Trends in Engineering
Content

National Trends → Education Trends → Employment Trends
National Trends
# Changing Demographics

<table>
<thead>
<tr>
<th>Age Group</th>
<th>White</th>
<th>Hispanic</th>
<th>Black</th>
<th>Asian</th>
<th>Other</th>
<th>2+ races</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 5 years</td>
<td>51%</td>
<td></td>
<td></td>
<td>25%</td>
<td>14%</td>
<td>4%</td>
</tr>
<tr>
<td>5-17 years</td>
<td>55%</td>
<td></td>
<td>22%</td>
<td></td>
<td>14%</td>
<td>4%</td>
</tr>
<tr>
<td>18-35 years</td>
<td>58%</td>
<td></td>
<td>20%</td>
<td></td>
<td>13%</td>
<td>5%</td>
</tr>
<tr>
<td>35-49 years</td>
<td>64%</td>
<td></td>
<td>16%</td>
<td></td>
<td>12%</td>
<td>5%</td>
</tr>
<tr>
<td>50-64 years</td>
<td>73%</td>
<td></td>
<td>10%</td>
<td>11%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>65-74 years</td>
<td>79%</td>
<td></td>
<td>7%</td>
<td>9%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>85+ years</td>
<td>85%</td>
<td></td>
<td>5%</td>
<td>7%</td>
<td>2%</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Author’s analysis of 2010 census data*
International Trends

University Graduates: Percent in Engineering

GENDER DIVERSITY
US Population
- 49.3% Men
- 50.7% Women

Employed as Engineers
- 89% Men
- 11% Women

ETHNIC DIVERSITY
US Population
- 72.1% Other
- 12.8% African American
- 14.1% Hispanic
- 1% Native American

Employed as Engineers
- 91.7% Other
- 3.1% African American
- 4.9% Hispanic
- 0.3% Native American
The Overall Numbers

- 1.5 M engineers
  - 37% Manufacturing
  - 28% Technical & Professional Services
  - 12% Government
  - 23% Other - Construction, telecommunications, wholesale trade

- 0.5 M engineering technicians
  - 33% electrical technicians

- Oversea Engineering production (China & India) is questionable
  - Accounting methods and definition of engineer
  - 70,000 US engineers (20% increase); China/India 100% increase
Education Trends
BS Degrees Awarded
Nationwide: 2002 - 2012
UTK Enrollment
EECS Undergraduates: 2008 - 2014

Fall '08  Fall '09  Fall '10  Fall '11  Fall '12  Fall'13  Fall '14

0          175       350       525       700
UTK Enrollment
EECS Graduate Students: 2008 - 2014

Year
2008
2009
2010
2011
2012
2013
2014
Number Students

M.S.
223
204
220
214
233
228
225

Ph.D.
116
119
157
159
178
175
185

Total
239
323
377
412
411
403
410

2008
2009
2010
2011
2012
2013
2014
Year

Number Students
0
120
240

M.S.

Ph.D.

Total

• M.S.
• Ph.D.
• Total
Diversity
Why Diversity?

- Competitiveness
  - Encourages a larger workforce of underutilized human capital

- Good Citizenship
  - Encourages understanding of other cultures and respect

- Challenges Stereotypes
  - Encourages personal growth and critical thinking

- Exchanges Knowledge
  - Encourages more knowledge dissemination
Benefits of Diversity

- Teams of Diverse Gender show increased cognitive activity (Curseau et al., 2013)

- Long-term diverse team cohesiveness may diminish over time (Keller, 2001)
Bachelor’s degrees awarded in selected subfields of engineering, by citizenship and race/ethnicity: 2012

- Aerospace engineering
- Chemical engineering
- Civil engineering
- Electrical engineering
- Industrial engineering
- Materials engineering
- Mechanical engineering

Legend:
- Orange: Temporary resident
- Black: White
- Gray: Asian/Pacific Islander
- Light green: Black
- Blue: American Indian/Alaska Native
MS Racial Diversity

Master's degrees awarded in selected subfields of engineering, by citizenship and race/ethnicity: 2012

- Temporary resident
- White
- Asian/Pacific Islander
- Black
- Hispanic
- American Indian/Alaska Native
- Other/unknown race/ethnicity

Aerospace engineering
Chemical engineering
Civil engineering
Electrical engineering
Industrial engineering
Materials engineering
Mechanical engineering

0 2,500 5,000 7,500 10,000 12,500 15,000
Ph.D Diversity

Doctoral degrees awarded in selected subfields of engineering, by citizenship and race/ethnicity: 2012

- Temporary resident
- White
- Asian/Pacific Islander
- Black
- Hispanic
- American Indian/Alaska Native
- Other/unknown race/ethnicity

Aerospace engineering
Chemical engineering
Civil engineering
Electrical engineering
Industrial engineering
Materials engineering
Mechanical engineering
Women Representation by Degree
General Trends

Demographic Imbalance

Figure 1. Gender Shares of Total and STEM Jobs, 2009

- Men: 52% (Total jobs), 76% (STEM jobs)
- Women: 48% (Total jobs), 24% (STEM jobs)

Source: ESA calculations from American Community Survey public-use microdata. Note: Estimates are for employed persons age 16 and over.
Degrees Awarded by Gender

Bachelor's degrees awarded in selected subfields of engineering, by sex: 2012

Doctoral degrees awarded in selected subfields of engineering, by sex: 2012
EECS Undergraduate Enrollment

- Fall 2014 Freshman
  - Computer Science: 74
  - Computer Engineering: 56
  - Electrical Engineering: 50
  - Total EECS Freshman: 180

Total female students: 15 (8%)
Total minority students: 29 (16%)

- Freshman Enrollment is 15% increase over previous year.
<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>White</th>
<th>African American</th>
<th>Asian American</th>
<th>Hispanic</th>
<th>Multiple</th>
<th>Not reported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CS</strong></td>
<td>272</td>
<td>23</td>
<td>295</td>
<td>224</td>
<td>10</td>
<td>27</td>
<td>2</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td><strong>CE</strong></td>
<td>134</td>
<td>9</td>
<td>143</td>
<td>105</td>
<td>8</td>
<td>11</td>
<td>2</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td><strong>EE</strong></td>
<td>228</td>
<td>27</td>
<td>255</td>
<td>208</td>
<td>11</td>
<td>17</td>
<td>4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>634</td>
<td>59</td>
<td>693</td>
<td>537</td>
<td>29</td>
<td>55</td>
<td>8</td>
<td>30</td>
<td>32</td>
</tr>
</tbody>
</table>
## EECS Graduate Student Trends

### Number of Students

<table>
<thead>
<tr>
<th>Year</th>
<th>M.S.</th>
<th>Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>223</td>
<td>223</td>
</tr>
<tr>
<td>2009</td>
<td>204</td>
<td>204</td>
</tr>
<tr>
<td>2010</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>2011</td>
<td>214</td>
<td>214</td>
</tr>
<tr>
<td>2012</td>
<td>233</td>
<td>233</td>
</tr>
<tr>
<td>2013</td>
<td>228</td>
<td>228</td>
</tr>
<tr>
<td>2014</td>
<td>225</td>
<td>225</td>
</tr>
</tbody>
</table>

### Fall 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>M.S.</th>
<th>Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>male</strong></td>
<td>88%</td>
<td>80%</td>
</tr>
<tr>
<td><strong>female</strong></td>
<td>12%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>domestic</strong></td>
<td>75%</td>
<td>27%</td>
</tr>
<tr>
<td><strong>international</strong></td>
<td>25%</td>
<td>73%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Total students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total students</strong></td>
<td>40</td>
</tr>
<tr>
<td><strong>Comp Sci</strong></td>
<td>15</td>
</tr>
<tr>
<td><strong>Comp Engr</strong></td>
<td>11</td>
</tr>
<tr>
<td><strong>Elec Engr</strong></td>
<td>14</td>
</tr>
</tbody>
</table>
Employment Trends
Wage Gap

**Most Common Dialogue**
$0.77 to $0.86 are common numbers used to describe hourly wage differences between men and women.

**Counter Argument**
$0.05 is the real difference when comparing similar jobs. The distribution of women within jobs is different than men.

*Figure 3. Average Hourly Earnings by Gender and Occupation, 2009*

Source: ESA calculations from American Community Survey public-use microdata.
Note: Estimates are for full-time year-round private wage and salary workers age 16 and over.
Figure 6. College-educated Workers with a STEM Degree by Gender and STEM Occupation, 2009

- **Other occupations**
  - Men: 23%
  - Women: 23%

- **Business & financial occupations**
  - Men: 5%
  - Women: 6%

- **Non-STEM managers**
  - Men: 16%
  - Women: 11%

- **Healthcare occupations**
  - Men: 10%
  - Women: 19%

- **Education occupations**
  - Men: 6%
  - Women: 14%

- **STEM occupations**
  - Men: 40%
  - Women: 26%

Source: ESA calculations from American Community Survey public-use microdata. Note: Estimates are for employed persons age 25 and over. The shares for men and women do not add up to 100% due to rounding.
Job Segregation is the grouping of people based upon demographic characteristics.
Job Distribution

The work force has a much broader range of men than women.

- Higher attrition rate
- Different set of interests
- Women are just recently becoming a major component in the job market (in past few decades)

Figure 1. Percent distribution of years since first baccalaureate degree of U.S. engineers, by sex: 1995

Percent distribution

NOTE: Plots in figure 1 are of full-time engineers in April, 1995 who were U.S. citizens or permanent residents.

SOURCE: National Science Foundation, Division of Science Resources Studies, SESTAT (Scientists and Engineers Statistical Data System), 1995.
Upper Management

- Currently on average, 10 women (3%) attain CEO status annually compared to 300 men annually.

- US and Canada have the fastest rate of women gaining CEO status (3%)

- By 2040, the level of women selected to CEO positions is thought to be as high as 33%
Highest Paying Fields

1. Petroleum Engineering: 87% male
2. Pharmacy Pharmaceutical Sciences: 48% male
3. Mathematics and Computer Science: 67% male
4. Aerospace Engineering: 88% male
5. Chemical Engineering: 72% male
6. Electrical Engineering: 89% male
7. Naval Architecture and Marine Engineering: 97% male
8. Mechanical Engineering: 90% male
9. Metallurgical Engineering: 83% male
10. Mining and Mineral Engineering: 90% male
Lowest Paying Fields

1. Counseling Psychology: 74% female
2. Early Childhood Education: 97% female
3. Theology and Religious Vocations: 34% female
4. Human Services and Community Organization: 81% female
5. Social Work: 88% female
6. Drama and Theater Arts: 60% female
7. Studio Arts: 66% female
8. Communication Disorders Sciences and Services: 94% female
9. Visual and Performing Arts: 77% female
10. Health and Medical Preparatory Programs: 55% female