

Testimony to the United States Senate Committee on Health, Education, Labor, and Pensions  
for the hearing titled "Educating Our Children to Succeed in the Global Economy"

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Introduction

Good morning, Senator Merkley. My name is Nancy Stueber, and I am the President of the Oregon Museum of Science and Industry (OMSI), a scientific, educational, and cultural resource center located here in Portland that is dedicated to improving the public's understanding of science and technology. OMSI makes science exciting and relevant through exhibits, programs, and experiences that are presented in an entertaining and participatory fashion. I am also here on behalf of the Washington, DC-based Association of Science-Technology Centers (ASTC), a nonprofit organization of science centers and museums dedicated to furthering public engagement with science among increasingly diverse audiences. ASTC represents more than 440 science center and museum members – including 7 here in Oregon – in 42 countries, and encourages excellence and innovation in informal science learning by serving and linking its members worldwide and advancing their common goals. I serve as the president of the Association of Science-Technology Centers, and am honored to represent not only my institution, but the science center and museum field, before you today.

Before I continue, allow me to express my sincere appreciation to you for scheduling this morning's field hearing here in Portland, and for the opportunity to testify before you and the Committee. Even more importantly, I want to thank you and your staff for all of your efforts regarding the pending reauthorization of the Elementary and Secondary Education Act (ESEA) and for the leadership you have shown in addressing the monumentally important science, technology, engineering, and mathematics (STEM) education issues facing our young people – and our country – today.

Science Centers, OMSI, and Teacher Professional Development

I would like to begin by focusing on an often overlooked aspect of what science centers and museums contribute to America's educational infrastructure: teacher professional development opportunities. While school visits are often at the forefront of one's mind when they envision science centers – and I will address the multitude of options science center provide to visitors of all ages a bit later in my testimony – the programs and services we provide for educators may not be. In fact, 82% of science centers offer workshops or institutes for teachers, aligning with research-based best practices and the recommendations found in Title IX, Section 9101(34) of ESEA. ASTC members reach 73,000 schools – 62% of the total schools in the country – impacting 9,000 school districts, 36 million students, and 2 million teachers. Almost half (44%) of the schools served have a proportionally large population of underserved students. In addition, 75% of ASTC members report that they offer curriculum materials.

Clearly, effective classroom teaching is critical to helping children develop the essential thinking skills they require to weigh evidence, solve problems, balance risks and rewards, and make sense of their environment. And the need for additional support for teachers is strong: many teachers are assigned science as a subject to teach, without having a lot of science background themselves. The engaging, hands-on, inquiry methods that science centers have proven to be effective can be applied to the classroom; these methods are largely not taught in pre-service academic training, yet are an invaluable tool for teachers' effectiveness and student success.

Like science centers across the country, OMSI is doing our part to help teachers gain confidence, experience, and expertise when it comes to STEM teaching. I take great pride in the fact that OMSI has the largest science outreach education program in the United States. We offer teacher education programs and in-service workshops serving seven Western states; educational field trips and hands-on lab sessions in our eight interactive laboratories; camps and classes throughout Oregon and the Pacific Northwest for youth as well as families and adults; and community events exploring a wide range of relevant topics combining science, technology, engineering, mathematics, and the arts. At OMSI, we provide a variety of professional development tools for educators, from workshops and school partnerships to classroom activities and resources. These include:

*No Hassle Messy Science with a WOW!*, where participants experience a workshop chock-full of affordable, inquiry-based, and standards-aligned activities. Educators take home the 460-page manual *No Hassle Messy Science with a WOW: Chemistry in the K-8 Classroom*, which includes complete activity set-up instructions, scientific explanation for various age levels (grades K-8), extensions to broaden understanding, and student handouts in English and Spanish.

*Science Inquiry*, where participants learn how to move beyond conducting science activities in their classrooms to actually engaging their students in scientific inquiry. In this workshop, OMSI guides educators through the inquiry process, provides tools to modify existing activities and increase their inquiry potential, and offers templates and outlines to help students create work samples. Activities are aligned to Oregon science standards for grades 2-8.

*Engineering Design*, where teachers can try out some of OMSI's favorite design challenges and experiment with different materials as they explore ways to integrate the engineering design process into the classroom (grades 4-8). This workshop includes an introduction to LEGO NXT robotics and will address the new Oregon standards for engineering.

*Expedition Northwest*, a curriculum designed by OMSI educators that provides exciting standards-based science activities for grades 4–8. The program focuses on how water connects landscapes, people, and ecosystems across the region – from glaciers to rivers to oceans; from ancient floods to power generation. The program includes digital labs, online sharing of data, and teacher message boards.

*No Hassle Messy Science with a Wow: Chemistry for the K-8 Classroom* serves as an aid for teachers bringing chemistry to their elementary and middle school students. Together with the aforementioned workshop of the same name, it has brought science education to diverse audiences. Teachers, both nationally and internationally, have used this curriculum to inspire wonder in their students.

In the *OMSI School Ambassadors* program, which is designed to make it easier for schools to use OMSI's resources, a school faculty member becomes a museum ambassador, learning all about what OMSI offers and how it might benefit their school. Ambassadors serve as their school's representative to [3]

OMSI, giving us feedback on how we can better meet their needs. Our goal is to have an OMSI Ambassador in every Oregon school.

I also want to note that in two weeks, OMSI will announce the recipients of a unique professional development and field trip scholarship opportunity. These scholarships – to be awarded to three schools in Oregon and southwest Washington – include year-long professional development support (minimum 30 hours per school) for science teachers and field trips to OMSI during the 2011-2012 school year. The scholarship program is designed to positively impact students' STEM learning by deepening the connection between classroom instruction and museum visits, all while providing extensive access to OMSI resources.

Many science centers have extensive programs or courses specifically designed to support the competency of classroom science teachers related to both content and pedagogy. These centers work closely with their local teachers, school districts, and universities to build supportive professional development programs that are designed to enhance the quality of a student's science education experience while promoting the professional development goals of the teachers and the practical needs of the districts.

There are commonalities across these programs that account for their impact and – upon change to ESEA law to allow non-profit, community-based science centers to be eligible to compete for teacher professional development opportunities – could be replicated by dozens if not hundreds of other science centers across the nation in partnership with their local school districts to improve the quality of science instruction in our K-12 schools. For example, in addition to providing informal science and engineering educational experiences, the Museum of Science, Boston has developed K-12 engineering curricula and a network of teacher professional development programs to deliver technology and engineering education across the country. This is especially noteworthy, as Oregon recently incorporated engineering into their K-12 science standards, and engineering will have a significant presence in the Next Generation science standards.

Common programming elements among science centers include:

1. Adherence to evidenced-based practices that is confirmed through extensive iterative evaluation.
2. Integration of national, state and local standards when applicable to ensure classroom relevance and applicability.
3. Extensive support of teacher use of human and material resources outside of the traditional classroom to broaden capacity to build student motivation and inspiration.
4. Partnerships with institutions of higher education and/or state teacher certifying authorities so that program participation advances professional credentials, needs and goals of teacher workforce.
5. Utilization of inquiry-based, hands-on activities for teacher use in classrooms.
6. Reflection of national recommendations in STEM learning that can impact student growth and achievement.

Educating must encompass a wide range of support services, and science teachers do not hesitate to reach out to science centers for instructional assistance. Likewise, science centers are well-positioned to target schools most in need of resources. They can help gifted educators excel, and, once again, remove barriers for others with limited experience teaching science. For example, in Chicago – like many school districts across the country – 70% of teachers teaching science in the middle grades do not have a science degree or an endorsement in science. Responding to this need, the Chicago Museum of Science and Industry (MSI) provides science teacher professional development through its Institute for Quality Science Teaching. Teachers are able to obtain a Master of Science Education degree, a Middle School Science Endorsement, or professional development credit. Furthermore, science centers like MSI Chicago have become integral parts of broad school- and district-wide educational improvement plans in STEM subjects, designing coursework in accordance with topics identified in state standards.

### Recommendations for ESEA Reauthorization

With valuable contributions like these in mind, I want to share several key recommendations regarding the Elementary and Secondary Education Act as you and your fellow Members of the Senate Committee on Health, Education, Labor, and Pensions continue to work on its reauthorization.

First, I urge you to do all you can to allow nonprofit informal education institutions (such as science centers and museums) who have a proven track record of providing quality teacher professional development programs to directly compete for Title II teacher quality funds. Under the current ESEA, districts and states may use Title II teacher professional development for a variety of purposes, but all too often, the funds don't reach non-profit education organizations – such as science centers – that provide teacher professional development. Section 2131 of the existing statute establishes outlines which “eligible partnerships” are allowed to compete. Such partnerships must consist of an institution of higher education and a high-need local education agency (school district). It is only after that requirement is satisfied that eligible partnerships may also include other institutions, such as non-profit education organizations. In short, eligible science centers are considered as an afterthought in the law when they are often at the forefront of providing the congressionally-intended activity of improving teacher quality.

The President's FY 2011 budget and the *Blueprint for Reform* of ESEA proposed a refashioning of the current Mathematics and Science Partnership program (Title II, Part B of ESEA). ASTC has been supportive of Congressional iterations of this revamped language that would allow nonprofit organizations that improve the effectiveness of STEM teachers to apply directly for funding in partnership with a local education agency. Such eligibility language is included in both the STEM Master Teacher Corps Act of 2011 (S. 758), introduced by Senator Al Franken, and the Effective STEM Teaching and Learning Act of 2011 (S. 463), introduced by Senator Mark Begich, and is consistent with that which has also been included in the Department of Education's Investing in Innovation (i3) program.

We also urge you to include technology and/or engineering teachers alongside math and science teachers as eligible participants in all programs enacted to recruit, train, mentor, retain, and further educate K-12 teachers. After all, we live in an engineered world. Engineering design creates the technologies that support our health, convenience, communication, transportation, living environments, and entertainment; our entire day-to-day life. Yet, technology and engineering design are not part of the mainstream curriculum. In most academic environments, the term “technology” is used to describe electronic devices. Most people do not understand that everything human-made, other than some forms of art, is a type of technology. Although students spend years in school learning about the

scientific inquiry process, the process scientists use to discover the natural world, they never learn the engineering design process, which is responsible for most of the things that support their day-to-day lives. Science centers are ideal places to help educators fully integrate STEM concepts in their classrooms.

In addition, the science center field supports recommendations made by the President's Council of Advisors on Science and Technology in *Prepare and Inspire: K-12 Education in STEM for America's Future*. Specifically, we ask the Committee to: (1) acknowledge the importance of educational innovation by endorsing initiatives like the Advanced Research Projects Agency for Education (ARPA-ED) and the aforementioned Investing in Innovation program, designed to stimulate the next generation of high quality educational experiences by new technology and other means for both in- and out-of-school learning environments; and (2) to ensure the recruitment, preparation, and induction support of at least 100,000 new math and science teachers over the next decade. We urge science center and museum eligibility in resulting teacher professional development opportunities and/or programs, to include both pre-service and in-service educators.

### The Importance of STEM Education

As you are well aware, there is a strong consensus that improving science, technology, engineering, and mathematics education is critical to the nation's economic strength and global competitiveness in the 21st century. Reports like the National Academies' *Rising Above the Gathering Storm* (2005) and the recent offering from the President's Council of Advisors on Science and Technology (PCAST), entitled *Prepare and Inspire*, have emphasized the need to attract and educate the next generation of American scientists and innovators, and have recommended that we increase our talent pool by vastly improving K-12 science and mathematics education. Clearly, in order to improve STEM education, we must draw on a full range of learning opportunities and experiences, including those in non-school settings.

In its report entitled *Learning Science in Informal Environments: People Places, and Pursuits*, the National Research Council (NRC) of the National Academies, *Pursuits*, said "beyond the schoolhouse door, opportunities for science learning abound..." The NRC found, among other things, that there is ample evidence to suggest that science learning takes place throughout the life span and across venues in non-school settings. Furthermore, the report highlighted the role of afterschool STEM education in promoting diversity and broadening participation, finding that non-school environments can have a significant impact on STEM learning outcomes in historically underrepresented groups, and that these environments may be uniquely positioned to make STEM education accessible to all. Out-of-school programs, such as those provided by OMSI, the MESA program at Portland State University, the SMILE program at Oregon State University, Self Enhancement Inc., and 4-H, are key in reaching underserved populations that might not otherwise have access to STEM resources in school.

The informal learning environment is especially important when you consider that, by the age of 18, a child will have spent, at most, 9 percent of his or her lifetime in school. If a child spends about 6 hours a day in school, for each of the 180 days of the school year, he or she will spend little over 1,000 hours in school in a year, not including homework. Science centers and museums, along with nonprofits providing after-school programs, can help make hands-on, experiential learning an essential part of the many hours that remain.

## Science Centers as an Integral Part of the Nation's Educational Infrastructure

Science centers are physical places where science and citizens can meet. Many have scientists on staff, and some feature research facilities on-site. Through exhibits and programming – such as lectures and science cafés – science centers help bring current research findings to the public while encouraging discussion and debate of current science issues. More and more, science centers are also getting members of the public involved in research projects themselves.

Science centers reach a wide audience, a significant portion of which are school groups. Here in the United States, 90% offer school field trips, and ASTC estimates that nearly 11 million children attend science centers and museums as part of those groups each year. Field trips, however, are just the beginning of what science centers and museums contribute to the educational experience of students and teachers alike. In the United States, 90% offer classes and demonstrations, 89% offer school outreach programs, 71% offer programs for home-schoolers, 41% offer programs that target senior citizens, and 40% offer youth employment programs. Furthermore, more than half offer afterschool programs – especially noteworthy given that more than 15 million school-age children, including more than 1 million in grades K-5, are on their own after school. Research shows that kids who participate in such programs improved significantly in three major areas: feelings and attitudes, indicators of behavioral adjustment, and school performance. This translates, of course, to self-confidence and self-esteem, positive social behaviors, and accomplishment in school settings. Again, these activities are in addition to those already mentioned which focus on teachers.

### About OMSI

As you know, the Oregon Museum of Science and Industry – like science centers all across America and all across the world – seeks to inspire wonder in people of all ages by creating engaging science learning experiences, making those experiences available to a broad audience, and providing compelling ways to explore the role of science in our world today. Major museum components that help us achieve that mission include: five exhibit halls; hundreds of interactive exhibits; eight laboratories; and two new permanent exhibits: *Science on a Sphere*, which projects dynamic real-time data from NOAA and NASA satellites on a globe, and *Innovation Station*, which explores the human side of technology and innovation. OMSI also features a 305-seat, five-story OMNIMAX® Dome Theater; the Harry C. Kendall Planetarium – which is the largest planetarium dome in the Pacific Northwest with seating capacity of 200; the USS Blueback, a 219-foot diesel electric submarine and the most modern U.S. submarine on public display in the country; and a 25,000 sq. ft. exhibit-building shop.

That shop helps feed the largest museum-based, traveling science exhibits program in North America. To date, OMSI has developed 45 interactive science traveling exhibits – including world-popular exhibits such as *Animation featuring Cartoon Network*, *Moneyville*, *Eyes on Earth*, *Brain Teasers*, *BUSYTOWN*®, and *Mindbender Mansion*, – that have been featured at museums throughout North America and Europe.

### About ASTC and Science Centers

OMSI is a member of the aforementioned Association of Science-Technology Centers, a nonprofit organization of science centers and museums dedicated to providing quality educational experiences to students and their families as well as furthering public engagement with science among increasingly diverse audiences.

As you know, it is now more important than ever for us to do all we can to spark the interests of our young people in all that the STEM fields have to offer. For that reason, OMSI and literally hundreds of other community-based science centers throughout the country are providing unique educational programs that excite, energize, and enrich our understanding of science and its many applications, often in conjunction with – and support from – U.S. federal agencies like the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the Institute of Museum and Library Services (IMLS), and the Department of Education (ED), among others.

Collectively, science centers and museums garner nearly 90 million visits annually worldwide. Here in the United States, visitors pass through science center doors nearly 63 million times to participate in intriguing educational science activities and explorations of scientific phenomena. The most recent *Science and Engineering Indicators* (2010) supports this data, finding that 59% of Americans visited a science center, museum, or similar. Science centers come in all shapes and sizes, from large institutions in metropolitan areas – like my own, the Maryland Science Center in Baltimore, the Science Museum of Minnesota in Saint Paul, and the Museum of Science and Industry in Chicago – to smaller centers in somewhat less populated areas – like the Science Zone in Casper, Wyoming, the Museum of Life and Science in Durham, North Carolina, and Explora in Albuquerque, New Mexico. ASTC member institutions range in size from 3,000 square feet of exhibit space to one that has more than 200 times that – nearly 650,000 square feet.

#### Serving All Youth - The ASTC Youth Inspired Challenge

In closing, I want to draw the Committee's attention to an effort to further expand upon the strong educational programs offered by science centers and museums. To better assist the nation's youth in becoming the innovative and creative thinkers needed for the 21<sup>st</sup> century workforce, ASTC launched a major new initiative, the *Youth Inspired Challenge*, last September. The *Challenge* – extended to more than 300 science centers in all 50 states and across the world – sets a three-year goal to engage thousands of youth, ages 10-19, in 2 million hours of science enrichment. Building on the valuable science education and youth employment programs ASTC members already offer, the goals of the *Youth Inspired Challenge* include: (1) increasing the STEM literacy of America's students; (2) expanding opportunities for STEM engagement of underrepresented groups, including minorities and women; and (3) moving America's students from the middle to the front of the pack in STEM achievement over the next decade. As part of the *Challenge*, ASTC and its member institutions will also collect, catalog, and share best practices for improving STEM literacy for all youth, and will measure and report success based on participation and reach of programs in specific audiences.

That process has already begun. I am pleased to report that 102 science centers representing 7 countries and 37 states – including OMSI, the Science Factory Children's Museum and Exploration Dome in Eugene, and the Science Works Hands-On Museum in Ashland – have formally accepted the *Challenge* to date. I look forward to keeping you and the Committee abreast of these numbers – and even more importantly, our collective impact – as this initiative matures.

#### Conclusion

Senator Merkley, thank you once again for the opportunity to testify before you today. As you, your staff, and your fellow HELP Committee Members continue your efforts to reauthorize the Elementary and Secondary Education Act, I urge you to do all you can to recognize, highlight, and take advantage of

the essential STEM-related contributions science centers and museums provide for students and teachers. The Oregon Museum of Science and Industry, Association of Science-Technology Centers, and hundreds of science centers and museums stand ready to assist you – and the country – in any way we can.

I would be happy to respond to any questions or provide additional information as needed by you and the Committee.