Supporting Stronger K-12 Science Education

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Our children live in a rapidly changing world where scientific knowledge and technology are evolving quickly. However, the United States lags behind other nations in student understanding of the science, technology, engineering, and mathematics (STEM) disciplines necessary for success in this changing environment. Young people will increasingly face stiff competition for jobs across the globe, and will need a much stronger foundation in STEM areas to help our nation compete in a global economy. Our society has changed to a knowledge driven one; as such, we need to equip our children with the conceptual tools to solve problems, make decisions, and learn more.

Standards Outdated

In the past, science teaching required students to learn many concepts. The unintended consequence of this was that learners did not see how the ideas were connected. They developed only superficial knowledge that many learners could not apply. However, employment opportunities today and in the future will require our children to apply ideas and to have critical thinking and reasoning skills, imagination, judgment, creativity, and mathematical thinking.

Our past standards for science education are no longer adequate. Where previous standards focused on helping students acquire content knowledge measured through testing, the new standards instead focus on students engaging in scientific practices through which they experience key ideas and explore crosscutting themes that focus on explaining phenomena and solving problems.

Not every child will grow up being interested in STEM or a career in STEM, but to live a fruitful and productive life, understanding STEM is critical. We need citizens who can make wise choices about the environment, health care issues, energy usage, and socio-scientific issues. Understanding and using science is not a luxury; it is essential for ensuring that future generations will live in a society that is sustainable and free.

A New Framework for Science Education

The National Research Council crafted its Framework for K-12 Science Education (2012) to serve as the foundation for the development of new national science education standards. The Framework took the stance that all children in our society need to understand the disciplinary core ideas and practices of science and engineering to serve as conceptual tools for solving problems, explaining phenomena, and learning more.

In April 2013, the Next Generation Science Standards (NGSS) were released. These new standards are based on a solid foundation of what is known about the teaching and learning of science and what students should know and be able to do to live in the 21st century. Grounded in rigorous science, the standards require students to build deep, applied understanding of disciplinary core ideas and practices. Introducing an engineering thread to K-12 education for the first time, the NGSS emphasize knowledge in use so that the next generation of employees can solve problems, innovate, make decisions, and learn and apply new information. This will help our children to compete in a world that increasingly values deep understanding and real production, and ensure that Michigan will meet the workforce needs of a new century.

MSU Is National Leader In STEM Education
The CREATE for STEM Institute at MSU is strongly engaged in developing and advancing STEM education research and NGSS in Michigan and beyond. MSU is nationally recognized as a leader in improving teaching and learning in mathematics and science. Two members of the NGSS leadership team and lead writers for the chemistry and physical science standards, Dr. Melanie Cooper and Dr. Joseph Krajcik, are professors with the Institute.

Forty-one teachers and educators from throughout our nation wrote, revised, reviewed, and monitored the development of the NGSS. With funding from the Carnegie Corporation, science teachers, scientists, and educators from 26 lead states, including Michigan, provided feedback as NGSS was developed. Even within the 26 states, Michigan’s leadership stands out. Michigan developed a strong team of educators and university researchers that engaged teachers throughout the state in commenting on multiple drafts.

MSU and CREATE for STEM are partners with the Michigan Department of Education, the Michigan Math and Science Network, the Michigan Science Teachers Association, and other state leadership organizations. With these partners, we continue to develop resources for professional development of teachers, administrators, business leaders, parents, and the general public regarding the NGSS. Science teachers in Michigan are ready to move forward and anxiously await the adoption of NGSS by the State Board of Education.

New Standards are Only the Beginning

New standards, however, are only part of the picture to bring about sustained change to our educational system. Along with the standards, teachers and school systems need new curriculum materials, assessments to monitor student progress, teacher professional development so that science teachers can learn new content and new teaching practices, and new resources—including equipment—for students to explore phenomena. Revision of how K-12 science teachers are prepared at the university level is also needed.

The overall effort is indeed ambitious. Yet, this ambitious agenda brings many opportunities to revitalize our science classrooms to help all children learn science and to develop the conceptual tools to live in an ever-changing global society. We only have to look at the trends in current educational, economic, and environmental statistics to foresee our children’s future—which looks grim if we don’t act to restructure our current science education system. With the release of NGSS we have new opportunities. Our science classrooms will change to prepare our children for the world they live in. Research shows that when curriculum materials incorporating science and engineering practices blended with core ideas are introduced in the classroom, even in the nation’s poorest schools, students rapidly make measurable gains in scientific learning. We will need professional development to accomplish this; however, our teaching pool is ready, capable, and willing to move forward.

With the release of the Next Generation Science Standards in 2013, we have a once-in-a-generation opportunity to dramatically affect the teaching and learning of science and engineering, building a 21st century workforce with vital long-term economic and development outcomes.

Joe Krajcik was the lead writer for the disciplinary core ideas in the NRC’s Framework for K-12 Science Education and on the leadership team for developing the NGSS.

Renee Bayer taught environmental and secondary science education before moving into community-based public health research, teaching and practice.

CREATE for STEM is an MSU-sponsored research institute with a broad mandate for collaborative research in education, assessment, and teaching environments for science, technology, engineering, and mathematics. The Institute is a joint endeavor of the College of Natural Science and the College of Education, in coordination with the Office of the Provost.

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Sources


- See http://www.nextgenscience.org


- See the CREATE for STEM website, http://www.create4stem.msu.edu/ngss

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