Science, Technology, Engineering, and Math (STEM)
South Metro-Salem STEM Partnership/Hub
Learning Community Framework
April 2013

Overview

Education in science, technology, engineering and math (STEM) has received increased attention in recent years due to fears that a failure to produce enough students with high-quality STEM skills will hamper America's ability to compete an increasingly global economy.

States are beginning to evaluate their own education systems and articulating strategies that will improve the overall quality of education in order to prepare students for jobs in a 21st Century workforce. States are considering policies that would increase the rigor of high school, address the problem of losing students who were college-bound, and improve the quality of the teaching and leadership within a school.

States are also beginning to focus on policies related directly to STEM education, in part because American students are being consistently outperformed in these areas on international tests. There is also a comparatively low percentage of American students that study in the STEM area in college and graduate programs in relation to other countries. As a result, many states are responding by increasing graduation requirements in math or science and providing incentives for teachers in STEM areas. Other notable state actions include enhancing the use of technology in school buildings, and providing incentives for students who pursue math and science during post-secondary studies.
--National Conference of State Legislatures

Definition

The Oregon Department of Education defines STEM as: *"An approach to teaching and lifelong learning that emphasizes the natural interconnectedness of four separate STEM disciplines. The connections are made explicit through collaboration between educators resulting in real and appropriate context built into instruction, curriculum, and assessment. The common element of problem-solving is emphasized across all STEM disciplines allowing students to discover, explore, and apply critical thinking skills."*

Taken separately, the four STEM subjects are defined by the National Research Council as:
1. *Science* is the study of the natural world, including the laws of nature associated with physics, chemistry, and biology and the treatment or application of facts, principles, concepts, or conventions associated with these disciplines.
2. *Technology* comprises the entire system of people and organizations, knowledge, processes, and devices that go into creating and operating technological artifacts, as well as the artifacts themselves.
3. *Engineering* is a body of knowledge about the design and creation of products and a process for solving problems. Engineering utilizes concepts in science and mathematics and technological tools.
4. *Mathematics* is the study of patterns and relationships among quantities, numbers, and shapes. Mathematics includes theoretical mathematics and applied mathematics.

The *Royal Academy of Engineering* adds, "[Engineering is] the knowledge required, and the process applied, to conceive, design, make, build, operate, sustain, recycle or retire, something of significant technical content for a specified purpose; a concept, a model, a product, a device, a process, a system, a technology."

Rationale (ODE)

Improving STEM education is an economic and civic imperative. Creating a coherent, rigorous, and equitable system of STEM education from pre-kindergarten through high school graduation will help ensure that:

- Oregon students have the knowledge, skills, experience, and enthusiasm needed to enter post-secondary education and high-paying, in-demand careers in STEM-related fields.
- Oregon businesses and industries have access to an Oregon-educated STEM talent pool that is highly skilled, motivated, and globally competitive.
- Oregon schools and teachers have the tools and support needed to deliver world-class STEM instruction.
- Oregonians have the scientific literacy and technological knowledge needed to make informed decisions in their personal lives and as citizens to address increasingly complex and interconnected local, national, and global challenges.

Characteristics

STEM education should:

- Integrate the STEM disciplines of science, technology, engineering, and math
- Provide authentic experiences, contextual learning, and career awareness through partnerships with businesses, industries, agencies, and non-profits in the community
- Focus instruction on problem-solving and critical thinking skills through inquiry and design
- Include effective instructional strategies that develop collaboration and teamwork
- Develop communication and literacy skills
- Include the use of standards-based performance assessments
- Provide post-secondary and career relevance and connections

Standards to Support STEM Education

- Next Generation Science Standards
- Common Core State Standards
  - English Language Arts (Literacy in Science and Technical Subjects)
  - Mathematics

Continuum of Practice

Class with several STEM disciplines woven into a single project during the school year.	Class with several STEM disciplines woven into many projects during the school year.	Class with all STEM disciplines woven into a single project during the school year.	Class with all STEM disciplines woven into many projects during the school year.

Progression of STEM Education

Professional Development Working Plan for SMS STEM Partnership/Hub

STEM Learning Community Phase 1 (2013-2014)
- Gather names in spring of 2013 to convene a teaching and learning team composed of three selected teachers (grades K-5, 6-8 and 9-12), instructional coaches, and TOSAs from each district who are committed to the practice of STEM education
- Periodic meetings to:
  - Define and describe STEM
  - Inventory current status and gather examples of effective projects, programs, and practices
  - Assess deficits/needs to inform future professional development for K-5, 6-8, and 9-12

STEM Learning Community Phase II (Summer of 2014)
- Based on the deficits/needs assessment for K-5, 6-8, and 9-12
- Classes, summer academies, seminars, webinars, institutes

STEM Learning Community Phase III (2014-2015)
- Ongoing support throughout the school year (visitations, hub STEMposiums)
- Develop clearinghouse of curriculum, instruction and assessment resources
- Collaborations and sharing best practices