STEMSmart: Lessons Learned from Successful Schools

Perspectives from the National Science Foundation

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Workforce Concerns

- Many jobs require STEM expertise
- U.S. will not have enough qualified STEM-trained workers to fill available jobs
- America will not be able to successfully innovate and compete in the global marketplace
- Lack of technical expertise jeopardizes national security and national defense
- Populace will not have the educational base needed for good decision-making

K-12 STEM Concerns

- U.S. students lag behind the highest performing nations on international assessments
- Engineering and Technology (the “E” and “T” in “STEM”) are seldom taught in K-12
- There’s been a decreasing emphasis on and time for science education in the elementary years

K-12 STEM Concerns

- Poor mathematics preparation of K-12 students leads to too many students in remedial programs in the first year of college
- Pre-service and in-service experiences for teachers are seldom coherent and linked to each other
- Incoherent system across the nation’s 14,000 school districts

Why NSF?

- NSF brings strong connections to higher education (including teacher preparation)

- NSF has experience and expertise in diversifying the STEM workforce

- NSF has linkages to the informal science education sector, linkages which need to be strengthened to ensure more seamless experiences for students

Directorate for Education and Human Resources

Vision: a healthy and vital national science, technology, engineering, and mathematics (STEM) enterprise

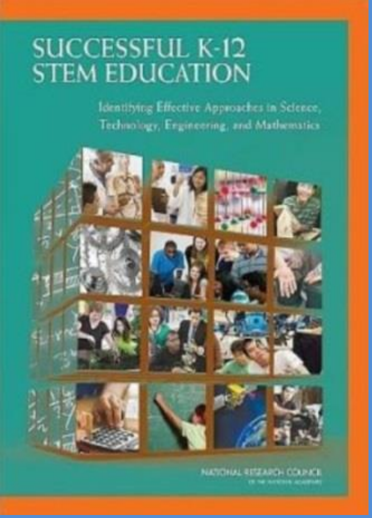
Mission: to support the preparation of a diverse, globally competent STEM workforce and a STEM-literate citizenry through investment in research and development on STEM education and learning

Directorate for Engineering

Division of Engineering Education and Centers (EEC)

EEC integrates disciplinary basic research and education conducted in other divisions of ENG and across NSF, into strategic frameworks critical for addressing societal grand challenges and promoting innovation.

EEC invests in faculty, graduate and undergraduate students, post-doctoral scholars, and K–12 teachers.

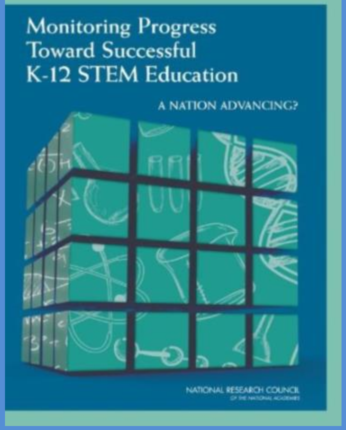


Content:

- Three Types of Criteria to Identify Successful STEM Schools
- What Schools & Districts Can Do to Support Effective K-12 STEM Education
- What State & National Policy Makers Can Do to Support Effective K-12 STEM Education

Regional Workshops:

-Philadelphia (September 2011)
-Seattle (February 2012)
-Chicago (April 2012)
-Las Vegas (September 2012)
-Baltimore (March 2013)
-Atlanta (June 2013)



Recommendations from *Successful K-12 STEM Education* (2011)	Indicators
Districts Should Consider All Three Models of STEM-Focused Schools	1. Number of, and enrollment in, different types of STEM schools and programs in each district.
Districts Should Devote Adequate Instructional Time and Resources to Science in Grades K-5	**2. Time allocated to teach science in grades K-5.**
	3. Science-related learning opportunities in elementary schools.
Districts Should Ensure That Their STEM Curricula Are Focused on the Most Important Topics in Each Discipline, Are Rigorous, and Are Articulated as a Sequence of Topics and Performances	**4. Adoption of instructional materials in grades K-12 that embody the *Common Core State Standards for Mathematics* and *A Framework for K-12 Science Education*.***
	5. Classroom coverage of content and practices in the *Common Core State Standards* and *A Framework for K-12 Science Education*.
Districts Need to Enhance the Capacity of K-12 Teachers	**6. Teachers' science and mathematics content knowledge for teaching.**
	7. Teachers' participation in STEM-specific professional development activities.
Districts Should Provide Instructional Leaders with Professional Development That Helps Them to Create the School Conditions That Appear to Support Student Achievement	8. Instructional leaders' participation in professional development on creating conditions that support STEM learning.
Policy Makers at the National, State, and Local Levels Should Elevate Science to the Same Level of Importance as Reading and Mathematics	**9. Inclusion of science in federal and state accountability systems.**
	10. Inclusion of science in major federal K-12 education initiatives.
	11. State and district staff dedicated to supporting science instruction.
States and National Organizations Should Develop Effective Systems of Assessment That Are Aligned with A Framework for K-12 Science Education and That Emphasize Science Practices Rather Than Mere Factual Recall	12. States' use of assessments that measure the core concepts and practices of science and mathematics disciplines.
National and State Policy Makers Should Invest in a Coherent, Focused, and Sustained Set of Supports for STEM Teachers	13. State and federal expenditures dedicated to improving the K-12 STEM teaching workforce.
Federal Agencies Should Support Research That Disentangles the Effects of School Practice from Student Selection, Recognizes the Importance of Contextual Variables, and Allows for Longitudinal Assessments of Student Outcomes	**14. Federal funding for the research identified in *Successful K-12 STEM Education*.**

June 12 NSF Hill Briefing on Harnessing the Power of Engineering to Improve STEM Education in K-12 Schools

- Sponsored by NSF, Discover Magazine and ASME
- Featured presentations on innovative research-based tools for engineering education funded by NSF's Directorate for Education and Human Resources
  - Leigh Abts (AP Engineering and E portfolio) and Christine Cunningham (Engineering is Elementary)

Opportunities

- NSF funded the early R&D for presentations featured today
  - Gone on to expand and acquire other partners
- Rationale for Engineering in K-12 education
  - Weaves together experiences that are in-school and out-of-school (e.g., robotics clubs)
  - Teaches both cognitive & non-cognitive skills
  - Engages and gets learners interested in engineering activities and applications
  - Can provide a vehicle for integrating STEM

Thanks!

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