

Driven by Diversity

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Diversity of perspectives, ideas, and priorities comes from varied backgrounds, experiences, and cultures, and can help shape science and engineering. As science increasingly is done in teams, collaborations bring diversity to research. Diverse experiences and interactions can support cognitive growth and critical thinking (1), can benefit problem-solving (2), and are priorities among STEM (science, technology, engineering, and math) businesses for global competition (3).

Currently, U.S. STEM education efforts are not fully drawing upon the full scientific potential of all demographic groups and populations. Hispanics, African Americans, and American Indians and/or Alaska natives made up 26% of the general population, but only 9% of STEM workers, and 11% of STEM degree holders in 2008 (4). Without change and a strong inclusion culture to increase the representation of women and minorities, the STEM workforce will not reflect the broader U.S. population, posing a challenge to economic efficiency and social equity (5). We must embrace and encourage more comprehensive and strategic approaches in order to advance diversity and inclusion in the STEM workforce and beyond.

How to Provide the STEM Workforce for Tomorrow?

Equitable opportunity to learn from excellent K–12 teachers. The distribution of STEM teacher expertise in high-needs schools from kindergarten to high school (K–12) is an issue. As of 2012, 69% of science teachers in low-poverty schools had advanced degrees versus 49% in high-poverty schools (4). Research is needed to better understand how teacher background, knowledge, and preparation relate to effective teaching. Advanced secondary school courses, such as physics and calculus, are disproportionately offered in schools with lowest Black and Hispanic enrollments (6). Unless all youth in all schools have the opportunity to learn significant STEM in their early years, it seems improbable that students will be prepared,

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either in adequate numbers or with appropriate knowledge of content and practices, to make choices leading to successful STEM careers. State-led efforts to implement Common Core State Standards and Next Generation Science Standards have potential to lead to common opportunity to learn for all students.

Widespread opportunity to engage in authentic, inspiring STEM learning inside and outside of school. Young children's thinking about science is "sophisticated"; they can understand and reason about complex STEM concepts (7). All children should have opportunities to be engaged in challenging STEM learning activities. Students who have the chance to participate in authentic experiences that model the excitement and rewards of STEM have a good start toward entering STEM pathways (8). Outside-of-school or "informal" STEM learning environments such as museums, science centers, and media settings can "make science accessible, meaningful, and relevant for diverse students by connecting their home and community cultures to science" (9). Students who are able to develop strong science identities and self-efficacy are more likely to persist in STEM (10); continued attention to developing these qualities in all learners is warranted.

Recruit and retain a wide diversity of students into undergraduate STEM courses and majors. Women and minorities make up about 70% of college students but only receive about 45% of STEM degrees (11). Recommendations to retain undergraduate STEM majors include catalyzing the adoption of evidence-based teaching practices and addressing the mathematics preparation gap (11). College students are less likely to leave a STEM discipline if they have had the opportunity to engage in research with a professor, with strongest impact on African American students and second-year undergraduates (12).

Preparation for all graduate students for the international science workplace. The nature and practice of science and collaboration are changing more rapidly than ever. The number of articles with authors from multiple institutions and countries has increased (4). International collaboration is already a norm for scientists. Stronger career preparation is needed, with professional

Evidence is growing on benefits, and approaches, to increase diversity in the science and engineering workforce.

development in innovation, communication, and enhanced collaborations with industry (13, 14), and international experiences when possible.

Vannevar Bush (15), writing about increasing the scientific capital of basic research, said "First, we must have plenty of men and women trained in science, for upon them depends both the creation of new knowledge and its application to practical purposes." The National Science Foundation remains committed to broadening participation because it is essential for the nation's scientific progress.

References and Notes

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