Turning Dreams into Reality: Engineering Messages for a New Generation

Jennifer Groh
WIEP Associate Director
About WIEP

• The Women in Engineering Program was started in 1969!

• We have 5 professional staff and student assistants.

• We do K-12 outreach activities, recruitment activities, and programs for current students.

OFFICE
ARMS 1245
Structure for this session

The need for diversity in STEM
Myths and messages: what kids hear & think about engineering
What is your role as STEM rep & influential adult?
How to apply what you’ve learned:
Messages and Activities
Resources
Questions
QUIZ!
Activity Time – meet one person you don’t know

How would you/do you typically describe engineering (or STEM) to kids and/or the general public (basically someone not versed in STEM like you)
Economic projections point to a need for approximately 1 million more STEM professionals than the U.S. will produce at the current rate over the next decade if the country is to retain its historical preeminence in science and technology. To meet this goal, the United States will need to increase the number of students who receive undergraduate STEM degrees by about 34% annually over current rates.

US PRESIDENT’S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY
## Engineering Degrees

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2009</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bachelor's</td>
<td>89693</td>
<td>80213</td>
<td>78800</td>
</tr>
<tr>
<td>African American</td>
<td>3251</td>
<td>3179</td>
<td>3283</td>
</tr>
<tr>
<td>AA % of total</td>
<td>3.6%</td>
<td>4.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Asian American</td>
<td>9434</td>
<td>8567</td>
<td>9000</td>
</tr>
<tr>
<td>Asian % of total</td>
<td>10.5%</td>
<td>10.7%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6566</td>
<td>5514</td>
<td>5160</td>
</tr>
<tr>
<td>HA % of total</td>
<td>7.3%</td>
<td>6.9%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Native American</td>
<td>360</td>
<td>344</td>
<td>331</td>
</tr>
<tr>
<td>NA % of total</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>International</td>
<td>5871</td>
<td>4723</td>
<td>5022</td>
</tr>
<tr>
<td>Int % of total</td>
<td>6.5%</td>
<td>5.9%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Female</td>
<td>16539</td>
<td>14299</td>
<td>14226</td>
</tr>
<tr>
<td>female % of total</td>
<td>18.4%</td>
<td>17.8%</td>
<td>18.1%</td>
</tr>
</tbody>
</table>

What might explain the low percentages for women and URM?
Myths about engineers

- Nerdy
- Guys
- Must LOVE math/science
- Narrow field
- Solitary
- Repetitious
- Boring/not creative
Not for lack of aptitude

**Early Aptitude and Achievement** - Results from the National Assessment of Educational Progress (NAEP) in mathematics and science show very little difference between boys and girls. *Throughout school, girls and boys show the same aptitude for math and science.*

**Something happens** - 4th grade 66% girls vs 68% boys are interested in science but by 8th grade, boys are 2X more interested.
# Changes in Societal Norms

Percentage of women in these fields by year

<table>
<thead>
<tr>
<th>Field</th>
<th>1970</th>
<th>Early to mid-2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law school</td>
<td>5%</td>
<td>48%</td>
</tr>
<tr>
<td>Business school</td>
<td>4%</td>
<td>45%</td>
</tr>
<tr>
<td>Medical School</td>
<td>8%</td>
<td>50%</td>
</tr>
<tr>
<td>High school sports</td>
<td>4%</td>
<td>42%</td>
</tr>
<tr>
<td>STEM fields</td>
<td>Less than 1%</td>
<td>11% engineers/20% scientists</td>
</tr>
</tbody>
</table>
What Do Engineers Do?

Build/Construct/Make things
### Contributing To Society

<table>
<thead>
<tr>
<th></th>
<th>Engineers</th>
<th>Scientists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make strong leaders</td>
<td>56%</td>
<td>32%</td>
</tr>
<tr>
<td>Care about the community</td>
<td>37%</td>
<td>51%</td>
</tr>
<tr>
<td>Sensitive to societal concerns</td>
<td>28%</td>
<td>61%</td>
</tr>
<tr>
<td>Save lives</td>
<td>14%</td>
<td>82%</td>
</tr>
</tbody>
</table>

Source: Harris Poll, December 2003

Judging the relative prestige of professions, engineering ranks well below medicine, nursing, science and teaching.
OK...so how do we know what messages will work?

• What motivates students toward or away from an interest in engineering (STEM)?

• What messages (which don’t work) are unknowingly being used by both the engineering community and the public?

• What messaging opportunities exist for increasing enrollment/diversity/interest in engineering?

http://www.engineeringmessages.org/
“It’s not easy—but if you’re the type who when faced with a problem some would call impossible is even more driven to move mountains to find a solution, then you might have it in you to be an engineer.”

“Someone who excels in math and science…. who is motivated, dedicated, & who doesn’t mind sitting in a cubicle all day.”
What Do Pre-College Students WANT in a career?

Enjoyable
“How happy I will be—what’s the point of doing anything you don’t like?”

Good working environment
“If I can’t interact with people...I will probably drop the job.”

To make a difference
“That I would make a difference in some way, you know, make my mark on the world.”

Good Income
“As shallow as it sounds, money is the one thing I have to consider when I’m choosing a job. I’m not going to do something that I know can’t help me pay bills.”

Flexibility
“My career can’t consume all of my time...I need free time to do a lot of other things...before I die.”
Engineering as a career
Mismatched Messages

What students want
• Enjoying what I do
• Good working environment
• Making a difference
• Good income
• Flexibility

Messages students hear about engineering
• It's a challenge
• Go for it! It's difficult, but rewarding
• Use math and science to solve problems

Do people typically say they want to be an MD because they are good at anatomy and physiology and taking the MCAT or is it because they want to help people?
Engineering is...

“the application of creativity and teamwork using math and science principles as tools to solve problems

OR

• Use “create” instead of “build”
• Use images of people instead of just things
• Use the words discovery, design, imagination, innovation, contribution

“creating things that will benefit society”
“Engineering will challenge you to turn dreams into realities, while giving you the chance to travel, work with inspiring people and give back to your community.”

www.engineeryourlife.org
Engineers have a hand in designing, creating, or modifying nearly everything we touch, wear, eat, see, and hear in our daily lives.

American Society of Engineering Education
Some research shows parents are #1 influence on daughters' career paths.

- Unconscious bias
  - Leads adults to encourage boys more than girls to become engineers

- Stereotype threat
  - Leads girls to believe they are not as good as boys at some things (e.g., math)

Role for influential adults...including librarians
Expectations for boys fit better with what we think engineers are.

<table>
<thead>
<tr>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Competent</strong></td>
<td>Nurturing/Caring</td>
</tr>
<tr>
<td><strong>Do well in math</strong></td>
<td>Do well in English</td>
</tr>
<tr>
<td><strong>Leaders</strong></td>
<td>Followers</td>
</tr>
<tr>
<td><strong>Like things</strong></td>
<td>Like people</td>
</tr>
<tr>
<td><strong>Focus on task (solve problems)</strong></td>
<td>Focus on process (involve everyone)</td>
</tr>
<tr>
<td><strong>Not emotional</strong></td>
<td>Emotional</td>
</tr>
</tbody>
</table>

As a result, we unconsciously provide more encouragement to boys to be engineers.
“Now What?”
OR
How to apply this for outreach?

NOTE: don’t have to be scientists or engineers to bring fun, educational STEM activities to kids.
What Engineering Goes Into _____?

- Aeronautical
- Astronautical
- Agricultural & Biological
- Biomedical
- Chemical
- Civil
- Computer
- Electrical
- Environmental
- Industrial
- Materials
- Mechanical
- Nuclea
FUN hands-on activities relating to broad audiences
Engineers

Management
Entrepreneurs
Law
Technical Sales
Medicine

Research and Development
CEO
Quality Control
Finance
Consulting
Teachers
## Career benefits

<table>
<thead>
<tr>
<th>Discipline Group</th>
<th>2010 Avg Start</th>
<th>2011 Avg Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>$46,378</td>
<td>$48,144</td>
</tr>
<tr>
<td>Communications</td>
<td>$38,450</td>
<td>$39,577</td>
</tr>
<tr>
<td>Computer Science</td>
<td>$58,229</td>
<td>$60,594</td>
</tr>
<tr>
<td>Education</td>
<td>$37,040</td>
<td>$37,830</td>
</tr>
<tr>
<td><strong>Engineering</strong></td>
<td><strong>$60,971</strong></td>
<td><strong>$61,872</strong></td>
</tr>
<tr>
<td>Health Sciences</td>
<td>$44,451</td>
<td>$44,955</td>
</tr>
<tr>
<td>Humanities &amp; Social Sciences</td>
<td>$34,856</td>
<td>$35,503</td>
</tr>
<tr>
<td>Math &amp; Sciences</td>
<td>$39,749</td>
<td>$40,204</td>
</tr>
</tbody>
</table>

So...what about the math and science?

Once we have shared a message about how creative engineering is and what engineers do for society (OUTPUTS), then we can fill them in about the requirements (INPUTS).

But remember to put it into the right context & realize students are already getting the math/science message from elsewhere.
Activity Time – meet one person you don’t know

Think, Pair, Share

How would you/do you typically describe engineering (or STEM) to kids and/or the general public (basically someone not versed in STEM like you)
Why Engineering?

1. Love your work, AND live your life too!
2. Be creative.
3. Work with great people.
4. Solve problems, design things that matter.
5. Never be bored.
6. Make a big salary.
7. Enjoy job flexibility.
8. Travel.
9. Make a difference.

See handout for websites and other resources

www.engineeryourlife.org
Engineering in Action!
The Engineering Design Process

Hands-on engineering activity
Questions?
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