFRIO: I understand.

MR. MAGNANTI: We need systemic changes in pedagogy, as well.

MR. DONOFRIO: I do understand. You're close to the same topic, but you're all quite different. So I do understand that.

But, Joel, what you talked about was more about changing the way the young are actually taught. Tell me a little bit more about that.

MR. SMITH: So the answer is that these Open Learning Initiative courses are being -- and parts of them -- are being used at Carnegie Mellon. And, yes, it's fundamentally changed the way that we teach introductory statistics, introductory economics, it's changing the way we teach introductory biology. The faculty, working with this team of experts, is learning about what we now know about how people learn. That's the difference. These are world class researchers who are interested in the quality of their instruction, but they don't have time to go and learn cognitive science.

I'll tell the Commission one of the things that has frustrated us. We have on repeated occasions submitted proposals to the National Science Foundation and the Department of Education saying we as a nation need some way -- and we would like to get started --

to help faculty understand what we now know about how students learn, and to continue to learn that as the cognitive sciences and the other learning sciences develop. There seems very little interest in this engineering piece of taking the results from the research, and taking the methodology, and pushing it into classrooms in ways that will actually be useful for faculty. And that's faculty across the range, from R1 to community college faculty. And those will be different. Right? But find ways to help them learn about this new information. And there's really not much support making that effort.

CHAIRMAN MILLER: Who are the people you listed there? That was National Science Foundation, NIH. Did you try the Department of Education?

MR. SMITH: No, I think we'll try them next.

CHAIRMAN MILLER: All right.

MR. WILEY: I'll just give one example briefly, as well. As a faculty member in instructional technology, I teach a two-course sequence on the design of educational materials, with an emphasis on designing them so they can be easily reused by someone else at another point in time. It's a design field. There are many points of view. There are principles that are well understood, but there are not

clear answers that are right as opposed to others that are wrong.

In the second semester of this two-course sequence, in trying to think about how to apply some of these principles about being digital and open and connected and participatory and these things, with the goal -- with the primary goal really being of helping students understand what the different arguments from the different perspectives are, I designed a course that read basically like a script for a sitcom. So, several characters, one who's the vice president of an educational software company, one who's a researcher, one that's a corporate and structural designer that's creating training materials there, five or six kinds of people, and wrote all the lectures from this perspective. It's basically a group of people that get together weekly and argue about the different points of view.

Now, I took that course, and I put it onto a wicky (ph). And if you're not familiar with a wicky, a wicky is a website on which every page has a button that says "edit," and anyone can click that button, and anyone can edit it. So I took that, and I put it in a public place, as well, so that people could find it. About three weeks into the semester, one of the students -- well, I came back to the

course, and I saw that there was a new character in the sitcom. It was a graduate student. And one of the students had said, you know what, the perspective of students isn't represented here. And they got in and started weaving their comments and their points of view, and actually wrote that out through several weeks of the course.

So it would take a different kind of solution if you were teaching math. I'm definitely a believer that the approaches need to be customized depending on which content area that you work in. But in this particular area, this was an approach that was very successful with the students. It was digital, it was open, and things were connected to each other. They participated, and they took it a direction that they were interested in. I think it was a moderately successful example.

MR. DONOFRIO: It's actually in their -- it's in their real life, too, Dave.

MR. WILEY: Yeah.

MR. DONOFRIO: I mean, this is the way they live; right? It's wicky, PD, blogs. I mean, we just don't really grasp yet just how multi-tasking and how unstructured their whole world is. So I am encouraged here. I mean, so clearly we'll have to focus more on this.

MR. MAGNANTI: I want to offer a brief comment here, and that is, we think this sharing and multi-tasking is new in some ways. Now, some of us did it before, but at a slower pace. I wrote a book once, and I claim I wrote this book with Johnny Carson, because I used to write it at 11:30 at night until 1:00 in the morning watching Johnny Carson. So we did it at a slower pace, but we did do it.

MR. DONOFRIO: I still do it.

MR. ZEMSKY: If you've been here through this day and a half, you'll discover I frequently follow Nick, and I'm not nearly as nice.

(Laughter.)

I've been -- Joel, you know this -- but I've been a long-time watcher of you guys, and fascinated by the technology and what you do. But I keep coming back to the following proposition, which I have two parts to it to ask you to respond to. The not nice way to put it is, your problem is you don't have any customers. You have answers for other people's problems, and they don't see the problems that you're talking about.

The other proposition is -- and again, it doesn't work exactly at MIT what I'm saying, and I understand that, or at Carnegie Mellon in the narrow sense -- but, you know, we have at least two major

problems in the education realm that we just aren't getting done. We're not getting language instruction done. There isn't anybody that's going to say we are good at language instruction in this country. Actually, we're not getting science or math literacy done. I keep -- the proposition I -- every time I'm sort of in this is, I'm always amazed, and I'm all for openness, and I get all that message, but I think you guys need customers.

I was sort of struck that I think all three of you said you're living off the foundations. You're not living off the core budget. If you had customers, you'd be living off the core budget. I think that's the change that just doesn't get made somehow, because the people you need to serve don't think they need your services, in the nicest way I can put it.

MR. SMITH: So I think that that is a basic problem. I mean, we do have customers in the sense that there are dozens of universities across the nation that are now learning Open Learning Initiative courses. Gradually, over five or six years of difficult work, the company, Carnegie Learning, that now markets the algebra and geometry cognitive tutors, made tremendous inroads into being used in the public education system, the K through 12 system, in the

United States. But I think in that case, the change that happened was the demand for curriculum that actually worked.

Suddenly from above there was a demand that, oh, my goodness, we really have to teach these students in a way that's going to be effective so they actually know algebra and geometry. That was the point at which Carnegie Learning could haul out all of the research, the dozens of scientific research papers, and say to the superintendents, you can buy this, and this is going to work. That is when they got customers. Of all the customers that started with them, only they and one other are left. And you're right; they didn't have many customers to start with.

We don't have that customers for the Open Learning Initiative courses we're developing now. But what we are trying to do is understand what it will take when the tipping point comes, when we hear about the difficulty of students fulfilling their requirements in California, having to go an average of seven years in order to actually get all their courses. When the tipping point comes, and somebody says, we're going to have to do something about this, we want to know what it takes to actually deliver effective online learning. And so in many ways, we're preparing for a future that we hope comes, and that

we'll have customers for these now. But you're right; right now, people don't realize that this is a way that could solve problems that they have.

CHAIRMAN MILLER: It probably comes that the average retirement age of the current faculty at large -- we have change-resistant institutions, is what we know, and it's very hard for people to adapt new technology and new circumstances. In fact, it tends to work against some of their interests, it seems to me. That's an argument that happens in other places, too. Your K through 12 example is clear. And if you don't have standards, there's no way to measure whether it's good or bad to begin with.

MR. WILEY: I want to disagree in the politest way possible with Bob's comment, because even though the foundation does fund the software that we write that provides the social wraparound of MIT OpenCourseWare, and the foundation funds the open source software we write that people can use for free to pick up and do their own OpenCourseWares, they don't fund my teaching. I was actually trying really hard to suppress the great offense I took yesterday at a comment that was made. I can't remember who made it, but the comment was that employers are the primary consumers of higher education's product. And I thought, where are the students? And to tell me that

I don't have a customer, when I'm in the classroom teaching students, and I do the kinds of things I do to respond to the needs that they have, I definitely do have customers. Now, they're not large-scale, you know, it's not a thousand of them. But I've got classrooms full of students that demand something different, and I try to be innovative to respond to those. And I think I absolutely do have customers.

MR. ZEMSKY: Just a quick -- it -- it seems to me that what happened in medical technology is an interesting example. You want to talk about a resistant profession, try the docs. Okay? And they're greedy to boot. That's got the two things that don't work too well. That wasn't recorded, I trust.

(Laughter.)

But when they really had some major problems, suddenly they changed dramatically. And one of them was they wanted non-invasive diagnostics. They embraced things that they wouldn't have thought of embracing.

See, I think, Charles, that the thing that the Commission could do -- and this isn't meaning to -- these guys are doing great. Nick is absolutely right. Our job, it seems to me, is to create the customer base, not to invest further in the product

development. We just need a customer base for what these guys do. And they will do fine if we can drive them to a customer base.

MR. MAGNANTI: I guess we've all had an allergic reaction to your comment, so I'm going to respond to it, as well.

CHAIRMAN MILLER: He warned you ahead of time.

MR. MAGNANTI: The packaging label was good. But I'm a little puzzled by your comment. There's a question of who's going to fund what we're doing, and then whether we have customers. Now, as I mentioned, 11 million unique visitors have visited OpenCourseWare sites -- 11 million unique visitors. When we started OpenCourseWare, we began by going through a strategic planning exercise at MIT to say, are we going to get into the distance education game and a for-profit game? And we decided not to do that. We decided it would be better to move to this OpenCourseWare movement and give it away, to the consternation of some of our faculty, I might say, who said this is the dumbest thing MIT could ever do, which is to give away all our intellectual property and intellectual content.

But I think there are customers for this. I think one of the things I recommended, and maybe

didn't recommend forcefully enough, is I would ask us to think about creating multiple versions of these across the nation, as David has said, but also one for secondary education. If we think about trying to improve secondary education in this nation, providing OpenCourseWare material that's widely available for that institution to bring the best math, physics, science, chemistry and biology education to them, and to also introduce engineering education to that population -- I think if we can introduce engineering education to help stimulate and motivate the basic math and sciences, we would improve secondary education, we would improve the literacy of our population in terms of their understanding of science and technology, and we would create more, I think, of a demand for science and engineering education and learning at the college level. I think some of the pipelines --

CHAIRMAN MILLER: How does that happen? I'm having a hard time as a lay person. You said it's not for education, it's sort of out here as a great opportunity, but I'm not sure what it does to educate people. So you just said it would inspire people if they had this available for secondary.

MR. MAGNANTI: That's correct.

CHAIRMAN MILLER: And what's the

connection? How do they fit?

MR. MAGNANTI: Well, there's a certain, "If you build it, they will come," I think, mentality here. And I don't say that to be flip in any sense. But we could unleash the creativity of our students, we would unleash the creativity of our faculty across the nation, if they had a set of materials that they could use. And we've seen this with respect to OpenCourseWare, people using it in very unusual ways, ways that we didn't anticipate -- self-learners, home-schooled people using this, people using this all around the world in a wide variety of ways. I think just let's unleash the creativity of the population out there by providing them with some compelling material. And we can't do this compelling material unless we have some collective activity as a nation to develop this. We can't afford to do this one at a time across the nation. We need, I think, a concerted effort by the nation. It will not be that expensive on a per-use basis if we do that.

MR. ZEMSKY: Could I just say that the difference between Joel and Tom is, remember when Joel told his story, he had a real problem he went out and solved. They couldn't learn geometry and algebra. Tom, I think the difference between you and I is I just don't believe in "awe shucks." I think that

until the educational establishment comes to a recognition, this is the job we're not getting done, they're not going to reach out for you guys. So that we could -- my argument, for what it's worth, is you will be inundated if people like me, who do the teaching -- because I'm like David in that way -- said, I can't get this job done using my current tools. Right now, 95 percent of the people who stand in college and high school classes actually think they can get the job done with current tools. That's what we have to change.

It's not a comment about open source. I believe. I'll bleed for you if you need me to. But I need the problem on the table, because the evidence, to me at least, says the innovation does not work unless -- in this country particularly -- unless it's problem-attached. And we need to get more specific. It's not just science literacy. It is, how many people do you have to teach to speak Arabic, Sally? She's got a real problem you could help her with, actually, it turns out.

CHAIRMAN MILLER: Okay. So I think you just got some new customers here today, one for sure.

I need to still understand, is the idea that you'd have a nation of learners, you'd have all this information, and you'd create the intellectual

curiosity, and somehow a large set of people start communicating with each other to access that, that they spend their time now accessing this information more than doing something else?

MR. MAGNANTI: I would, again -- and the other panelists might have a different view on this -- think of this as publishing, think of this as textbooks, think of this as putting in the hands of educators compelling material that they can use. This compelling material need not be at the level of a course. It could be modules that they could use so that they could infuse some of their basic education, at the secondary education, or at the college level, to provide a set of compelling materials that will help improve their education and provide them with some resources for that, but done at a national level.

MR. DONOFRIO: So, I mean, maybe -- if I could, Mr. Chairman? -- maybe this has something to do with the other issue we've been dealing with, which is the lack of science and the lack of math teachers in K through 12. Maybe what Tom is suggesting is that that type of offering could be put together -- and maybe it needs to be put together by colleges, by the way, so that we could then open it up and offer it to people who want to upgrade or improve their ability to teach math and teach science in K through 12. That could go

a long way to getting this whole movement started, Tom.

MR. MAGNANTI: Yeah. So already we've unleashed creativity; right? So now the thought is, let's take this and use it to educate those 70,000 math teachers that we want to educate; right? So let's use this as a mechanism for doing that.

CHAIRMAN MILLER: All right. I want to ask a question that's separate from that. I heard a comment about the Chinese will eventually have many more of these OpenCourseWares. So is that going to be in Chinese, or what's the validity of that data? Can we rely on it? I mean, what's the quality? Or is that sort of an intellectual head-fake? I mean, what controls that in that kind of world?

MR. WILEY: I'm not -- I think I can answer your question, but I don't quite understand it. So that's actually probably pretty dangerous. Would you restate it?

CHAIRMAN MILLER: Well, I heard somebody say that --

MR. WILEY: It was me.

MR. DONOFRIO: It was David.

CHAIRMAN MILLER: -- we're just creating this, but in the relatively near future, there'll be many more of these kinds of opportunities created by,

say, Chinese universities. I don't know anything about the reliability or validity of that. I have a brand effect when I hear MIT, but I don't know that from a Chinese -- and what language will it be in? I mean, what's the benefit of it for most people that speak other languages if it's in Chinese?

MR. WILEY: In our OpenCourseWare, we do have modules on how to speak Chinese. But there's a -- the group of schools that are doing this initially do a lot of information-sharing in terms of what are the best practices. How do we do it with as little resource outlay as we can? How do we prevent exposing the university to risk of litigation from sharing IP that we don't own? And so there's a lot of communication back and forth between these groups. In fact, in April, there'll be a meeting in Kyoto of all the 50 main universities around the world that are doing this kind of OpenCourseWare work. There's a consortium of the ten very best schools in Japan. It's Tokyo University, and Waseda (ph), and Osaka, and Kyoto, and Kyushu Daigaku (ph), and it's the big schools there, the schools in China, it's Beijing --

CHAIRMAN MILLER: How do you know what the validity of the information is? We have a reliability here when people put out with the name MIT or something. We trust it. Why would anybody trust some

other university that most of us would not know about? Are you going to vet information? Are you going to --

MR. DONOFRIO: What are they doing it for, David? Are they doing it for themselves, or are they doing it for the world? Maybe that helps.

MR. WILEY: Well, mostly it's done by consortia; right? It's ten schools in France, it's ten schools in Japan. But the Japanese schools are all translating the materials into English, as well as into Japanese. At the Chinese schools, some of them are doing it in English. All of it's being done in Chinese. In fact, some of what they're doing is translating the MIT materials into Chinese so that students can use it there.

But the question of what's the validity or the reliability of those materials are -- well, the simple answer is it's people with Ph.D.'s that teach at universities, so it's the same reliability and validity answer as what happens in the classrooms.

MR. SMITH: Well, I think you raise the issue of sort of trusted sources and credentials and credentialization. Johns Hopkins is putting up an OCW source in medicine. Well, that's a trusted source, and we know that that's going to be high quality because it's a trusted source. It's the same way when

we develop textbooks. We write textbooks, and some of them you're going to say you trust in terms of their content, and some you're going to less trust. But the movement here is to provide openness and provide this ability. It's not to validate, it's not to credentialize other universities.

MR. DONOFRIO: But here's my biggest worry. If China gets customers -- to Bob's point -- before we do, they'll come up with a better blended model, Joel, and they will drive this a lot faster and educate a lot more, and maybe, to your point, a lot more effectively.

MR. WILEY: Well, and realize that quality doesn't mean the kind of content that comes out of the R1 schools; right? There's a lot bigger need for this in community college just in terms of sheer numbers. You couldn't take the linear algebra course out of MIT, and without changing it at all, drop that material into a community college mathematics course and have it work. We need these OpenCourseWares at all levels. The R1s need to be collaborating on them. The teaching universities need it, the community college level. We need a broad collection of schools that are working together on this, and one place where we can go to get access to all of it.

MR. MAGNANTI: In that sense, if we're

going to do something for secondary education, we've got to extract the content from that system. It's not from our universities. We've got to go to that system and find creative ways of extracting that content, and then providing it in a way that's compelling.

MS. NUNLEY: That all spurs a question for me, talking about the multi-culture and so on. I presume that your materials are in English, and that they aren't available in multiple languages, unless some other country, as you mentioned, is translating it to their language. But I'm concerned about non-native speakers in this country and how we can use the developments in education to not further stratify our country economically. I just wondered about your thoughts on that.

MR. SMITH: So I think that's a very important part of this. I mean, understand that many of these initiatives really have just been -- are just a few years old, and are sort of getting it right first in terms of delivering it in English, and now we're working, for instance, with universities in Columbia to do translation and contextualization there. But that's not the appropriate thing for contextualization in Southern California community colleges. So it's going to require this creation of partnerships in order to contextualize it.

I mean, we're now deploying some of this Qatar. Although they want it in English, it turns out that many of the students learn it much faster in Arabic. And so we're going to face that translation and contextualization. They've never seen snow. A lot of our problems come from Pittsburgh, and they have to do with snow.

So it's got to be a -- this is a long-term effort. It's not something that's going to happen overnight in terms of making this useful, especially the sort of thing we're doing in terms of fully online education. That's something that's going to take years, and the tipping point, we think, is still several years out there. Although we do fear that perhaps China might get there before us in terms of what was talked about.

MR. WILEY: Well, and even for as short a period of time as we've been doing this, there's already a consortium of schools in South America that's translating these materials into Spanish and Portuguese. There's a group in China that's translating them into simplified Chinese. There's a group in Taiwan that's translating them into traditional Chinese. There's a group in Korea that's about to form to translate them in South Korea into Korean. Because they're digital, and they're available over

the network, it only takes one person or one group doing it. So even for a short a period of time as we've been working, to already be in five languages, the original plus four more, and to have other people contributing things back that we could translate into English if we weren't so ethnocentric as we are, there's a lot of activity already happening for as short a time as it's been going on, and I think it'll continue that way and just get faster, because it's open. They don't have to ask for permission and write memoranda of understanding to be able to do these translations. They can just do 'em, and then share them back.

MR. MAGNANTI: I actually think your point is very well-taken. We've got to make sure that we provide wide access to the U.S. population, and understand that that's not a homogeneous population. It's a very good point.

CHAIRMAN MILLER: Any other questions? Go ahead, Bob.

MR. MENDENHALL: I'm very encouraged with the idea and the potential of sharing of courses, the opportunity that it provides us for both better quality and lower cost, as we share great content. I, for one, would like to be a customer, so we'll talk.

MR. DONOFRIO: Especially for free.

MR. MENDENHALL: But I think, you know, one of the challenges, as Bob said, is, how do we get institutions and faculty out of their silos to actually be open to sharing course ware? Is there something specifically that you feel like this commission ought to be recommending in order to facilitate that?

The other question it seems to me we've kind of not addressed is that there's a disconnect between your OpenCourseWare that can be customized, and the scientifically developed course ware with good cognitive science, which you would not want to have modified or changed. Clearly, the OpenCourseWare is relative inexpensive to put online and let people access, and the cognitively developed content is quite expensive, and probably would have a cost attached to it. But I think the idea of having courses that could be shared across institutions and across faculty, particularly if we could develop a great course that was universally accepted as providing great instruction, could allow us to address the problem that we do have, which is, how do we educate more students at lower cost than we are today? Do you want to address those?

MR. SMITH: Let me take on two of them. One is, I think you're exactly right, and we just have

to be honest about this. The courses that are carefully developed, you know, using cognitive theory, using -- and careful testing, and -- I just can't tell you what goes into this. They watch the students use the courses. They do what they call contextual inquiries. They figure out where the students are having problems. They go back and redesign the course. And then it goes through iterative development.

There's no doubt that then you don't want just pell-mell modification of that, because a lot of thought has gone into it. That said, we do provide -- so it's a question of degree of customization. So we do provide a way that a faculty member can choose to use certain modules, and not use other modules, that sort of thing, as we do with textbooks, you know, please ignore chapter two, everything in it's false. So we provide -- so it's a question of degree of customization, you know, whether you can just modify it wholesale, which in many context would be fine, and in this context we'd say no. And I agree, there is that tension. We just live with that.

In terms of -- of -- I forgot what the second thing I was going to address, so maybe --

MR. MENDENHALL: Getting it shared among institutions and faculty.

MR. SMITH: Oh, yes. What the specific recommendation -- and I'll just say it again -- I think the vast majority of faculty don't have the time and don't have access to information about what we now -- why cognitive and learning sciences are now very important to what they do. I mean, we're talking about a national clearinghouse for content. We haven't talked about a national clearinghouse for teaching well, for management and engineering of your courses so that they use what we now know about how people learn.

I think what this Commission could recommend is that the nation provides for its teachers and professors that kind of information, that kind of transfer from what is being done in the learning sciences into the software, into the classroom. Right now, that is not something where there are many incentives to do that. There's just not much --

CHAIRMAN MILLER: We have a recommendation to do more research, or at least the possible recommendation to do more research and fund the kind of research you're talking about on learning, cognitive and otherwise, you're saying there's enough of that, or we're comfortable there, and what we need to do is expand it into practical teaching populations, is that it?

MR. SMITH: Yes, exactly. It's the transfer into the practical teaching. Once the faculty member becomes cognizant of this gap -- and there's a difference between knowing the content and teaching the content well. And again, I'm going to come back to saying, depending on research -- you know, sound, scientific research in what works -- and then they -- and they resonate with that. They say, oh, well, this is cognitive science. This is research. I understand these are research results. I'm willing to apply these in my classroom. This isn't just a theory somebody dreamed up. Here's the results that it works. So they're willing and get excited about using the classroom. So, yes, it's the transfer.

MR. MAGNANTI: I have a little question for you all. How many of you learned economics from Paul Samuelson's Principles of Economics? All right. So what we need --

CHAIRMAN MILLER: I read it, but I wouldn't --

MR. MAGNANTI: Oh, you didn't learn it. Well, --

(Laughter.)

Good distinction. Good distinction.

So an interesting question is whether,

coming out of this OpenCourseWare movement, there will be some analogs of that in certain fields where there'll be some seminal materials that will be adapted widely across the nation because it's compelling -- because it's compelling. So one is that.

The second that you asked, how we can help. I think what our faculty look for is impact and fame. They want to impact the world. So I think if we can find mechanisms for helping them to impact the world -- I don't know quite what those are -- or rewarding them -- and they are looking for fame, and so I could imagine national awards, corporate awards, whatever, that are some set of awards that you could establish as a Commission through the Department that would honor some of our faculty who are doing some of the most innovative things in this arena. I think that might help, as well.

MR. WILEY: And I'll add to your first question, what could we do? I think you could take it from the perspective of, how do we reward faculty, and how do we incentivize in that way? But think about what we've done in the last 10 or 15 years around diversity in higher education; right? Fifteen or 20 years ago, nobody had heard that term. Now it's a huge term. We do training on it. We hold workshops

on it. We promote it as what we want. We want this principle to be part of the culture of higher education in a way that it wasn't before, and we've pushed for that in very specific ways.

I think we can push for openness in the same way, as a principle that will improve higher education, in not the same way, but in a way analogous to an embracing of diversity as a principle and a commitment, and it has improved our education. So that's one thing.

The second thing, to your other question about you don't want to change -- your comment that you don't want to change the cognitively informed tutors. I would disagree with that. Actually, Joel disagreed with it in his first statement. He said it doesn't snow in Qatar; right? We do have to modify those materials in certain ways. I would think about it like a cell phone -- right? -- where there's underlying structure, but then you can buy different skins that you snap on and snap off, the way you think about a web page now, where there's a clean separation between the structure and the content and the way that it's presented. Is it red, blue, large, small, whatever?

We can abstract the content and the presentation of the content away from each other so

that we do keep the effectiveness of these proven principles from cognitive science. But when we take it into Qatar, we can change the example from snow to something else, or when we take it into Tonga, we can't talk about a slice of a pie, because pies aren't round there. Questions like that on tests just flummox students because they don't know what they mean.

We do have to be able to appreciate the cultural context of these students, and we have to be able to adapt for that. But we can do that and still hold to these proven cognitive principles if we separate those two parts out.

MR. MENDENHALL: I was on a little different point, in that, you know, Charles mentioned the OpenCourseWare from MIT has credibility because it's MIT. Joel would say it's only as good as the faculty member who actually is very trained in the subject matter, but not particularly in how to teach it. Therefore, you know, it represents content and not instruction, which I think Tom was clear to say at the beginning.

The question is, are we looking for open content, or are we looking for great instruction that we can share across universities that actually helps us educate more people at lower cost with high quality

instruction?

MR. SMITH: Both.

MR. WILEY: Yeah, and it's probably a phase; right? Once there's lots of open content available, we can take and assemble that into lots of open instruction; right? The content is infra-structure that we innovate on top of once it's open and available.

CHAIRMAN MILLER: Well, we have a lot of content today. What I just heard somebody say is we don't know how to deliver it if we don't know the brain works and so on. So the content itself doesn't solve it. I'm not sure I heard that connection. I have a disconnect there. I heard one -- we have this marvelous amount of content, and I'd think that would create a large amount of activity in general, but not at institutions of learning, unless you have people who know how to use the cognitive sciences. That's what I think I heard you say. We have all these people out there today that have the knowledge. You're saying we can't deliver it very well.

MR. SMITH: So you may find disagreement at the table, but I would agree with what you just said. I mean, the content alone, without the various mechanisms -- although, I mean, David talked about many of the mechanisms in terms of developing social

relationships so people can help each other use open content. Tom talked about the faculty members inter-changing ideas about how to use the content. So getting the content out there changes that other scene. But I would agree that the content alone is insufficient. You've got to have supporting mechanisms to help people learn better with it and teach better with it. That's our great challenge is putting both out there and making them available.

MR. MAGNANTI: I would refer to a comment that David made before, and that is that the content is better because it's open-sourced. Our faculty, again, who are very proud and want fame, they want the best possible content out there. So the content of an MIT education is better today than it was three years ago because of open content, because the faculty, in bringing these courses together and putting them together, have developed better content. But I would say that content is not widely available, and I think that's why we need more of this OpenCourseWare.

CHAIRMAN MILLER: Thank you. I beg your pardon. Would you like to --

MR. WILEY: Just briefly. If I wanted to do something innovative with this Samuelson textbook, because it's not open, because the rights are owned by a publisher, I'm basically stuck with, "Skip chapter

two." So there is plenty of content, but it's all IP-encumbered.

If there is open content, I could take that, and I could translate it into another language. I could change an example so that, instead of snow, it talked about something else. I could do those innovative things. There is lots of content, but we're prevented, to a large extent, from really innovating with it, because that infrastructure is closed.

MR. MAGNANTI: And also, if I can add to that, as David knows, one of the great challenges in putting this material together is the IP. So we have to go through -- with all these sites for the OpenCourseWare, we've got to go through every single course, and we've got to check every single piece of IP, because there's a fair use doctrine that says, if I'm teaching at MIT, I can take a page of Time Magazine and flash it up, and I can use it. I cannot broadcast that over the web. So someone's got to cleanse every single course that we do because of the IP. It's an important, I think, aspect of this, and it's an important limitation, as well.

CHAIRMAN MILLER: And you're implying one of these pieces of course work is going to be the gold standard because everybody will adopt it. If we raise

a question about standardization of anything, even in general education, we get a lot of push-back. Would we have Samuelson in another philosophy? How do you do that? That's what I meant about whose name is on it, and what the brand is, and things like that. It makes a difference to me whether it came from a Chinese university, or a United States university, or a British university. Things like that would be how we would differentiate philosophy and truth, even validity.

MR. WILEY: I would say let the market work, and the market --

CHAIRMAN MILLER: That's a good answer.

MR. WILEY: -- the market worked pretty well for Samuelson.

CHAIRMAN MILLER: Except we don't have it in places that you talked about.

MR. WILEY: That's true.

CHAIRMAN MILLER: Thank you. This has been one of the finest panels for me, and I feel for the rest of the Commission. I have a sense we're going to be back to ask more questions from all three of you. Thank you very, very much.

(Applause.)

Would our student panel come to the table up front.

(Pause.)

EXECUTIVE DIRECTOR OLDHAM: All right. We're a little bit behind schedule, so I'll -- we'll kick this off. As you all remember from Nashville, we have set aside time at each of the meetings to hear from our consumers of education, either current or very recent consumers of education, our nation's students. The three students we have today have all benefitted from the alternative and innovative educational delivery models that we heard from yesterday, WGU, Kaplan and Capella.

I'll just turn the microphone over to Jerry, and hope that they all give a little brief introduction -- personal introduction of themselves, and leave that to them rather than me do it. Thanks.

MR. DAVIS: My name is Jerry Davis. I am the Chief Information Security Officer for the U.S. Department of Education. I've been in the security field for about 14 years. Prior background -- spent a number of years at the Central Intelligence Agency, Marine Corps counter-intelligence officer, and served as the manager of wide area network security for the District of Columbia.

I'm a lifelong student. All of the degrees I do have -- the three degrees that I have have all been from alternative education. I am

currently working on another degree at this time, also in alternative education.

Would you like me to go ahead and go right into my remarks, ma'am?

EXECUTIVE DIRECTOR OLDHAM: Please.

MR. DAVIS: Absolutely. Okay.

Members of the Commission, distinguished guests and fellow students, I bid you all a good afternoon. As I said earlier, my name is Jerry Davis, and I'm a 37-year-old student from Sterling, Virginia. I hold degrees at both the undergraduate and graduate level, and I'm currently working on a second graduate degree. I am honored that I have been given this opportunity to exchange dialogue with you in regard to the many innovations in education that I have witnessed and experienced as a lifelong student, father of two college-bound students, spouse, and a full-time member of our country's workforce.

For any high school student exercising the option to attend an institution of higher education, it is a daunting task that is overshadowed only by the voluminous choices in institutions, and the stress of acceptance and accessibility, which is forever punctuated with the impediment of cost containment. I am an adult who has never truly left the higher educational system, and as such, those same stressors

that weigh intensely on the minds of the college-bound high school student weigh even heavier on the adult student. Adult students must contend with conflicting and competing priorities, and professional and personal responsibilities, all while making an attempt to acquire the fabled balance between work and life. Finding an institution to attend that is amenable to a student of this sort is an arduous undertaking.

My reason for choosing to be a lifelong learner is rather simple. I enjoy the benefits derived of possessing knowledge. But to continue acquisition of knowledge through a structured program of study for the adult learner must be attained through a program that is pliable enough to conform to the lowest common denominator, and fully satisfy navigating what I express as the triple constraints of true educational innovation.

This program must be accessible and on demand, and must provide measurable and tangible value, and it must be economically feasible. Western Governors University is one such institution that answered the call of the triple constraint. WGU's innovative approach to delivering a quality degree program through its competency-based format is long over due. The extreme pliability of WGU's program provides options that are not normally seen in degree-

granting virtual environments, and is not available in a traditional learning environment.

WGU's program was my logical choice because I was able to structure my studies around my lifetime requirements and commitments instead of the reverse. The competency-based format fully promotes the student's control in management of time. Courses were available to me as I needed them, on demand. This removed the regulation of having to be somewhere at some predetermined time, when time, as it seems, is often rarer than money.

At WGU, the student drives success. WGU allows for as much or as little interaction with the appointed mentor or with other students as a student needs or desires, implicating further accessibility and traversing yet another constraint.

The method of proctoring tests is not new; however, the implementation of proctored testing in a competence-based format is very powerful. Test results are provided in near real time, and a passing score reenforces to the student that the course material had been adequately assimilated. This is immediate proclamation of value add, measurable and tangible learning.

The tuition structure that WGU offers is savvy and smart. The tuition is built around spans of

time vice per-credit fees. This structure, combined with the competency-based format is highly synergistic and incentive-based, meaning that if I work quickly in demonstrating the required course competencies, then the quicker I can complete the program, while expending a minimum amount of funds.

I completed my course of study in business with a concentration in IT security in just around five months. WGU is the only higher learning institution I've attended -- and I have attended many -- where I've actually had funds return.

As a Chief Information Security Officer at the U.S. Department of Education, I am required by law to possess the requisite experience and education needed to carry out the duties of the position. There is an over-arching and critical need to acquire professionals who are well trained and who own the relevant education. WGU substantiated my employment and provided me with some additional tools and skills that I'm able to leverage in my current role.

To this end, I will close my remarks with a few recommendations for the Commission. Number one, drive home the ideology that an innovative education delivery model is not based solely on technological attributes, but rather, on innovations that address and enable accessibility, promote measurable and

tangible results, and aggressively support cost containment.

Second, continue to evaluate virtual competency-based post-secondary educational programs in an effort to expand their ranks.

Third, continue to evaluate solutions to ensure that virtual learning institutions remain cost-effective, and accessible to students of the lowest common denominator.

Fourth, develop solutions and programs to market virtual learning institutions and their programs.

Finally, establish a student forum consisting of current or private virtual learning institutions with the intent of collecting suggestions for the improvement and enhancement of the virtual learning environment.

This concludes my remarks. Again, I'd like to thank the Commission for its undivided attention and for this rare and valuable opportunity.

EXECUTIVE DIRECTOR OLDHAM: Thanks, Jerry.

Jon.

MR. LAMPHIER: Hi. Good morning. My name is Jon Lamphier. I wanted to begin by thanking you for the opportunity to come and speak with you today.

I thought I would tell you a little bit

about my experiences with non-traditional education, my background leading up to that, and what I've done with it afterwards. I grew up in western North Carolina. I graduated in 1994 from Hendersonville High School. I enjoyed being a student. I had a very good grade point average. I went to a traditional educational institution. I went to the University of North Carolina, where I attended for one semester, and I ran out of money.

As is common, I think, in western North Carolina, since I had left the higher education field, I went into the military. I went into the Marines, where I served for six years. I left the military service in early 2001.

I had a wide range of experiences. I had attended a variety of traditional school and non-traditional school while a Marine. That was not readily transferrable into a traditional degree. I had also gotten married, I had a child, and was not in a position that traditional schooling really met my needs.

The Marine Corps experience did not train me to accept defeat, however, so I found a solution, and the solution was Kaplan University. As you know, Kaplan offers the non-traditional approach, offering the vast majority of courses online. A number of

institutions I had been familiar with, including the Marines, including the National Security Agency, including the Navy, had all used some variant of that model, so I was a little bit familiar with it. And Kaplan seemed like a full-featured program.

I received from Kaplan all the same academic support I had received from the traditional undergraduate programs before that, and that I've received from traditional graduate programs afterwards. University representatives walked me through the process of applying, walked me through the process of financial aid, and helped me explore how my previous course work would fit into my new degree program.

I had an academic advisor at Kaplan who assisted me in everything from selecting courses to balancing my academic and professional workload. I was working a full-time job at that time, as well as having the family duties. I think that's a familiar situation for most non-traditional students.

The academic experience was also similar in the non-traditional education as I had received in previous more traditional classes. My classes typically met once per week. Most involved guided discussions by the instructors, a format that I have seen used in more traditional academic settings to

encourage student participation and understanding.

Moderate sized classes of generally about 20 students ensured a diversity of ideas, but gave everybody a chance to participate. The instructors were all very well qualified for their courses, and generally went above and beyond to help students comprehend the material and apply it.

Where a non-traditional education surpasses a traditional experience really is in the diversity factor. Universities have cited time and again diversity as a crucial ingredient in applying and preparing young minds and exposing them to new and different ideas. Whereas most traditional schools attempt to foster diversity through admitting students with different backgrounds, and then combining them in nearly identical settings, online schooling allows for diversity because students are actually coming from those divergent backgrounds each and every time they attend class.

In my courses, I connected with professors at Princeton while working in Atlanta. Some of my classmates were full-time students at Kaplan's Iowa campus, while some were single mothers in Kansas, and some were New York City policemen. The effect this has on learning and discussion is enormous and important, and it cannot be duplicated in the same way

in a traditional setting.

One of the purposes of this Commission is to investigate the accessibility of higher education for less advantaged families. Non-traditional education is one method that addresses this problem by affording access to higher education to many students for whom the rigors of a more traditional program may simply not be feasible. Rather than be forced to choose between supporting a family and pursuing a degree, online education allows students to pursue both. It acknowledges and accommodates our increasingly mobile society, allowing students to work and attend class even when their geographical location is in flux. It brings flexibility to an area that badly needs it, and ultimately makes college a realistic opportunity for many students that may otherwise have given up their dreams of attending school.

I graduated from Kaplan in 2003, and I went on to pursue my law degree at Fordham University School of Law in New York, a top-tier school known nationally for its academic prestige. I served there as an editor on the Fordham Moot Court Board and the Fordham International Law Journal, and I have never felt at a disadvantage to my peers. If anything, I have excelled. While in school, I have worked as a law clerk, as a research assistant, and as an intern

with the Federal Trade Commission, and I have performed well in each position, if I judge that myself. I have relied on the learning I accomplished at Kaplan each time, and I have not been disappointed.

In May of this year, I will graduate from Fordham and sit for the New York State Bar exam, and have accepted an offer to begin as a senior associate as Ernst & Young in New York. Additionally, I am continuing at Fordham, expecting to achieve an MBA in finance in spring of 2007. None of these accomplishments would be possible, not even remotely, without Kaplan and without the non-traditional educational benefits.

I encourage the Commission to strongly consider non-traditional education as an important step in preparing our nation to meet the academic challenges of tomorrow and better equipping our citizens to compete on the international field. Thank you.

EXECUTIVE DIRECTOR OLDHAM: Thank you, Jon.

Carol.

MS. YOUNG: Hello. My name is Carol Young. I am a registered nurse. I work in a low risk newborn nursery, and occasionally in the neonatal intensive care unit. I am certified in low risk

neonatal nursing.

I also want to thank you for the opportunity to speak before the Commission on the future of higher education. I am honored to join the other panel members as they describe their experiences in the learning process for adults.

I am a recent graduate of Capella University, where I earned a Ph.D. in organization management with a specialization in leadership. My educational path has been a long one, and it's been fueled by a desire for knowledge and the aspiration for continual growth.

I started first grade at the age of four in a very small rural elementary school in Kansas that did not even have an inside bathroom, if you can believe that. I made the eighth student at that school, and that allowed that school to remain open for one additional year.

I continued in the Kansas public school system until I graduated from high school. I then attended a Catholic nursing school in Wichita, but left there and started a professional nursing program in Houston. I did not have to work during that time. I did graduate, and I passed my licensing exam to become a registered nurse.

I worked as an RN for several years,

during which time my daughter and son were born. As they approached school age, I felt the desire to return to school, and believed that a Bachelor's degree was essential to future success as a nurse. I earned a Bachelor of Science degree in nursing from Houston Baptist University.

About five years later, I again felt the desire to learn and the need for more education to enhance my career, but along a different line. Working full-time, having a family, and trying to meet school class schedules, it took me six and a half years to complete a two-year program at the University of Houston, but I did earn an MBA. That degree opened many doors for me, including the opportunity for a nurse executive fellowship and for promotions at work.

My current job requires a Master's degree. About eight years after earning my MBA, I made the decision to begin a Ph.D. program. That quest took nearly four years, but I treasure the experience, and I feel fulfilled. Just think, a little girl from a farm in Kansas is now Dr. Young. It's just still a thrill.

I chose an innovative, non-traditional school because it was the only way I could continue my chosen career in a company where I'd worked for nearly 30 years. It's now approaching 34 years with that

company. As a neonatal nurse, I work 12-hours shifts, varied days, weekends and holidays. Additionally, I have family considerations, and for pleasure, I travel and run marathons around the country.

As I searched for a school that would fit me, I discovered Capella University. It was fully accredited, and was small enough that I felt like I would receive individual attention. I did. I received an e-mail just a couple of months ago from an admissions advisor just saying hello. Learner support services met every need, and answered or found the answers to questions in a prompt, helpful and professional manner.

Most of all, the faculty were wonderful and treated us as peers. There were not more than 16 learners in my courses, which allowed us to get to know each other, in addition to the instructor, as well. We had access to faculty in the course room, via e-mail, and by telephone. I was able to log on and complete my course work, comprehensives and dissertation around my work schedule, family, and marathons in Anchorage, Honolulu, Nashville, Baton Rouge, and other cities.

I also met many faculty members and other learners at colloquia. The colloquia were an innovative idea that provided an excellent opportunity

for more in-depth interaction with faculty, administrators, support services and learners from my own school, along with learners from other schools in Capella University.

The quality of my instructors was excellent. For example, my dissertation committee was made up of my mentor, who has a Doctor of Business Administration, a member who is a practicing physician, as well as a Ph.D., a psychologist with a Psy.D., who is also a lawyer, and a visiting scholar from Louisiana State University who has a Ph.D. Additionally, most of my faculty had held or were holding positions of responsibility in the business world. That added a richness and depth to my education. They could speak to the latest research on a topic, and enrich it with experiences they had encountered in their career.

I'm currently working as a peer with my mentor on two different but related academic projects. Each step of my college career has opened more doors for employment and career advancement that I never even dreamed of as a young girl starting out.

I spoke to the chief nurse executive where I work about a month after I graduated to tell her I was finished with my Ph.D., and she offered an exciting job on the spot. My hospital is beginning

the journey toward Magnet Recognition, a program developed by the American Nurses Association that recognizes the unique contribution of registered nurses to the health care of hospitalized Americans. She offered the opportunity to coordinate that journey, and to use my Ph.D. to direct the nursing research program that will assist us in providing evidence-based practice to improve patient outcomes. That opportunity would not have been offered to me without the successful completion of my Ph.D. at Capella. I am now filling that role, along with my previous role as RN-IV in the low risk newborn nursery. I have the best of both worlds.

But along with that opportunity, I can now serve as a faculty member to help other learners along their path to fulfill their dreams. I'm now starting to investigate other innovative educational programs where I can work in the same manner that was so successful for me as a learner, one where I can work at a time most convenient to me, and one where I can work from anywhere in the world, so that I can continue to travel for pleasure. Along with knowledge that I have to share, all I need is internet access.

I did receive financial aid for the first time while I was at Capella University. An advisor helped me to get started, and it was easy after that.

Everything I needed to apply for and keep track of my loans was easily available on the Capella website. Even though I am still in the grace period, I have started to pay back the loan. The debt is very manageable, and I'm planning to pay it off in one half or less of the required time.

Compared to the cost of a doctoral program at a traditional university, my education at Capella was not only more convenient, but affordable. I was able to continue full-time employment throughout that program, and that would not have been possible in a traditional program -- in the traditional program I investigated. I also did not pay the many fees that were required when I earned my other degrees, such as those for sports programs where I had no interest. My time is valuable also, and I got to spend my available time on continuing my career, and on learning rather than driving to class and looking for a parking spot. I value my educational opportunities in the traditional program; however, that does not fit my life at this time.

Specific recommendations that I would have for the Council is to encourage and help finance additional innovative and non-traditional models that will increase access for those adults who are unable to attend traditional programs, such as those with

full-time jobs, burdensome family responsibilities, those who travel frequently, or may live a long distance from campus.

Like Monica Poindexter said, my second recommendation fits right in with her comments, that we need to encourage and help finance programs to attract more faculty members with appropriate degrees who work outside of academia to join the pool of available instructors. In order to produce graduates who are adequately prepared to step into the work place, there must be an adequate quantity of faculty with impeccable credentials. Non-traditional programs can draw from a pool of professionals who are unable to attend traditional programs for the same reason that adult students cannot.

That concludes my remarks. Again, I thank you for this opportunity, and I would welcome questions or comments.

EXECUTIVE DIRECTOR OLDHAM: Thanks, all three of you.

Does anyone have any questions, Commissioners?

MS. NUNLEY: All very, very impressive. Congratulations for your accomplishments and for your wonderful testimony.

MS. HAYCOCK: If I could ask a question?

Let's say the three of you have 18-year-old children who are about to decide on colleges, and are ready to -- can afford to go full-time. How would you help them think about the pros and cons of traditional versus the alternative kinds of programs that you've chosen?

MS. YOUNG: I have already been through sending children to college. I have children that are from -- my -- my son was able to go through his under-graduate program. He did work at the same time, but he was tied to a classroom schedule. When he went back -- he has a Master's degree as a social worker, and he again worked at that time. The traditional school was good for him, but he also might've benefitted if he'd been able to work a little more hours to help support that if he'd been able to do a non-traditional program, and I would encourage him to look at both methods and see what best fit with him.

My daughter went to a traditional program only. I would encourage her to just look at the programs that are available out there, maybe do a blend of both. I'm encouraging my daughter now to attend -- she's a stay-at-home mom now -- I'm encouraging her to go back and do a non-traditional because she's a stay-at-home mom.

MS. HAYCOCK: Thank you.

MR. DAVIS: Kind of along the same lines, I do have a daughter that's headed to college at the end of this coming school season, in the fall, and I have one that'll be going the following year. I did present those options. But I looked at it really close with her, because it's not -- the non-traditional is not a program, I believe, if you're not really a self-starter, if you're not really motivated, if you really have to be pushed to go to school to begin with. She is very motivated. She is very much a self-starter. But I didn't believe it would suit her to start off at a non-traditional school on her own. That's largely just by looking at her bedroom, from the mess of things that are all over the place.

(Laughter.)

So she needs structure. She still needs a lot of structure in her life. A traditional school, I believe, will give her a lot more structure that she needs at her age, as well as for my next youngest that's going to be going, again, in another year or so.

So those are kind of the things that we looked at, myself and my wife looked at, in letting her decide really what she wanted to do. She's seen me online for years now. It's kind of a thing in the house, you know, you can't bother Dad, he's doing

schoolwork right now. She was heavily recruited by some of the Ivy League schools and whatnot, so it was a give-and-take with her. But I encouraged her to go the traditional route largely because of structure.

MR. LAMPHIER: If I can answer from a little bit different perspective, my daughter is six, so picturing her going off to college is quite a jump for me. But I believe you have also -- the way I think about it, you have the higher education opportunities that exist now, and the higher education opportunities that will exist when she is 18.

You know, to put it in different terms, I've had an e-mail for about 16 years now. About five years after I got one, I heard of a guy starting a business, and he was going to sell books online. I thought, this is the stupidest idea ever, because you can go down to Waldenbooks and pick it up, and if you want a book, do you want to wait for days and days to get it? It doesn't make any sense. And of course Jeff Bazos made Amazon, and I think he's doing just fine. I really wish I had thought more about that investment opportunity.

I think 12 years down the road, you may have much, much grander concepts. Just the way that Jeff Bazos got in at an early stage, and now I don't think there's a company out there that doesn't see

what could be considered an alternative form of product delivery as an important part of their business model. I think higher education is similarly served by considering that. I don't think it's for every student, but it might be for some courses for every student, or for all courses for some students, and no courses for some students. But it definitely has a place. So I would have to see when she's old enough what the world looks like then. But it's definitely something that would play a factor in my mind.

MS. HAYCOCK: Thank you.

EXECUTIVE DIRECTOR OLDHAM: Anyone else?

(No responses.)

Thank you all so much for being here. I think we're running ahead of schedule, so we can wrap up early and let everybody get on their planes. Thank you.

(Proceedings adjourned at 12:27 p.m.)