Science, Technology, Engineering, and Mathematics (STEM)

The STEM Challenge

As the United States seeks to remain a leader in the global marketplace and reinforce national security, the nation has turned its attention to education policies and programs in science, technology, engineering, and mathematics (STEM) at all levels.

According to the President’s Council of Advisors on Science and Technology (PCAST), economic projections suggest that if we are to maintain our standing as a leader in science and technology worldwide, the U.S. will need to increase the number of students graduating with STEM degrees by 34% annually.

Methods is important to attracting and retaining STEM students—particularly women and minorities, who make up 70% of the college population but represent only 45% of undergraduates who receive STEM degrees. The need for diversity is even more pronounced in certain STEM fields, particularly engineering and computer science.

Evaluating STEM Initiatives

According to a recently released report from the Government Accountability Office, in FY 2010, 13 federal agencies invested over $3 billion in 209 programs designed to increase knowledge of STEM fields and attainment of STEM degrees. Unfortunately, because 66% of STEM programs have not been evaluated since at least 2005, little is known about the effectiveness of these programs.

The U.S. will need to increase the number of students graduating with STEM degrees by 34% annually to maintain our standing as a leader in science and technology fields worldwide.

In a new report to the president, PCAST estimates that less than 40% of students who enter college intending to major in a STEM discipline actually receive a degree in a STEM-related field. The report further suggests that a greater emphasis on evidence-based teaching

Efforts to Improve STEM Education

Much of the federal effort to improve education and workplace outcomes in STEM-related fields has focused on the untapped talent pool. STEM initiatives in K-12 education seek to support research and improve science and math curricula as well as teacher quality in order to raise student achievement and retain students in the STEM pipeline. Higher education STEM efforts aim to encourage research, build college capacity to educate students through revamped curricula and better teaching techniques, and provide financial support for students, faculty, and institutions to help build and diversify the STEM workforce.

Much can be done to build a strong evidence base that can inform continued innovations in STEM education policies and programs. Mathematica Policy Research is a national leader in program evaluation and policy research, survey design and data collection, research assessment and interpretation, and program performance and data management.
Mathematica has long been engaged in evaluating STEM efforts and is currently assessing several K-12 and post-secondary programs at the national level.

Program Evaluation and Policy Research

In K-12 education, Mathematica evaluated the Upward Bound Math-Science (UBMS) program, which provides intensive math and science pre-college experience for economically disadvantaged K-12 students. Mathematica’s findings suggest that UBMS improves several student outcomes in high school and college.

In terms of undergraduate STEM efforts, Mathematica examined the effectiveness of the National Institutes of Health’s Undergraduate Scholarship Program (UGSP). The program offers scholarships to undergraduate science students from disadvantaged backgrounds to encourage them to pursue careers in biomedical research. Mathematica analyzed the program’s recruiting and outreach efforts, its operations, and evaluated student outcomes, finding that UGSP scholars achieved higher grade point averages and pursued M.D. or Ph.D. degrees more frequently than their non-UGSP funded peers.

With respect to STEM initiatives at the graduate level, Mathematica is evaluating the Bridge to the Doctorate (BD) fellowship of the National Science Foundation, created in 2003 to increase the number of students completing doctoral degrees in STEM and entering the workforce in these fields. Mathematica’s evaluation will monitor the educational progress and ultimate employment outcomes of about 4,600 BD participants and non-participants at 55 universities throughout the country. This rigorous assessment’s findings will provide an objective measure of the initiative’s success in achieving its education and workforce goals.

Survey Design and Data Collection

With funding from the National Science Foundation (NSF), Mathematica collects data on the employment, educational, and demographic characteristics of scientists and engineers in the United States, and provides expert statistical services and database management for NSF’s Scientists and Engineers Statistical Data System (SESTAT). SESTAT comprises data from three national surveys: the National Survey of College Graduates, the National Survey of Recent College Graduates, and the Survey of Doctorate Recipients. Data from these surveys are used to monitor and study STEM educational and workforce outcomes, and Mathematica’s expertise helps to ensure the quality of these data.

Research Assessment and Interpretation: Guidance on Effectiveness

Through the What Works Clearinghouse (supported by the Department of Education), Mathematica created and continuously updates a central source of scientific research and information on effective education programs and approaches, including science curricula and math curricula.

In continuing to apply its expertise to STEM and STEM-related programs, Mathematica will contribute to the development of a robust evidence base to support policy makers and program leaders as they seek to maintain the United States’ preeminence as a global leader in science and technology.