Report recommends ways to improve K-12 STEM education, calls on policymakers

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State, national, and local policymakers should elevate science education in grades K-12 to the same level of importance as reading and mathematics, says a new report from the National Research Council. The report recommends ways that leaders at all levels can improve K-12 education in science, technology, engineering, and mathematics.

The report responds to a request from Rep. Frank Wolf (R-Va.) for the National Science Foundation -- which sponsored the Research Council report -- to identify highly successful K-12 schools and programs in STEM fields.

"A growing number of jobs -- not just those in professional science -- require knowledge of STEM fields," said Adam Gamoran, chair of the committee that wrote the report and professor of sociology and educational policy studies at the University of Wisconsin, Madison. "The goal isn't only to have a capable and competitive work force. We need to help all students become scientifically literate because citizens are increasingly facing decisions related to science and technology -- whether it's understanding a medical diagnosis or weighing competing claims about the environment."

The report identifies key elements of high-quality STEM education to which policymakers could target improvements:

- A coherent set of standards and curriculum. States and districts

should have rigorous K-12 STEM standards and curricula that are focused on the most important topics in each discipline and presented as a sequence of content and practices that build knowledge over time.

- Teachers with high capacity to teach in their discipline. Good teachers need to know both STEM content and how to teach it; many teachers are currently underprepared to teach STEM-related courses.

- A supportive system of assessment and accountability. Current assessments limit educators' ability to teach in ways that promote learning the content and understanding the practices of science and mathematics.

- Adequate instructional time. The average amount of time spent on science instruction in elementary classrooms has decreased in recent years even as the time on mathematics instruction has increased. This is likely due to the focus on math and English language arts in the No Child Left Behind Act.

- Equal access to high-quality STEM learning opportunities. States and districts should strive to eliminate the disparities in access to high-quality STEM education between advantaged students and minority and low-income students, which contribute to the existing achievement gaps.

- School conditions and cultures that support learning. Although teacher qualifications certainly matter, so do school conditions and culture -- such as school and district leadership and parent and community involvement.

The report suggests that one way to elevate science to the same level of

importance as mathematics and reading is to assess science subjects as frequently as is done for reading and math, using an assessment system that supports learning and understanding. However, such a system is not yet available for science subjects, the report notes. States and national organizations need to develop assessments that are aligned with the next generation of science standards -- which will be based on a framework to be released soon by the Research Council -- and that emphasize science practices rather than mere factual recall.

National and state policymakers also should invest in helping educators in STEM fields teach more effectively, said the committee. For example, teachers should be able to pursue professional development through peer collaboration and professional learning communities, among other approaches. Schools and school districts should devote adequate instructional time and resources to science in grades K-5 to lay a foundation for further study, the report notes, as research suggests that interest in science careers may develop in the elementary school years.

In addition to strengthening STEM education in traditional schools, districts seeking to improve student outcomes in STEM fields could also consider three types of specialty schools targeted to that goal: selective STEM schools, which are organized around these fields and have selective admissions criteria; inclusive STEM schools, which have the same focus but without selective admissions; and STEM-focused career and technical education programs, which allow students to explore practical applications of science and related career options. Although there is no solid evidence about which approach works best for different student populations, or whether these three types are superior to enhanced STEM education in traditional schools, there are promising findings that the three types can be models for further development of effective STEM instruction and learning.

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