The STEM Equity Pipeline

California Association of Regional Occupational Centers and Programs Conference
Palm Springs, CA
Thursday, November 15, 2012
NAPE is a consortium of state and local education and workforce development agencies, businesses, and national organizations committed to the advancement of equity and diversity in classrooms and workplaces.
Mission to expand career options and the economic potential of America’s workforce by collaborating with stakeholders to build the capacity of teachers, administrators, parents, and employers.
NAPE’s Lines of Business

- Technical Assistance
- Public Policy (Advocacy)
- Research & Evaluation
- Professional Development

- Special Populations
- Nontraditional Career Preparation
- STEM Equity Pipeline

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Career and Technical Education in the National Dialogue
Recent Reports of Interest

Pathways to Prosperity
Harvard Graduate School of Education
Recent Reports of Interest

Center on Education and the Workforce, Georgetown University
Recent Reports of Interest

Enterprising Pathways: Toward a National Plan of Action for Career and Technical Education
Recent Reports of Interest

Investing in America’s Future: A Blueprint for Transforming Career and Technical Education
Recent Reports of Interest

Building Blocks For Change
What it Means to be Career Ready
Curriculum and Standards

- Common Core Standards in Mathematics
- Next Generation Standards in Science
- Common Career Technical Core Standards

Career Clusters™ Knowledge and Skills and a Common Career Technical Core
Why all the buzz about STEM?
NAPE’s Definition of STEM

Seven Career Clusters
Å Science, Technology, Engineering and Math
Å Agriculture, Food and Natural Resources
Å Health Science
Å Information Technology
Å Manufacturing
Å Transportation, Distribution and Logistics
Å Architecture and Construction
Figure 1. Projected Growth in Employment in Selected STEM Occupations, 2008-2018

- Total employment (STEM and non-STEM): 10%
- Engineering: 11%
- Computer support specialists: 14%
- Biological technicians: 18%
- Life and physical sciences: 19%
- Environmental engineering technicians: 30%

Why Do We Need to Encourage Students to Study STEM?

Â In the last 50 years, more than half of America’s sustained economic growth was fueled by engineers, scientists and advanced-degree technologists, a mere 5% of America’s 132 million-person workforce. (1)

Â Aging STEM workforce- DOD, NASA and NIH STEM workers eligible to retire will more than double by 2012. (1)

Source: See Notes Page © NAPE-EF 2012
Why Do We Need to Encourage Students to Study STEM?

Å The National Bureau of Labor Statistics projects that our greatest needs will be in computer-related field that propel innovation across the economy.

Å By the year 2050, 85% of the entrants into the workforce will be people of color and women.

Å Promoting scientific literacy among all the nation’s people integral to an educated citizenry.
Why Do We Care if Women and Minorities Become Engineers and Scientists?

Â As a consequence of a lack of diversity we pay an opportunity cost, a cost in designs not thought of, in solutions not produced.

Source: Dr. Bill Wulf, Past President, National Academy of Engineering

Â If we do not engage women and minorities in the engineering enterprise, we are ignoring more than 50% of America’s intellectual talent.

Source: Bostonworks.com

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Status of Women and Girls in STEM
Girls’ performance and participation in math and science subjects in high school has improved over time and, in some cases, has surpassed that of boys.
In high school, both boys and girls are earning more credits in math and science over time, and girls earn more credits than boys do.

High School Credits Earned in Math and Science, by Gender, 1990–2005

High school girls are more likely to take biology, chemistry, and pre-calculus than boys are, but girls are less likely to take physics.

Percentage of High School Graduates Who Took Selected Math and Science Courses in High School, by Gender, 2005

- Biology: Boys 90.8%, Girls 93.7%
- Chemistry: Boys 62.5%, Girls 69.7%
- Physics: Boys 34.8%, Girls 30.8%
- Precalculus: Boys 28%, Girls 30.8%
- Calculus: Boys 14%, Girls 13.2%
- Engineering: Boys 4.6%, Girls 4%

Female high school graduates now also earn higher GPAs, on average, in math and science, than their male peers do.

On average, boys perform better than girls do on Advanced Placement (AP) tests in math and science.

Average Scores on Advanced Placement Tests in Mathematics and Science Subjects, by Gender, 2009

CTE Secondary Female Enrollment in U.S.
by Career Cluster, 2009-2010

- Education & Training
- Health Science
- Human Services
- Hospitality & Tourism
- Mkt. Sales & Services
- Finance
- Arts, AV Tech. & Comm.
- Bus., Mgmt. & Admin
- Law, Pub. Safety & Security
- Govt. & Public Admin.
- Info. Tech.
- Agri., Food & Nat. Resources
- Sci., Tech., Engin., & Math
- Manufacturing
- Arch. & Construction
- Transp., Distrib., & Logistics
Despite the positive trends in high school, the transition from high school to college is a critical time for young women in STEM (science, technology, engineering, and mathematics).
CTE Post-Secondary Female Enrollment in U.S. by Career Cluster, 2009-2010
In 2007, women earned 27.5% of all sub-baccalaureate awards in STEM, down from 33.8% in 1997.
Percentage of associates degrees awarded to women in STEM has declined in the past 8 years

- 14% to White women
- 3.3% to African American women
- 2.2% to Hispanic women
- 1.3% to Asian, Native Hawaiian, and Pacific Islander women
Women are less likely than men are to declare a STEM major in college.

Intent of First-Year College Students to Major in Science and Engineering Fields, by Gender, 2006

Women have earned the majority of bachelor’s degrees since 1982.

Bachelor's Degrees Conferred, by Gender, 1971-72 to 2006-07

Women’s representation among STEM bachelor’s degree holders has improved over time but varies by field.

Bachelor’s Degrees Earned by Women in Selected Fields, 1966–2006

Women are underrepresented in many science and engineering occupations.

Percentage of Employed STEM Professionals Who Are Women, Selected Professions, 2008

What is NAPE doing to move the needle?
To increase the academic performance, retention, completion and transition of significantly more diverse female students in STEM programs of study
STEM Equity Pipeline Goals

• Build the capacity of the formal education community to provide high quality professional development on gender equity in STEM education
  • Institutional transformation
  • Classroom transformation

• Institutionalize the implemented strategies by connecting the outcomes to existing accountability systems

• Broaden the commitment to gender equity in STEM education
Professional Development for Educators:
STEM (including CTE) Access, Equity, Diversity

STEM Equity Pipeline™

STEM Equity Training for Inst. Change
Working with institutional leaders (administrators, dept heads, etc.) to improve enrollment, retention & completion of girls & under-represented populations in STEM courses

STEM Equity Teacher Training
Training teachers to use pedagogy that improves enrollment, retention & completion of girls & under-represented populations in STEM courses

STEM Equity Counselor Training
Coaching counselors to encourage girls and under-represented populations in STEM careers

Tools & Resources
Tools to support teachers’ & counselors’ learning and assist their students, e.g., camps, partner orgs, books
PIPE-STEM: Program/Pedagogy Improvement Process for Equity in STEM

Phase One – Orientation
Phase Two – Data and Root Cause Analysis
Phase Three – Implementation and Evaluation

Organize
Explore
Discover
Select
Act
Assess
Assess
Assess
Assess
Share
Micromessaging to Reach and Teach Every Student™

Transforming Pedagogy
Â Phase I: Data Collection and Analysis
Â Phase II: E-Learning Content Knowledge
Â Phase III Workshop
Â Phase IV: Capstone - Action Research Project
Â Phase V: Implementation Plan
Micromessaging to Reach and Teach Every Student™

Instructional Units
- Setting the Stage – Women in STEM
- The Influence of Micromessages
- Neuroscience Link to Learning
- Social Theories of Achievement
- Influence of Culture
- Career Development
- The Equitable Classroom
Å Goal: to support career counselors efforts to highlight STEM careers in a context that appeals to a diversity of students, their cultures, and their values.

Å Currently a high quality workshop focusing on engineering.

Å 2012 – 2013 building an intensive equity professional development program for secondary and college career counselors.
Increased Enrollment

Females

Males
Increased Enrollment of Girls in STEM Related Programs of Study in One Year
High School female enrollment increases:
- AP Physics: 18% -> 28%
- AP Chemistry: 35% -> 53%
- IED: 10% -> 16%
- CEA: 4% -> 18%
- POE: 3% -> 7%
Community college invited middle school girls enrolled in the PLTW Gateway program to the campus where they were introduced to various engineering career fields through speakers and projects.

- 40% said they would like to pursue a STEM career, with 11% specifically stating Engineering.
- 83% of the girls said that they would like to take an engineering class in high school.
- The next fall, 7 ninth grade girls enrolled in the PLTW introduction to engineering course (previously there was only one ninth grade girl enrolled) and 18 ninth grade girls enrolled in beginning drafting.
After hiring a female teachers aide in the auto technology program enrollment of women increased from 4-15 in one semester
After conducting targeted recruitment events the aviation maintenance program had 7 women enroll after never having women in the program.
A Nuclear engineering program graduated its first class in 2012 including 6 (25%) women and 7 (30%) women are enrolled this Fall

A After implementing a capstone project faculty are reporting increased achievement (grades) and retention of female students.data to be collected in January 2013.
Micromessaging Training

Comparing the number of AP Physics tests passed by all girls in 2003, (before the programs started) and 2010, there is a 5x increase.
Both boys and girls of the teachers that had Gender Equity training are passing at 20-30% points higher than students of teachers without the training.
Increased Achievement

A Micromessaging curriculum implemented with physics teachers student passage rates on the AP physics exam increased
- 4 times more female students
- 4 times more African Americans students
- 6 times more Hispanic students
Have Your School Become and Affiliate Member
www.napequity.org

www.stemequitypipeline.org
Upcoming Events

For more events go to the [STEM Equity Pipeline Calendar](#)

**Annual Conference for Women Engineers: WE12**
November 8-10, 2012

Science professors at American universities widely regard female undergraduates as less competent than male students with the same accomplishments and skills, a new study by researchers at Yale concluded. The bias was pervasive and probably reflected subconscious cultural influences rather than overt or deliberate discrimination.

[More Information](#)

**PLTW STEM Connection Conference**
November 12-13, 2012

Register to Participate
Resources

- Online Resource Collection
- NAPE Developed Tools
  - Taking the Road Less Traveled
  - Destination Success
  - Parent Magazine
  - Tip sheets
  - Training modules
  - More
- Webinars
  - Live and Archived
- Listserv
Partners in California

California Joint Special Populations Advisory Committee
Linking Education and Economic Development
Folsom Cordova Unified School District
San Jose Unified School District
Questions

Mimi Lufkin, Chief Executive Officer
Claudia Morrell, Chief Operations Officer
Courtney Reed Jenkins, Director of Professional Development
National Alliance for Partnerships in Equity
P.O. Box 369, Cochranville, PA 19330
610-593-8038 phone
610-593-7283 fax
www.stemequitypipeline.org
www.napequity.org