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Written Comments

to the

National Assessment Governing Board

regarding the proposed

Technological Literacy Probe Assessment

submitted by

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I congratulate the work of the NAEP Technological Literacy Planning and Steering Committees. In particular, I am very pleased that the panels of experts, from the fields of technology, engineering and education, were able to achieve considerable consensus around developing an assessment framework to measure student "technological literacy."

Not surprisingly, one outstanding issue regarding this new framework remains – specifically, what to call it? For years, the term "Technological Literacy" has had different connotations to different groups. Retaining this title will likely confuse states, schools, and teachers, who may not appreciate the full breadth of this new framework, based upon their past interpretation of this term. Therefore, I encourage you to consider adopting the alternate title recommended by the Steering Committee – the National Assessment of Educational Progress in **Technology and Engineering Literacy.**

Why all the confusion? For many educators, a "technology literate" student is narrowly defined as having access to and the ability to use computer-based programs or other educational technologies. This is due in large part to the U.S. Department of Education (USED) program originally designed to purchase hardware and software for schools called Enhancing Education Through Technology (EETT). Simultaneously, No Child Left Behind (NCLB) requires that states assure the USED that students are "technology literate" by 8th grade. The de facto term "technology literate" as used by states in schools has come to mean the access to and use of educational technologies (i.e. laptops, smart boards, graphing calculators, online resources, etc.).

This is a certainly a worthy endeavor – students and teachers need access to modern tools and equipment. However, students also need a broader understanding of technology that will allow them to think about innovation and solving real-world problems through the design and development of new technologies across many fields, beyond information and communication technologies.

To reach this goal, the framework developed by the Steering Committee is more inclusive and measures student knowledge in three key and related areas: 1) information and communication technology; 2) systems and design; and, 3) technology and society.

The panel relied heavily on the concept of "Technological Literacy," as defined by the National Academy of Engineering and the National Research Council[1], which includes: 1) knowledge of technology, the engineering design process, and impacts on society; 2) critical thinking and decision making weighing benefits, risks, costs, and tradeoffs; and, 3) capability to use a variety of technologies, apply the design process, fix simple technological problems, and obtain and understand information about technological issues. It is important to note that this concept is not finite, like any other form of literacy, it is expected to move along a continuum as students mature and their cognitive capacities increase.

To avoid this confusion, the new assessment should be called the National Assessment of Educational Progress in **Technology & Engineering Literacy**. This title addresses the de facto term "technology literate" *and* addresses the broader definition of technological literacy by incorporating the engineering design process as well as impacts of technology on society.

Furthermore, I urge the Board to use the term "Engineering Design" throughout the framework to avoid confusion with other design areas (i.e. interior design, fashion design, graphic design, web design, intelligent design, etc.) Similarly, I urge the Board to use the term "Systems Thinking" because students should be learning to think more broadly and approach problems more holistically. The goal should not be to learn all about existing systems (i.e. transportation, the electric grid, the internet, etc.) but to understand how systems are created, the interrelationships and effects of change among variables, and the opportunities to revise or reinvent systems.

To the surprise of many, K-12 engineering education is a growing trend in schools across America, with Massachusetts leading the way. The National Academy of Engineering and the National Research Council report, Engineering in K-12 Education[2], found that the introduction of K-12 engineering education has the potential to improve student learning and achievement in science and mathematics, increase awareness about what engineers do and of engineering as a potential career, and boost students' technological literacy. The report made several recommendations to federal agencies and others that fund K-12 engineering education efforts. It also offered the following principles for K-12 engineering, which align nicely with the proposed NAEP framework:

- K–12 engineering education should emphasize engineering design.
- K–12 engineering education should incorporate important and developmentally appropriate mathematics, science, and technology knowledge and skills.
- K–12 engineering education should promote engineering habits of mind

[1] Technically Speaking, National Academy of Engineering & National Research Council, 2002; Tech Tally, National Academy of Engineering & National Research Council, 2006

[2] Engineering in K-12 Education, National Academy of Engineering & National Research Council,2009

Engineering “habits of mind” align with what many believe are essential skills for citizens in the 21st century. These include (1) systems thinking, (2) creativity, (3) optimism, (4) collaboration, (5) communication, and (6) attention to ethical considerations.

Building off this report, the National Center for Technological Literacy has pulled together an informal coalition of technology and engineering education supporters and drafted legislation that will create a grant program to provide states and school districts planning, implementation, and evaluation grants to integrate engineering education into K-12 instruction and curriculum. We expect this bill to be introduced in Congress in the very near future. While the NAEP assessment is key to documenting student knowledge in technology and engineering literacy, our effort will help build the necessary infrastructure to enhance student learning in these areas and improve student achievement and the assessment results.

This groundbreaking probe study by NAGB will be a significant driver in fostering improved STEM education, particularly technology and engineering literacy, in America. Thank you for consideration of my recommendations and for your service to our nation’s students.

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Dr. Ioannis Miaoulis Brief Bio

On January 1, 2003, Ioannis (Yannis) N. Miaoulis, became President and Director of the Museum of Science, Boston. Dr. Miaoulis, came to the Museum after a distinguished association with Tufts University. There, he was Dean of the School of Engineering, Associate Provost, Interim Dean of the University’s Graduate School of Arts and Sciences, and Professor of Mechanical Engineering. An innovative educator with a passion for both science and engineering, Miaoulis championed the introduction of engineering into the Massachusetts science and technology public school curriculum. This prompted the Commonwealth to be the first in the nation, in 2001, to develop a K-12 curriculum framework and assessments for technology/engineering.

Miaoulis spearheaded creation of the National Center for Technological Literacy® (NCTL®) at the Museum in 2004. The goal of the National Center for Technological Literacy is to integrate engineering in core curricula in schools nationwide and to inspire the next generation of engineers and innovators. The NCTL fosters learning about how technologies are created and used. It offers educational products and programs for K-12 students and teachers, including research-based and teacher-tested engineering curricula, pre-service, in-service and online teacher professional development, and an online resource center. The NCTL partners with government agencies, universities, science centers, corporations, foundations, and teacher organizations to facilitate the re-engineering of curricula, teaching and learning standards, and assessments nationwide. Visit www.mos.org/nctl
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