

K-12 education should include engineering

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The introduction of K-12 engineering education has the potential to improve student learning and achievement in science and mathematics, increase awareness about what engineers do and of engineering as a potential career, and boost students' technological literacy, according to a new report from the National Academy of Engineering and the National Research Council. The report examines the status and nature of efforts to teach engineering in U.S. schools.

"The problem solving, systems thinking, and teamwork aspects of engineering can benefit all students, whether or not they ever pursue an engineering career," said Linda Katehi, chancellor of the University of California, Davis, and chair of the committee that wrote the report. "A K-12 education that does not include at least some exposure to engineering is a lost opportunity for students and for the nation."

Engineering education at the K-12 level should emphasize engineering design and a creative problem-solving process, the committee said. It should include relevant concepts in [mathematics](#), science, and technology, as well as support the development of skills many believe essential for the 21st century, including systems thinking, collaboration, and communication.

While science, technology, engineering, and mathematics instruction is collectively referred to as "STEM education," the report finds that the engineering component is often absent in policy discussions and in the classroom. In fact, engineering might be called the missing letter in STEM, the report says.

In preparing the report, the committee conducted an in-depth analysis of 15 K-12 engineering curricula; reviewed scientific literature related to learning engineering concepts and skills; evaluated evidence on the impact of K-12 engineering education initiatives; and collected preliminary information about pre-collegiate engineering education programs in other countries.

The committee found that engineering education opportunities in K-12 schools have expanded considerably in the past 15 years. Since the early 1990s, the report estimates, about 6 million children have been exposed to some formal engineering coursework. However, this number is still small compared with the overall number of students in K-12 schools (approximately 56 million in 2008). The committee noted that many challenges remain to expanding the availability and improving the quality of these programs, including the absence of content standards to guide development of instructional materials, limited pre-service education for engineering teachers, and structural and policy impediments to including this new subject in an already crowded school curriculum.

With these challenges in mind, the committee recommended that:

- the National Science Foundation or U.S. Department of Education fund research to determine how science inquiry and mathematical reasoning can be connected to engineering design in curricula and professional development;
- foundations and federal agencies with an interest in K-12 engineering education conduct long-term research to confirm and refine findings of studies of the impacts of engineering education;

- the American Society of Engineering Education begin a national dialogue on preparing K-12 engineering teachers, and on the pros and cons of establishing a formal credentialing process; and
- philanthropic foundations or federal agencies with an interest in STEM education and school reform identify models of implementation for K-12 engineering education that will work for different American school systems.

The committee also noted the importance of clarifying the meaning of "STEM literacy" and of developing curricula that would particularly appeal to groups typically underrepresented in engineering, such as girls, African Americans, and Hispanics.

Source: National Academy of Sciences ([news](#) : [web](#))

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