National Center for Technological Literacy®
Museum of Science, Boston

Science Park
Boston, MA 02114-1099
www.nctl.org

Oral Statement by
Dr. Ioannis Miaoulis, President and Director of the Museum of Science, Boston
and Founding Director of the National Center for Technological Literacy
on "Raising the Bar: Reviewing STEM Education in America"
before the House Subcommittee on Early Childhood, Elementary and Secondary Education
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Good morning and thank you Mr. Chairman, Ranking Member, and Members of the Committee. It is an honor to be invited to discuss K-12 STEM education, which is vital to our nation's ability to create a first-class, competitive, and innovative workforce.

I have been asked to discuss our work at the Museum of Science, Boston and the success of our National Center for Technological Literacy® (NCTL®). First, let's look at the big picture.

National STEM Concerns

There is a widespread concern that our nation's preeminence in science and innovation is eroding. Only 5% of U.S. college graduates major in engineering, compared with 12% of European students, and 20% of those in Asia. And we all know that our elementary and secondary school students lag behind many nations on international math and science assessments.

The introduction of engineering education in K-12 has the potential to improve student achievement in science and mathematics, increase awareness about engineering careers, and boost students' technology and engineering literacy, according to the National Academies report, "Engineering in K-12 Education."

While exposure to formal engineering education has increased over the past 15 years, reaching several million K-12 students, most students in the U.S. have never experienced an engineering course or lesson. Too many have no idea what an engineer even does.

Engineering isn't the only crucial STEM discipline that is missing in our K-12 classrooms. Of the 9.2 million jobs that will be waiting for STEM graduates in the year 2020, half of them will be in computing and IT jobs. But only 2,000 of the 40,000 high schools in the country offer an AP Computer Science course. We are now working with the computer science education community, including Computing in the Core and MASSCan, to increase demand for and interest in K-12 computer science in Massachusetts and across the country.

So Why the Museum of Science?

One of the Museum's primary missions is to promote and be a resource for the advancement of science, technology, engineering and mathematics (STEM) education. As a premiere venue of public learning experiences, the Museum of Science welcomes 1.5 million visitors each year and serves as the go-to place for educators, students, and the public interested in exploring the relationship between science, technology and engineering and math through exhibits, planetarium shows, live presentations, courses, and interactive programs for all ages and abilities. **But we are unique in that we play an outsized role in formal K-12 engineering instruction as well.**

The National Center for Technological Literacy

In 2004, we established the National Center for Technological Literacy (NCTL) at the Museum in response to the new Massachusetts state science, technology and engineering standards supported by business and industries in the state. We realized there were very few instructional materials for teachers to use so we embarked on a mission to create K-12 engineering curricula and teacher professional development (PD) programs. We aim to introduce all children, starting in the very early years, to engineering as an equal to science.

Most K-12 science curriculum focuses almost entirely on the natural world and ignores the human-made world. But more than 98% of our daily life is driven by the engineering world. Students need relevant, hands-on and rigorous experiences that allow them to apply their knowledge and skills; this leads to better retention and understanding of why these subjects are important. The engineering design process challenges teachers and students to solve problems with limited resources, just like real engineers.

The NCTL partners with industry, school administrators, and formal and informal educators, across the U.S. to introduce engineering design as a problem-solving process, to deliver cutting-edge engineering curricular resources, and to provide relevant pre-service and in-service teacher PD programs and tools. Our PD method is unique because we require teachers to learn a grade-appropriate engineering design process and then we ask them actually design a technology to solve a community-based problem that would be expected of their students in class. This is new for most teachers because often there is no one right answer. We also conduct district leadership institutes to help develop integrative STEM action plans for schools.

For example, we worked with the Minnesota Department of Education to embed engineering into their science standards. We have collaborated with Purdue University on early engineering education research. We are creating out-of-school engineering units for afterschool programs in California. We have PD partners in Minnesota, Arizona, Indiana, New Jersey, Texas, Alabama, New York, and more. Our engineering curricula and teacher training have reached over 48,800 teachers and an estimated 5 million students, including some attending Department of Defense schools. We have also partnered with the European Union.

How do we do it? Sources of Funding

Approximately 5% of our operating budget comes from competitive federal grants. These are important because they leverage corporate and philanthropic dollars. For example, our *Engineering is Elementary*® curriculum received some federal support but has attracted nearly four times as much in corporate and foundation support for teachers, dissemination, and development of supplemental materials.

The remaining 95% of our operating budget comes from contributions, admissions, membership, and program fees. Corporate partners include, for instance, Raytheon, which provides scholarships to educators to participate in our engineering workshops and funded the establishment of 3 additional training sites. Google invested $1 million for the development of our Pixar animation and computer science exhibit. Liberty Mutual has funded the development of math lessons for *Engineering is Elementary*. Genzyme established an endowment for biotechnology education and has long supported our teacher sabbatical program. Biogen Idec recently established an endowment to support middle and high school hands-on STEM education. And Microsoft & Cisco have provided critical hardware & software to the Museum.

Working together, we are engineering a better world for generations to come.