Testimony of E. Gordon Gee, President
The Ohio State University
Before the House Science and Technology Committee
Hearing on K-12 STEM Education Reform
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Chairman Gordon, Ranking Member Hall, Ohio Delegation Members Wilson and Fudge, and other distinguished Members of the Committee: Thank you for the opportunity to testify today on innovative efforts to reform K-12 science, technology, engineering, and mathematics (STEM) education. I appear before you not as a scientist or as an elementary or secondary school teacher, but as the president of one of the most comprehensive research universities in the world. Established in 1870, The Ohio State University is the flagship, land-grant institution of Ohio. The university is home to more than 63,000 students and 40,000 faculty and staff. We have 175 undergraduate majors, 133 masters programs, 99 doctoral programs, and seven professional schools, which offer roughly 12,000 courses each year.

When Thomas Jefferson was designing the University of Virginia, he established several "design principles" to guide the construction of one of the first public universities in the United States. Two of these principles are particularly relevant for STEM education in the 21st century. The first principle deals with the economic value of a well-trained mind. It states that a proper education must "give to every citizen the information he needs for the transaction of his own business." The second highlights the fundamental role science and math play in educational, economic and civic development. It states that students must be enlightened "with mathematical and physical sciences, which advance the arts and administer to the health, the subsistence and the comforts of human life." As a land-grant institution, Ohio State embraces those ideals and combines them with a founding purpose to expand public education more broadly and to assure that education directly improves lives and enriches communities. Such is the basis for our approach to STEM education and economic development. STEM-driven knowledge, innovation and talent are integral to how we confront the grand challenges faced in energy, environment, health, food, water, poverty and security.

This committee is well aware of the challenges facing STEM education in the United States. Countless reports have identified the problems and many have offered solutions. I am here today to report that institutions of higher education understand that we must play a vital role in solving the grand challenge of improving the STEM pipeline. Ohio State, like many educational institutions, is reinventing itself, and a comprehensive P-20 STEM education approach is a vital part of our strategy. We must seize this time of disquiet as an opportunity to create a new American educational ecosystem that connects and develops talented minds in new and more powerful ways with increased efficiencies and shared responsibilities. Significant change in the quality and reach of STEM education requires our unrelenting pursuit of deeper partnerships across the educational spectrum, with business and industry, government, parents and extended families, and our communities. We must work together to foster stronger early-learning skills for preschoolers and to encourage all high school students to be STEM literate, with greater numbers of them ready to pursue advanced STEM studies in college. To do so, we must re-think our

priorities and re-order our time. We must challenge traditional assumptions, and embrace not only innovation and creativity, but also risk. STEM education is essential if we are to fully prepare our students for leadership in a global context.

The work ahead requires new platforms for collaboration. By its sheer size, The Ohio State University is the most massive intellectual platform in America. From fostering the world-renowned and globally relevant research on the loss of polar ice at the Byrd Polar Research Center to co-founding one of the nation's finest early college STEM high schools, Ohio State brings talent, knowledge and resources together to tackle some of the toughest global problems. As we look to amplify and accelerate the quality of STEM teaching and learning from preschool through graduate school, we recognize that collaboration platforms are necessary to help dismantle barriers and to speed the cross-fertilization of innovative ideas, programs and solutions. Ohio State's STEM education strategy centers on three platforms for collaboration.

THREE PLATFORMS FOR STEM EDUCATION AT OHIO STATE

First, we enhance the power, reach and relevance of STEM education by ensuring that our internal academic structures support collaborative research, teaching and service on problems that cut across disciplinary borders.

We are investing in trans-institutional Centers for Innovation and Innovation Groups to encourage interdisciplinary scholarship across our campus. We are removing structural and budgetary boundaries and facilitating faculty collaboration to address issues and problems of global dimension that affect the quality of the human condition. The centers and groups are tackling challenges such as international poverty, food safety, computational modeling of global disease, and complex human, natural and engineered systems. With specific respect to STEM education, our recently merged College of Education and Human Ecology provides a collaborative platform to spur connections in human health, nutrition, family conditions, brain development and academic performance. Another major collaboration — both physically and intellectually — is occurring with our academic Medical Center. There, partnerships of all kinds are flourishing, translational medicine is taking hold, and plans for greatly expanded facilities are proceeding apace. State-of-the-art facilities are meaningless if top-notch medical care and talent are not available. With that in mind, we have partnered with Columbus State Community College to advance a much needed STEM workforce pipeline for health care workers.

Second, we are strengthening and extending collaborations with our early childhood and K-12 partners on the three most critical factors in making sure every child succeeds--the equitable distribution of high-quality teachers and school leaders, turning around persistently low-achieving schools and aligning the entire educational system around college- and career-ready standards.

Three examples demonstrate our commitment to increasing the number of high-quality teachers in STEM fields and enhancing an educational system around college standards: Metro Early College High School, Project ASPIRE, and Wonders of the World.

Metro Early College High School is a joint project of Ohio State, Battelle, and sixteen central Ohio school districts that began in 2006. This nationally recognized and Gates-funded STEM secondary school takes a project-based and integrated curriculum approach to preparing a very diverse student body (many first generation college students) to be college- and career-ready. Students at Metro participate in self-directed and hands-on learning experiences with teachers and mentors at Ohio State and in the community, and they participate in independent research projects and community internships. In June 2010, Metro will graduate its first class, all of whom have achieved college admission. Most Metro students have taken college coursework, with an average Ohio State GPA of 3.4.

Metro also serves as a research and development platform for Columbus City Schools. Metro helped launch Linden McKinley STEM Academy in a high poverty area of Columbus, and is the inspiration/prototype for the design and launch of state supported STEM schools in Dayton, Cleveland, Cincinnati, Akron and Columbus and other schools around the country. Dr. Jeffrey Wadsworth, Battelle CEO, will elaborate on this in his testimony.

Our overall STEM education strategy has been developed around Metro Early College High school. Ohio State benefits from its Metro partnerships in the following areas:

- **STEM R&D Innovation**: Advances the science of STEM teaching and learning and applies research-based knowledge to the improvement of practice, particularly in high schools and higher education.
- **Teacher Quality**: Helps Ohio State to be a national leader in an enterprise-wide approach to a teacher residency program model for STEM educators.
- **College Readiness and Access**: As perhaps the only early college high school situated on the campus of a research intensive university, Metro helps Ohio State to most effectively connect high-impact STEM-oriented early college efforts, particularly for underrepresented and first-generation student populations.
- **Economic Development**: Focus on STEM-oriented talent pipelines in key driver industries such as advanced energy/environmental technologies and health and life sciences.
- **Outreach and Engagement**: Leverage Metro's capacity to serve as an outreach and engagement portal for externally funded research projects in STEM disciplines.

The second example combines two major initiatives, Project ASPIRE and Wilson Fellows, to increase high-quality teachers in underserved schools in Columbus, Ohio. There is one simple truth that guides our support of schools--the quality of an education system rests on the quality of its teachers. This philosophy resulted in a $13 million Teacher Quality Partnership grant for Ohio State's Project ASPIRE from the U.S. Department of Education's Office of Innovation and Improvement. In partnership with the state's largest school district, Columbus City Schools, Project ASPIRE is designed to deliver more than 600 teachers in high-need content areas such as science and math. In the next five years, these teachers will be equipped to help low-achieving students in low-performing schools to grow and succeed academically.

We have aligned Project ASPIRE with the Woodrow Wilson STEM Teaching Fellows. In partnership with the Woodrow Wilson Foundation, Ohio State will design, deliver, scale and

sustain an academically rigorous, graduate-level, clinically based teacher residency program that: a) attracts the very best candidates from traditional and non-traditional pathways; b) places and supports strong STEM middle and secondary teachers in high-need schools; c) reduces teacher attrition and associated costs; d) transforms teacher education in Ohio; and e) strengthens the quality of STEM teaching and learning. This is an enterprise-wide commitment that will fundamentally reshape the way we prepare STEM educators and work with schools and school districts. Combined, Project ASPIRE and the Woodrow Wilson STEM Teaching Fellows deepen our shared responsibility with Columbus City Schools to co-manage a human capital system that greatly increases the chances that a student will have access to high-quality math and science educators.

One final example is the Wonders of the World science outreach program, or W.O.W., led by Dr. Susan Olesik. Since 1999, Dr. Olesik and her team have successfully paired science fellows with elementary school teachers to improve science education. Now she is working with academically talented graduate students in the sciences to collaborate with third through fifth grade teachers at Columbus City Schools to develop hands-on, inquiry based science lessons to cover all areas of the elementary science curriculum. Reported Ohio Proficiency Test scores show dramatic improvements in the passing rates in science among the elementary school children involved, and teachers participating in the program are showing great progress in their science content knowledge and their ability to teach inquiry-based science lessons.

With continued funding from the National Science Foundation, Dr. Olesik is now institutionalizing these efforts at Ohio State and with Columbus City Schools. New fellows and teachers are chosen through competitive application processes to ensure that the best graduate students are paired with teachers who are committed to improving their ability to teach science. The W.O.W. program is substantially enhancing graduate education at Ohio State, having a large impact on elementary school teachers in inner-city schools while advancing science skills of the students they teach.

Our third platform is to unleash our greatest resource--our faculty and researchers--to develop new STEM education programs and assessment tools to replicate, imitate and expand successful programs to the state and national level.

The Battelle Center for Mathematics and Science Policy is housed at Ohio State and headed by former astronaut and current vice-chair of the National Science Board, Dr. Kathryn Sullivan. This center addresses the need for strong science and mathematics education as a cornerstone of U.S. global competitiveness by developing policies and practices that will increase the number of students who pursue careers in STEM education. Presently, the Center is currently engaged in a major STEM modeling program, which includes powerful analytical tools designed to guide decision-making across the entire spectrum of STEM education, from policy to program to practice.

Using Ohio as a testbed, Dr. Sullivan and our colleagues at Battelle seek to understand how success in STEM education is linked to the economic growth and competitiveness of the state. This effort would be impossible without the partnership of Battelle, as well as also the Ohio

Business Roundtable and the Business-Higher Education Forum. It will involve a broad spectrum of partners from K-12 education, higher education, government and industry.

At the national level, Ohio State is participating in the Science and Mathematics Teacher Imperative (SMTI), spearheaded by the Association of Public and Land-Grant Universities (APLU). SMTI is a commitment by 122 public research universities across 42 states that prepare more than 7,500 math and science teachers annually – the largest initiative in advancing the preparation of science and math teachers in the nation. Our pledge is to substantially increase the number and diversity of high-quality science and mathematics teachers we prepare, and to build better partnerships among universities, community colleges, school systems, state governments, business, and other stakeholders. As stated during its commendation by the Obama Administration's Educate to Innovate effort, the collective goal of SMTI is to prepare more than 10,000 teachers annually by 2015. SMTI institutions are committed to quality and are using SMTI as a national platform to identify and share exemplary practices encompassing leading efforts such as Noyce Scholarships, Wilson Fellowships, UTeach and other leading approaches to foster expansion of successful programs. We look to our participation in SMTI as a mechanism to share our efforts and understand the innovations by others for potential adaptation in Ohio.

PARTNER OR PERISH

Academics are all too familiar with the phrase "publish or perish." When it comes to successful STEM programs, I suggest that institutions of higher education must "partner or perish." We are fortunate to be geographic neighbors with the Battelle Memorial Institute, a global leader in research and development, and we are aggressively deepening our collaboration to meet pressing needs.

In addition to the specific partnerships with Battelle and Columbus City Schools for Metro and Project ASPIRE, we are members of STEMColumbus, which brings together Battelle, American Electric Power, Columbus City Schools, Educational Council, the Ohio State colleges of Engineering and Education and Human Ecology, and COSI, an award-winning science center in Columbus, in a partnership to locate, link, lift and leverage Columbus City Schools middle and high school STEM clubs, camps and competitions.

Ohio State is also a founding member of the Ohio STEM Learning Network (OSLN). This is an unprecedented collaborative aimed at building and connecting STEM teaching and learning capacity in regions across Ohio. At its core, OSLN is focused on student and teacher success, built from a slate of committed partners from P--12 education, higher education and business and industry. Designed from a systems engineering approach, the OSLN develops and connects a state-wide system of innovative STEM schools and Programs of Excellence, leveraging the ongoing work of regions across the state, along with a $12 million grant from the Bill & Melinda Gates Foundation and an initial $5 million investment from Battelle.

Our successful partnerships flourish for several reasons. Together we mobilize, engage and empower the right stakeholders to make decisions on behalf of the institutions. We also must

seek agreement and commitment to specific outcomes, as part of developing a sustainable business model. We select an approach that meets explicit standards of proof, scalability and sustainability. Throughout the process, we build in oversight mechanisms. And finally, we communicate, communicate, communicate.

RECOMMENDATIONS FOR COMPETES REAUTHORIZATION

I would like to recognize the leadership in Congress and the White House, both past and present, to the issue of STEM education. Through America COMPETES, Congress has pushed the federal government to do a better job aligning federal programs to meet the needs of our students, teachers and researchers that are the STEM pipeline. As with any legislation, implementation is far from perfect. It is in the spirit of gratitude and good partnership that I offer a few suggestions as you debate the COMPETES reauthorization:

- **Approach STEM education from a P-20 perspective**. Nearly every report issued over the last quarter century suggests that the STEM pipeline must be strengthened. Federal programs should strive to better link the efforts from pre-kindergarten through the post-doctoral level. The multitude of individual programs across federal agencies ought to be re-aligned, both with one another, and with the growing industry and university initiatives focusing on STEM education and teacher development.
- **Support early college STEM schools which have proven success with underrepresented and first-generation students.** Metro Early College High School, and its sister institutions across the country, should be afforded opportunities through the federal agencies to share best practices and compete for innovation grants to enhance their outreach efforts to first generation students.
- **Demand, incentivize, support and recognize collaboration at the horizontal and vertical levels.** As I have described, Ohio State is working with our peer institutions of higher education, local school districts, the State of Ohio and industry at many different levels. Each of our partnerships is critical to the success of our STEM programs
- **Encourage national partnerships to make STEM "contagious" through social networking and viral education reforms.** For example Teach for America, the School for Everything and teachertv in the United Kingdom rely a great deal on information and social technologies that attract and invite talented minds to work together. A national and state STEM education strategy can be greatly augmented by a digital media and social networking strategy. Another way to make STEM contagious is to form public and private partnerships around "high leverage" problems using network strategies, structures and tools to promote the flow of high value knowledge and the development and exchange of powerful policies and practices.
- **Provide sufficient resources.** The funds provided through the American Recovery and Reinvestment Act for the Race to the Top and Investing in Innovation grant programs offered significant incentive for institutions to change the way we educate students and prepare citizens to lead the world in the new knowledge economy. It is important to ensure that the National Science Foundation is well connected to these Department of Education efforts and that NSF funding is appropriate. For example, it's been almost a decade since NSF had a program specifically targeted to preparing science and math

teachers. While the NSF provides scholarships for students through the Noyce program, it is important to provide some core funding for universities to better develop their teacher preparation programs to go along with this support for students.

In conclusion, I want to thank you for the opportunity to testify before this committee on such an important issue. This moment presents us with the greatest of opportunities: to wholly reinvigorate and reshape STEM education programs and to create a fully rounded system of education that is truly pre-K though life, one in which our interdependencies are our greatest strengths. Without question, you have a difficult job ahead. I respectfully urge you to move boldly, act quickly, and seek first-order change. And know that America's universities, and especially The Ohio State University, will be working with you to achieve our goals.

BRIEF BIOGRAPHY OF PRESIDENT E. GORDON GEE

E Gordon Gee, among the most highly experienced and respected university presidents in the nation, returned to The Ohio State University after having served as Chancellor of Vanderbilt University for seven years. Prior to his tenure at Vanderbilt, he was president of Brown University (1998-2000), The Ohio State University (1990-97), the University of Colorado (1985-90), and West Virginia University (1981-85).

Born in Vernal, Utah, Gee graduated from the University of Utah with an honors degree in history and earned his J.D. and Ed.D degrees from Columbia University. He clerked under Chief Justice David T. Lewis of the U.S. 10th Circuit Court of Appeals before being named a judicial fellow and staff assistant to the U.S. Supreme Court, where he worked for Chief Justice Warren Burger on administrative and legal problems of the Court and federal judiciary. Gee returned to Utah as an associate professor and associate dean in the J. Reuben Clark Law School at Brigham Young University, eventually achieving the rank of full professor. In 1979 he was named dean of the West Virginia University Law School, and in 1981 was appointed to that university's presidency.

Active in a number of national professional and service organizations, Gee served as a Trustee for the Harry S. Truman Scholarship Foundation and as chairman of the Kellogg Commission on the Future of State and Land Grant Universities. He is a member of the National Commission on Writing for America's Families, Schools, and Colleges, founded by the College Board to improve the teaching and learning of writing. He also serves as co-chair of the Association of Public and Land-Grant Universities' Energy Advisory Committee.

Gee is a member of the Board of Governors of the National Hospice Foundation, the Advisory Board of the Christopher Isherwood Foundation, and the Board of Trustees of the Christopher Columbus Fellowship Foundation, an independent Federal government agency established to "encourage and support research, study and labor designed to produce new discoveries in all fields of endeavor for the benefit of mankind." He also is a member of the Business-Higher Education Forum.

Gee has received a number of honorary degrees, awards, and recognitions. He was a Mellon Fellow for the Aspen Institute for Humanistic Studies and a W.K. Kellogg Fellow. In 1994, he received the Distinguished Alumnus Award from the University of Utah as well as from Teachers College of Columbia University. He is the co-author of eight books and the author of numerous papers and articles on law and education.

Gee's daughter, Rebekah, is an assistant professor of clinical medicine in the Department of Obstetrics and Gynecology at Tulane University and a Norman F. Gant/American Board of Obstetrics and Gynecology/IOM Anniversary Fellow.