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Brookings Institution Panel previewing PCAST's K-12 STEM education report
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Let me start by thanking the Brookings Institution for hosting this important conversation. I also want to thank Jim Simons and Math for America for bringing us together, and for Jim's phenomenal leadership in developing inspired and informed math teachers. And I know we will all miss Representative Bart Gordon, who has been a powerful force for the good through his work in Congress. Finally, I want to extend enormous gratitude to Eric Lander and PCAST for taking on this pressing issue so early in their work. Eric's preview of the report suggests that it will be appropriately ambitious in its recommendations.

I would suggest that everyone in this room, and most others, would agree that the most critical impediment to our nation's competitiveness is the comparatively weak preparation of our students, particularly in math and science. High-level math, science and engineering education is essential for responsible citizenship in a world where technology dominates. At the same time, people increasingly need math and science skills for 21st century jobs. What's more, if the US hopes to continue to lead in innovation and innovation-based economic growth, strong math, science and engineering education will be absolutely critical.

Unfortunately, as demonstrated in study after study, American students continue to fall further behind. According to the OECD PISA study of international educational achievement, in the 1960s, the US was the top-ranked country in high school completion rates; we now rank 21st. As recently as 1995, we ranked 2nd in college completion rates; we now rank 15th. If we narrow our focus to math achievement, the National Assessment of Educational Progress shows that in mathematics, American 17-year-olds have made almost no progress over the last 30 years.

The failure of American students to attain higher-order math skills would be worrisome even if the rest of the world were standing still. But as the OECD PISA study suggests, the rest of the world has not stood still; much of the rest of the developed world has passed us. One reason for the acceleration elsewhere is that competitor countries are doing a better job of recruiting, training, retaining, compensating and celebrating highly qualified teachers of math. In extending the benefits of secondary and higher education across our population, the US had the first-mover advantage. Other countries, however, have recognized the power of education to fuel our innovation-based economy, and they have effectively adopted the American model. While they have deliberately accelerated their progress in education, we have allowed ours to stall; predictably, then, we are steadily losing our lead.

If this trend continues, the consequences for our nation's future will be disastrous. It will drastically limit our ability take on urgent challenges: The global crises in water, food and healthcare; the urgent need for clean energy and smart cities; the battle against poverty and the fight to restore economic growth. All these challenges require understanding of math-based technology and math-based systems thinking. Continuing to lose our edge in math and science preparation will also gut our ability to lead in innovation, which will swiftly erode our deepest economic strength, dooming us to be merely consumers, rather than producers.

As you all know, I come from MIT, where 85% of our undergraduates major in mathematics, engineering or the natural sciences. We feel so strongly about the need for more highly trained scientists and engineers that we just announced that we will increase our undergraduate enrollment. Yet the fact that 85% of our graduates study engineering and science makes MIT an anomaly: nationally, only 15% of bachelor's degrees are awarded in these fields. In fact, the US now trails more than 16 nations in Europe and Asia in the proportion of 24-year-olds with bachelor's degrees in engineering and the natural sciences. From 1989 to 2003, despite a growing population, the number of American science and engineering PhDs remained constant, at an average of 26,600 a year. Over the same period and in the same fields, PhDs awarded in China shot up from 1,000 to 12,000. The trend eloquently speaks for itself.

We can all agree on the importance of excellent teachers, but while each year a small number of MIT graduates do decide to become K-12 teachers, and we do have a program that prepares them for teacher certification, it's a tough decision for them. Those who choose to become teachers do so despite the fact that they will be less well rewarded than if they had pursued most other science and engineering careers. I'll give just one data point to illustrate part of why it's so hard for an MIT graduate to choose a career in teaching: Last year, the average starting salary for MIT graduates was $67,000. In 2006-7, the median career salary for teachers was $51,000. That economic differential is particularly tough to take for our students, many of whom come from families without economic security.

Clearly, then, we face serious systemic problems. But on the way to systemic solutions, research universities like MIT can help. Let me describe only three of many ways.

First, research universities can help teachers teach better, by sharing materials, technologies and curricula. The open sharing movement is already hugely important in this area, and it's growing. At MIT alone, our OpenCourseWare (OCW) initiative offers materials for virtually all courses at MIT – 2,000 of them, online, free of charge -- and gets 1 million visits a month. To help those teaching or taking AP courses, we designed a special OCW portal called Highlights for High School, as well. In the same spirit, MIT has also created open-source teaching technologies—online tools that let teachers and

students perform experiments from remote locations on some of our highly sophisticated equipment or to access our computing resources.

I'll tell a little story that illustrates the potential impact of OCW and other open sharing sites on high school education: MIT's Alumni Association gives awards to high school teachers whom our students have nominated as having played a critical role in their education and development. Sometimes, when I visit MIT Clubs, I have the honor of presenting these awards. As I gave the award to one teacher, he told me, with enormous enthusiasm, "I just used OCW to teach linear algebra for first time." This is a teacher who loves his students and what he teaches them, and OCW has given him tools that amplify his effectiveness, allowing both him and his students to stretch beyond the bounds of the set curriculum.

Second, research universities can refresh, educate and re-inspire existing teachers. Anyone who's ever taught will tell you of the need for exciting new input, and that need is enormously magnified by the high rate of advance in every area of science and engineering. Especially in high school, it's absolutely essential that math, science and engineering teachers be experts in their subjects – and expert teachers. This challenge presents a terrific opportunity for universities to help. Again, if you will forgive me another MIT example, our Science and Engineering Program for Teachers (SEPT) brings teachers to campus each summer to hear from MIT faculty about leading-edge research and to learn new ways to teach hands-on problem-solving and modeling of complex systems. Over 20 years, SEPT has developed network of 1,000+ passionate alumni who continue to inspire one another.

Third and finally, research universities can add to the inspiration part of the PCAST equation: we can help inspire young people to pursue STEM—and STEM teaching.

As I described earlier, this presents no mean challenge, but we do have one huge fact in our favor: this is a generation that wants to make a difference. They don't feel defeated by the scale of a challenge. They're ready to roll up their sleeves and get to work solving the problems of our time, great and small. I think of them as "Generation Why Not?" They want to feel that their work is having an impact in the world – so we have to help them understand the incredible power of engineering and invention to do exactly that.

Let me share one more quick story: A friend of mine was encouraging his son to study engineering or science in college, and his son replied, "Dad, why would I do that? Everything's already been invented." If that's what young people think, it's no wonder they don't see the value in studying math and science. We have to find effective ways to say to them: the math, science, engineering skills you're learning will allow you to be the creators and inventors and problem-solvers of your world, not just spectators and consumers – and there's no greater joy or power.

We have to say: Think of your favorite device or application -- an iPod, or a smart phone, or a Wii, or GPS, or a video game, or Google. These things have transformed our lives. And I guarantee that the people who invented them knew a *lot* about math and engineering and science. If you know anyone whose life was saved by a medical treatment – who beat cancer, or had a heart bypass, or who's now living with HIV-AIDS – the people who invented those treatments knew a great deal about math and engineering and science. If you're hoping for technologies that might save the planet – like electric cars, or radical new ways of harvesting solar energy, or making nuclear energy a safer option – the inventors and entrepreneurs who will bring them to life will definitely know a lot about math and engineering and science. We need to tell America's youth: you can be one of those people. And we also need to tell them that if you really want to magnify your impact, learn about math and engineering and science, and then teach it to the generation that follows you.

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Developing teachers and leaders with advanced math, science and engineering skills could not be more urgent nor more central to America's future. I hope we can use the new PCAST report as a powerful accelerant to our national resolve to develop an elite core, a small brilliant army, of inspiring math and science teachers.