Critical Issues in Engineering Education Policy

INTRODUCTION

America’s global competitiveness depends upon our ability to train the next generation of scientists, technologists, engineers, and mathematicians (STEM). Business and policy leaders are “rightly concerned that without a robust STEM workforce, we will become less competitive in a global economy.”

The ability of the United States to meet the STEM challenge will require significant measures on several levels, especially in pushing individuals who are underrepresented in STEM fields, such as women, minorities, and those from low-income backgrounds, to higher education STEM fields.

Even though women represent approximately 57 percent of the U.S. population and 52 percent of the workforce, they represent only 24 percent of the STEM workforce (2009). Data are more stark for underrepresented minorities. Of all workers, 6 percent of white workers and 15 percent of Asian workers are currently working in STEM-related jobs (Figure 1). Comparatively, only 2 percent of Latinos and 3 percent of African Americans work in STEM fields. Figure 2 showcases the variation by employment of scientists and engineers by race and gender. As illustrated, not only are there large discrepancies by race, but also by gender within race. African American males, in particular, fall short in the STEM job market.

Former Lockheed Martin CEO Norman Augustine argues that 70 percent of our engineers with Ph.D.s are foreign born and that many others return to their home countries instead of staying in the U.S. The U.S. Department of Commerce recently stated that STEM workers are “essential to American innovation and competitiveness in an increasingly dynamic and global marketplace.”

The Georgetown Center on Education and the Workforce recently calculated that STEM occupations will grow by 17 percent between 2008 and 2018, compared to 10 percent of total jobs in the economy. The share of STEM jobs in the workforce will grow from 4.4 to 4.9 percent during that time period (Figure 3). Almost two-thirds of these jobs will require a bachelor’s degree or higher.

THE STEM PATHWAY

The workforce reality illustrated above does not occur in a vacuum. It is the result of a systemic process which keeps students from preparing, accessing, and succeeding in STEM course work, certificate, and degree programs, and, ultimately, careers.
Data from the National Assessment of Education Progress (NAEP) tell us the following (Figure 4):

- While 52 percent of fourth grade white students are proficient or above in mathematics on the NAEP assessment, only 17 percent of African American students, 24 percent of Latino students, and 22 percent of American Indian students are similarly proficient.
- By the eighth grade, proficiency has dropped for all students. Only 44 percent of white students are proficient or above, compared to 14 percent of African American, 21 percent of Latino, and 17 percent of American Indian students.

Figure 4. NAEP Mathematics Achievement Levels by Race/Ethnicity and Proficiency Level, 2011

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Below Basic</th>
<th>At or Above Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4th</td>
<td>8th</td>
</tr>
<tr>
<td>White</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>African American</td>
<td>34</td>
<td>49</td>
</tr>
<tr>
<td>Latino</td>
<td>28</td>
<td>39</td>
</tr>
<tr>
<td>Asian</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>American Indian</td>
<td>34</td>
<td>45</td>
</tr>
</tbody>
</table>


Exacerbating the problem is the high school dropout rates for underrepresented minorities, as illustrated below (Figure 5):

- Eighteen percent of Latinos, 13 percent of American Indians, and 8 percent of African American students between the ages of 16- and 24-years-old held dropout status in 2009, compared to 5 percent of white students.
- For underrepresented minorities, between 9 and 18 percent of students have withdrawn from the education path all together.

Inequity in college access and completion, especially in STEM-related areas, seriously impedes US competitiveness. Large inequities in college graduates are illustrated in Figure 6:

- Twenty-two percent of African American students and 14 percent of Latino students aged 16 and above earned a college degree, compared to 35 percent for whites and 54 percent for Asians.
- Of all college graduates, only 1-in-5 hold a degree in a STEM area, and less than 8 percent work in a STEM-related field.

Figure 6. Factors Affecting Likelihood of Having STEM Job by Race/Ethnicity, 2009

POLICY CONSIDERATIONS

To increase America’s global competitiveness, it is essential that federal and state policies provide opportunities for underrepresented minorities and others who have not traditionally participated for nor entered the STEM arena. To do so, we encourage policymakers, educators, and business and industry leaders to pursue the following policies and practices:

1. **K-12 EDUCATION.** Infuse STEM education throughout the K-12 curriculum via active, hands-on, project-based learning, and introduce students to STEM careers, starting with pre-school with awareness activities.

2. **HIGHER EDUCATION.** Remove systemic barriers to underrepresented minorities’ participation in college by addressing financial aid and admissions policies.

3. **GOVERNMENT.** Develop a national STEM workforce development policy that stretches from pre-school to Ph.D. level.

4. **BUSINESS.** Form partnerships with K-12 schools to promote STEM careers and education to underrepresented minority students, including providing STEM employees to serve as role models and mentors, offering onsite internships to students and teachers, and providing access to the latest equipment and software.

ENDNOTES

5. Georgetown Center on Education and the Workforce (http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/stem-complete.pdf)