



# Women in Engineering: Building Confidence and Interest

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# Background

## Women in Engineering Programs

Personal



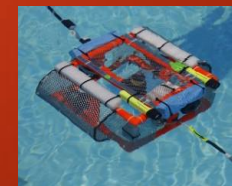
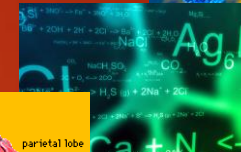
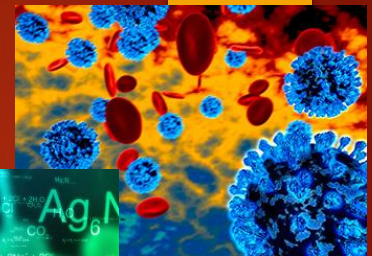
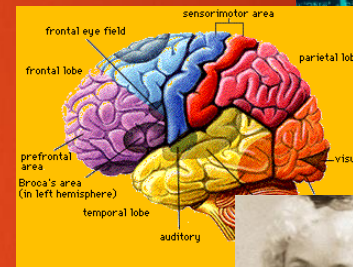
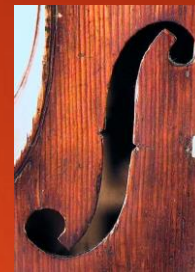
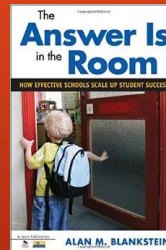
1997 - 2007



2011 - 2015



2015 - present



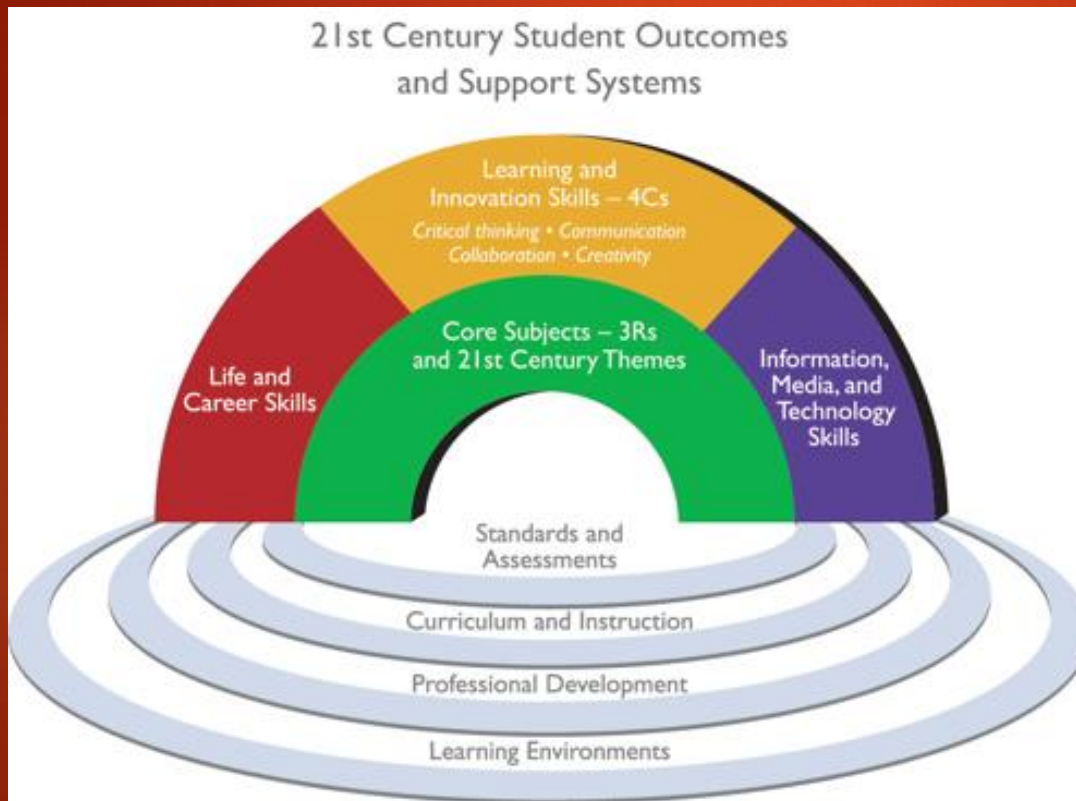
# Career Path

- ❖ Not a straight line!
- ❖ Your future career may not exist ... yet.
- ❖ What do I want to do?
- ❖ What kinds of skills do I need?
- ❖ How do I get there?





# Essential Skills for 21<sup>st</sup> Century Workforce



## Learning and Innovation Skills

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

## Life and Career Skills

- Flexibility and Adaptability
  - Initiative / Self-Direction
  - Social / Cross-Cultural
- Productivity / Accountability
- Leadership and Responsibility

# What is Engineering Diversity?



## Underrepresented Pops.

- ▶ Less than 25%
  - ▶ Perkins Legislation
  - ▶ Title IX
- ▶ Example:
  - ▶ African Americans / Hispanic / Latino Americans make up ~24% of the population / combined make up <10% of the engineering Ph.D.'s

## Inclusion in Engineering

- ✓ Women
  - ✓ African American
  - ✓ Hispanic / Latino
  - ✓ Native American
  - ✓ Disability Community
  - ✓ LGBTQQIA
- 
- ❖ Why is it Important?
    - Economic Imperative
    - Cultural Shift
    - Cultural Competency
    - Innovative Solutions

# Why Embed Diversity?

Scott E. Page

## THE DIFFERENCE

HOW THE POWER OF DIVERSITY  
CREATES BETTER GROUPS, FIRMS,  
SCHOOLS, AND SOCIETIES

**Diversity leads to better outcomes**  
**Diversity trumps ability**  
**Diversity and problem solving**

“By seeing problems differently and by looking for solutions in different ways; teams, groups, and organizations can locate more potential innovations.”

“Diversity leads to *superadditivity*, but only if members value the diversity present in the team”  
(i.e., people are heard and are willing to hear)

# National Data

Women are.....

Population

Everywhere - 50.8% of US Population\*

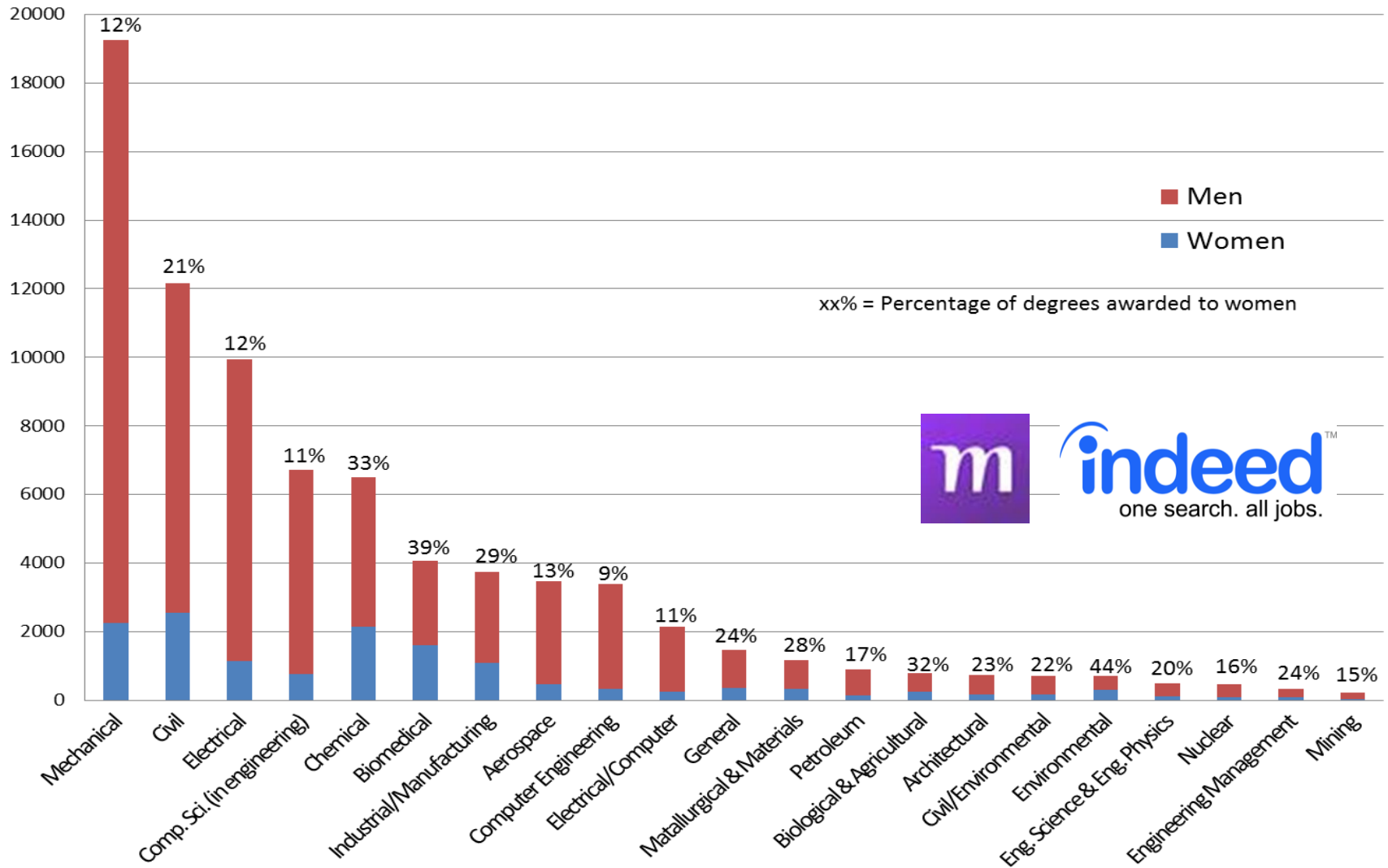
Where women aren't ....

Engineering

- represent 19.9% of all engineering undergraduate students in US
- women earn 19.1% of undergraduate degrees awarded in engineering\*\*\*
- 22.4% engineering Ph.D. produced\*\*\*
- up to 11% of practicing engineers?

Workforce

## Total Bachelor's Degrees Awarded by Engineering Discipline, by Gender, 2010-2011





# Confidence vs. Interest

## What comes first?



#Likeagirl



# Engineering Student Profiles & Retention

## ▶ Student Profiles

### ▶ High ACT / SAT Scores

- ▶ Avg. SAT composite 1850+
- ▶ Avg. math 720
- ▶ GPA 4.0+
- ▶ Admissions not necessarily based on holistic review
- ▶ More competitive profile than listed as published minimum requirements
- ▶ Women, on average, higher ACT/SAT scores than men
- ▶ Women, more involved in leadership activities and outside organizations

## ▶ Questions: Are these students successful?

### ▶ Do these students make the best engineers?

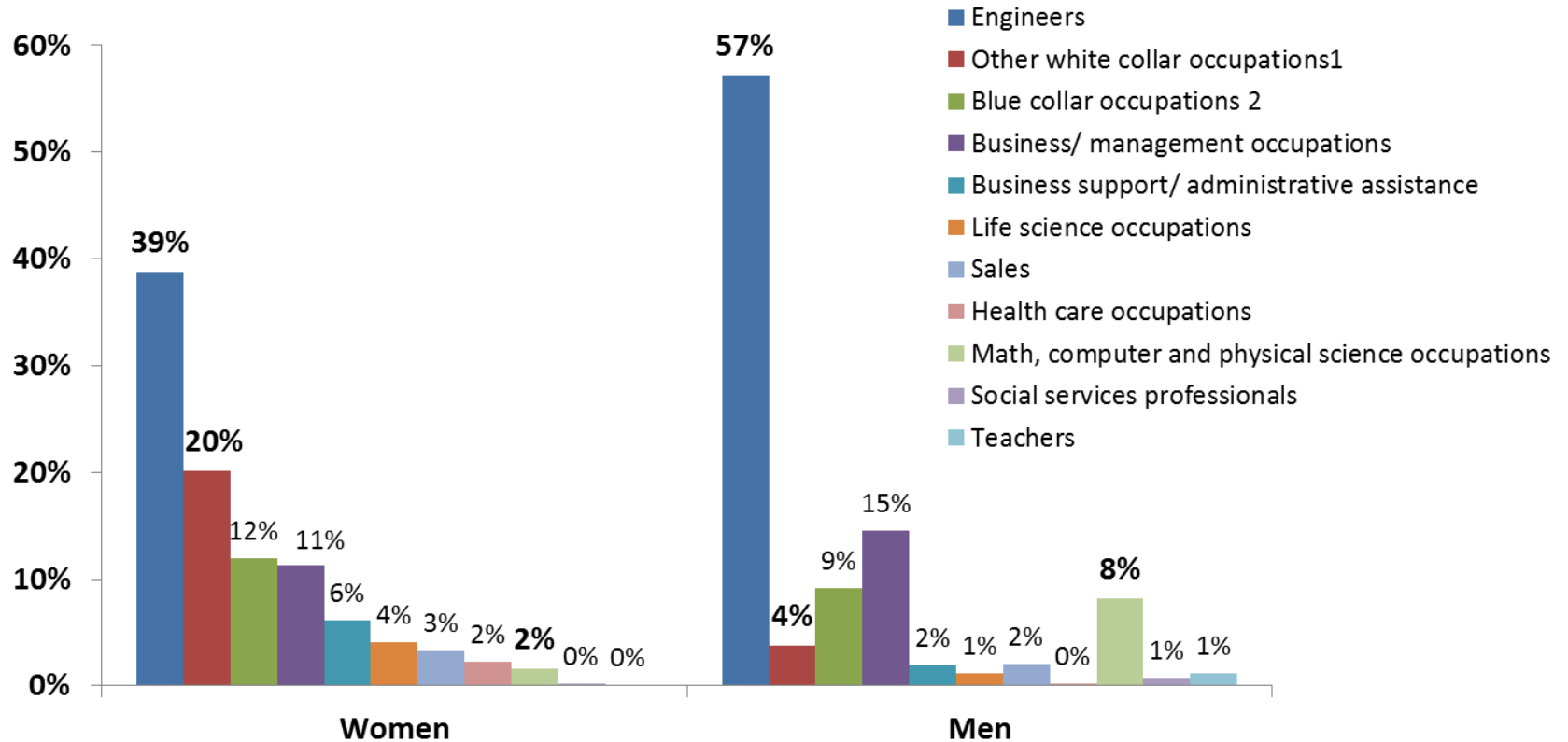
### ▶ What can help make students more competitive?

## ▶ Retention Issues

- ▶ Approx. loss of 40% students within first two years
- ▶ Who are we losing?
- ▶ Where are they going?
- ▶ Why are they going?

# Female Eng. Majors Less Likely to Work as Engineers after Graduation

**Occupations of Engineering Majors  
One Year After College Graduation, by Gender**



<sup>1</sup>Includes education, training, and library occupations (except teachers); arts, design, entertainment, sports, and media occupations ; and miscellaneous other white collar occupations

<sup>2</sup> includes drafters; food preparation and service occupations; farming, fishing, and forestry occupations; construction and extraction occupations; installation, maintenance, and repair occupations; production occupations; transportation and material moving occupations ; military specific occupations; and miscellaneous other blue collar occupations.

**Bold** numbers indicate a significant gender difference.

Source: Author's analysis of U.S. Department of Education, National Center for Education Statistics, *2008-2009 Baccalaureate and Beyond Longitudinal Study* data



# STEMMING the TIDE: Why Women Leave Engineering Report (2012)

National Longitudinal Study: University of Wisconsin-Milwaukee, NSF funded

- 30 universities recruited / 230 universities responded / 5,500 women
- **Key Findings** for women not enter engineering after graduation:
  - 33% because perceptions of engineering as inflexible or engineering workplace culture not supportive of women
  - 30% no longer interested in engineering
  - Using knowledge they learned in engineering in other fields

# Case for Improving Climate

## Rankings:

University Rankings based on freshman retention rate; 6 year graduation rate; stud/fac ratio; class size; faculty resources; % faculty full-time; alumni giving; PhDs/faculty; NAE members; research \$; reputation

**Climate has DIRECT impact** on factors considered in ranking...

## Workforce Development:

Industry is demanding engineering education adapt to dramatic changes in engineering practice and engineers be prepared to build their future through wide range of leadership roles to meet grand challenges

**Climate has DIRECT impact** on factors considered in workforce development...

## Research Funding:

NSF, industry partners, and other agencies have demanded that research criteria not only contain intellectual merit but **broader impacts**, the benefit to society and how research contributes to the achievement of specific, desired societal outcomes

**Climate has a DIRECT impact** on factors considered in research and funding...

**Increasing diversity is a byproduct** and climate is central to the overall “state” of the college of engineering.

# WEPAN – National Conversation on Climate

▶ Handouts



**Frame 2** **Create Equal Opportunity**  
Focuses on eliminating structural and procedural barriers that are biased against women and impede advancement. Interventions tend to be legalistic and policy-based.

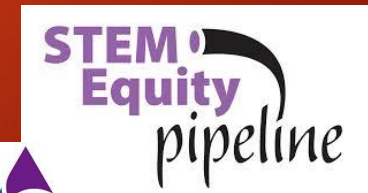
**Frame 1** **Equip the Women**  
Minimize differences in experience between women and men so that women can compete as equals. Focus is on the individual.

Simmons  
<http://www.simmons.edu>  
S  
provid

# Great activities to develop future engineers!



WIE CONNECT





# WIE FIRST LEGO League



WIE TECHie  
and  
TECHie Bytes

# WIE FIRST LEGO League



# Eagle Robotics





# Project Teams and Stereotype Threat



- \*75 students responded
- \*80% team retention in the first year
- \*biggest hurdle: fear of making a mistake



# Components – must haves for girls!

- ▶ Gender neutral – beware of programs that have gender bias towards one sex or other.
- ▶ Context is important!
- ▶ Never be afraid to challenge girls, technically
- ▶ Encourage MISTAKES! Lots of them!
- ▶ Use mistakes as LEARNING opportunity, rather than belittling experience
- ▶ Encourage men and boys to be advocates...
- ▶ Help women to gain coping mechanisms for challenges they will face – be realistic!
- ▶ **Why Eastern And Western Cultures Tackle Learning Differently** September 02, 2013 4:45 AM ET NPR







# Prepare Her!

- ▶ FIRST Lego League
  - ▶ <http://www3.usfirst.org/>
- ▶ Project Lead the Way (PLTW)
  - ▶ <https://www.pltw.org/>
- ▶ Take STEM or CTE Courses
- ▶ AP Courses
- ▶ Take Physics!!!!
- ▶ More Math Please!!!!



Fix Something!!  
Hands-on  
Get a job in High School!

# Links to area STEM-related summer camps

- **Techie Camp – TECH CORPS (Columbus)**
  - <http://hadron.techcorps.org/>
- **iD Tech Camps (OSU and Case Western)**
  - [www.internaldrive.com/locations/oh-summer-camps-ohio-computer-camps/](http://www.internaldrive.com/locations/oh-summer-camps-ohio-computer-camps/)
- **Camp Invention (all over)**
  - [www.invent.org/camp/default.aspx](http://www.invent.org/camp/default.aspx)
- **Math Plus Academy Technology Camps (Powell / New Albany)**
  - [www.mathplusacademy.com/summercamps/](http://www.mathplusacademy.com/summercamps/)
- **Great Lakes Science Center Camps (Cleveland)**
  - <http://www.greatscience.com/programs/summer-camps.aspx>
- **Camp COSI (Columbus)**
  - [www.cosi.org/families/camp-cosi](http://www.cosi.org/families/camp-cosi)
- **Young Women’s Summer Institute**
  - <https://osc.edu/education/ywsi>

# Engineering Grand Challenges

- ▶ Make Solar Energy Economical
- ▶ Provide Energy from Fusion
- ▶ Develop Carbon Sequestration Methods
- ▶ Manage the Nitrogen Cycle
- ▶ Provide Access to Clean Water
- ▶ Restore and Improve Urban Infrastructure
- ▶ Advance Health Informatics
- ▶ Engineer Better Medicines
- ▶ Reverse-Engineer the Brain
- ▶ Prevent Nuclear Terror
- ▶ Secure Cyberspace
- ▶ Enhance Virtual Reality
- ▶ Advance Personalized Learning
- ▶ Engineer the Tools of Scientific Discovery





THANK YOU!

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