Diana Ong/Getty Images

REFLECTIONS IN DIVERSITY

Increasing Minority Participation in University STEM Programs

Milton Dean Slaughter

A proposed university program could increase the number of science, technology, engineering and mathematics (STEM) degrees earned by women and minorities in the United States.

The United States needs to increase the number of women and minorities in STEM postsecondary education to meet the future demands for STEM talent and to ensure the country's competitiveness, security and defense for generations to come. The number of minorities—defined in the United States as African American (Black), Hispanic (Latino) or Native American—is steadily increasing, and future STEM jobs will require more training as technology evolves.

According to Ernestine Psalmas, senior program officer at the U.S. National Academy of Sciences, by 2042, the country is on track to becoming a minority-dominant nation; these populations are expected to grow at a rate that will outpace the majority. Therefore, the rally for diversity is an even more urgent priority because it is a fast-approaching reality that the number of white males who find STEM careers attractive enough to resupply the workforce will be inadequate to meet the nation's needs.

The focus on attracting underrepresented groups is a critical maneuver that will ensure a robust scientific workforce for the future of the United States. Bill Valdez, director for the U.S. Department of Energy, Office of Workforce Development for Scientists and Teachers, says "We have a stewardship responsibility to ensure that the next generation of physicists exists out there." To keep up with the anticipated demands for STEM graduates, we must expand our cache of qualified participants by "growing our own" professionals, with special effort to include underrepresented individuals.

The United States is not doing enough to address the imminent shortage of qualified STEM personnel.

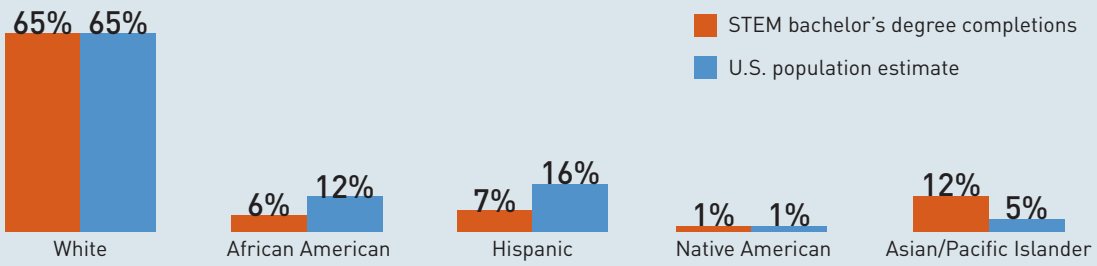
Addressing the issue

The United States is not doing enough to address the imminent shortage of qualified STEM personnel. With few exceptions, the current situation could be described as retrogressive. Statistics are still so low that Roman Czujko, director for the Statistical Research Center at the American Institute of Physics, reports numbers have only increased by 0.4 percent for certain underrepresented groups from 1973 to 2005. It is imperative that we identify, attract, motivate, prepare and graduate more women and students from underrepresented populations with STEM degrees, and then move these individuals into productive careers.

In roles centering on minority representation and education with the American Physical Society, and as chief administrator of two National Science Foundation STEM programs based at my home university, I've gained a wealth of experience specific to the underrepresentation of women and minorities in the sciences and in academic environments. These experiences helped shape my perspectives on how and why a college-based solution for underrepresentation might be applicable nationwide. The solution is called the University Organizational Unit Program (UOUP). The UOUP projects and interventions outlined below are designed to identify, attract, motivate and retain women and minority students:

- Recruit targeted minorities and women at the freshman and sophomore levels.
- Retain these students and offer them research opportunities as juniors and seniors.
- Use STEM gateway courses to target minorities and women.
- Change curriculum to create credit courses suitable for UOUP undergraduate researchers. For example, a vector analysis course or a special topic course, because understanding and using vectors is generally a major obstacle for STEM students; summer STEM classes; and hands-on laboratories that involve student presentations.
- Integrate, coordinate and interface classes with ongoing UOUP educational projects.

STEM bachelor's degree completions relative to population



Source: 2009 census population estimates by race/ethnicity, www.nae.edu/Publications/Bridge/69735/69745.aspx

A complex problem like underrepresentation in STEM needs the dedication of the entire academic community.

- Recruit students who require academic and/or financial assistance.
- Invite visiting minority lectureship (VML) scientists, engineers or mathematicians to serve as role models and instructors.
- Arrange a two- or three-day VML colloquium for UOUP students and faculty.
- Create an undergraduate-to-graduate "bridge phase" for the UOUP. For example, require university offices to function synergistically to support the bridge phase, and do not replace already extant stipends or other aid to UOUP participants.

Additionally, universities should provide mentoring, counseling and role models for STEM students. Furthermore, universities must also promote partnerships and collaborations with other UOUP universities. Any solution should provide early research experiences for participating students, thus strengthening the academic environment at all UOUP universities.

Strategies that address the problem of underrepresentation in STEM degree programs should be comprehensive, multidisciplinary and collaborative. UOUPs should contain representatives from government agencies, academia, industry, national research laboratories and professional societies charged with ensuring the health of STEM education from kindergarten through graduate school. For example, the Department of Education, the National Science Foundation, the National Institutes of Health and the Department of Energy could play major roles in UOUP activities to support these goals. Each organization associated with a UOUP must carry out its responsibilities in a way that ensures a dynamic research-education mission balance, and must have the authority to recommend long-term projects for funding, and ultimately for institutionalization.

Ultimately, UOUPs should strive to significantly improve the quantity and quality of underrepresented minority students receiving STEM baccalaureate degrees, thereby expanding the pool of qualified minorities eligible for STEM doctoral study and careers.

Exemplary programs

The Massachusetts Institute of Technology (MIT) exemplifies an institution which not only has an outstanding graduation rate for women and minorities in its STEM programs, but also has an excellent reputation for its commitment to diversity. Stanford University in California also does well in recruiting underrepresented populations to STEM programs, but Stanford is more dependent on specific personnel for its success. From my experience with each institution, both MIT and Stanford have good UOUPs in place, demonstrating a commitment to diversity from the top down, with dedicated faculty and staff committed to long-term success.

The lack of underrepresented groups in STEM is a serious and growing problem for the U.S. scientific community. Universities that have the most success in recruiting, retaining and graduating minorities and women with STEM degrees should be approached to implement their own UOUPs because they already have a strong foundation of highly motivated personnel in place.

A complex problem like underrepresentation in STEM needs the dedication of the entire academic community to bring about the critical mass required to sufficiently refurbish America's future scientific workforce. OPN

Milton D. Slaughter (slaughts@physicsresearch.net) is professor of physics emeritus and chair and department head emeritus of the University of New Orleans, USA; and an affiliate visiting professor of physics at Florida International University, USA.

To learn more ...

- F. Ahmad and S. Iverson. "The State of Women of Color in the United States," Center for American Progress, www.americanprogress.org/wp-content/uploads/2013/10/StateOfWomenColor-1.pdf (24 October 2013).
- M.D. Slaughter. "Status of Underrepresented Minorities in Science, Technology, Engineering, and Mathematics (STEM)," www.physicsresearch.net/STEMDiversityOutline_April_2014.pdf (April 2014).
- R. Heuer et al. "Foreign Graduate Enrollment in Science and Engineering Continues to Rise While Overall Graduate Enrollment Remains Flat," U.S. National Science Foundation 14-313, www.nsf.gov/statistics/infbrief/nsf14313/ (May 2014).
- The U.S. National Center for Education Statistics, http://nces.ed.gov
- The Education Trust, www.edtrust.org and www.collegeresults.org