



Research-based Professional Development to Increase the Participation of Women in STEM

Mimi Lufkin

Educating for Careers Conference

Garden Grove, CA

March 2, 2010

Goals

- Build the capacity of the formal education community to provide high quality professional development on gender equity in STEM education
- Institutionalize the implemented strategies by connecting the outcomes to existing accountability systems
- Broaden the commitment to gender equity in STEM education

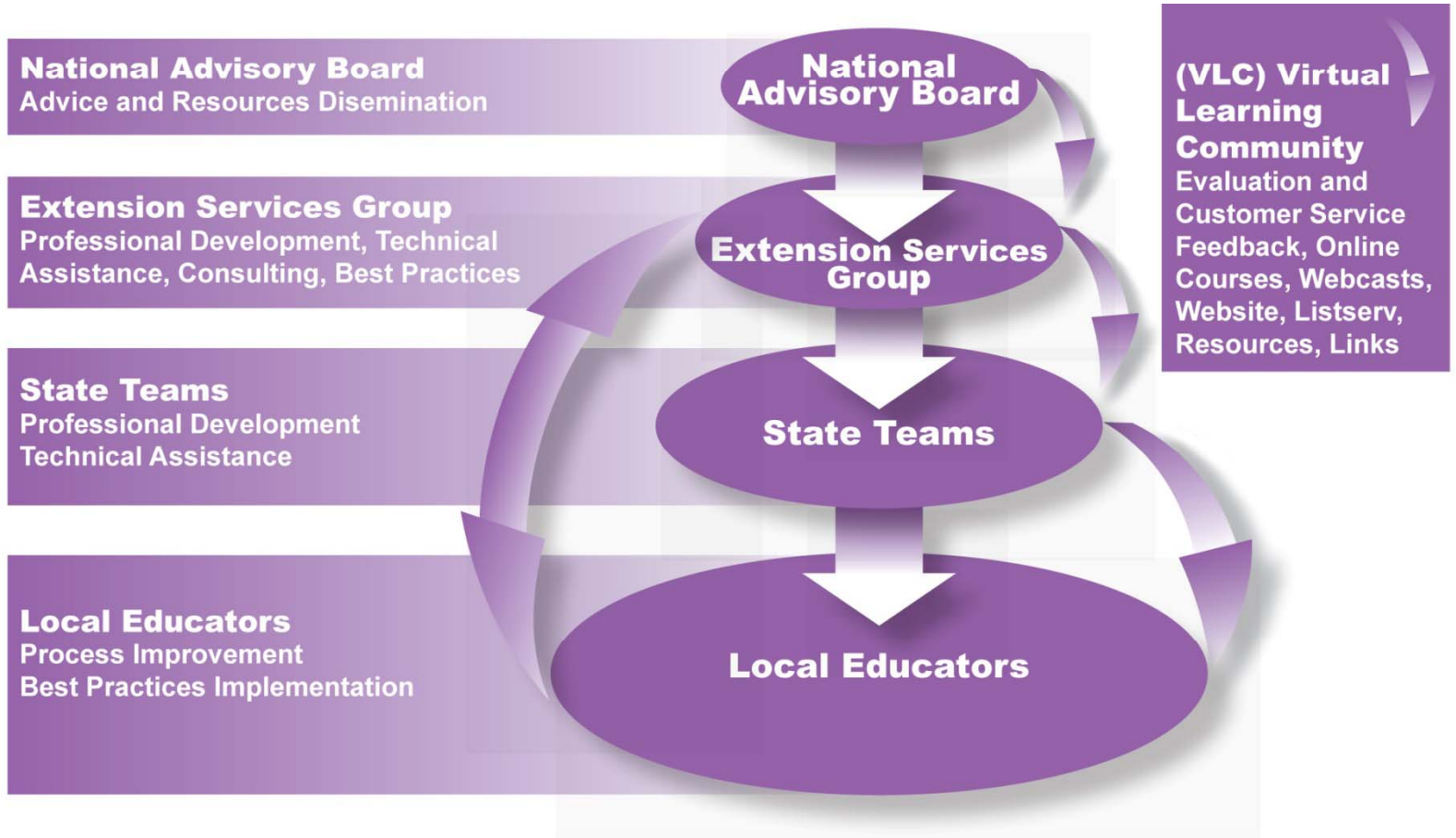


Defining STEM

- Science, Technology, Engineering and Math
- Agriculture, Food and Natural Resources
- Health Science
- Information Technology
- Manufacturing
- Transportation, Distribution and Logistics
- Architecture and Construction



Model



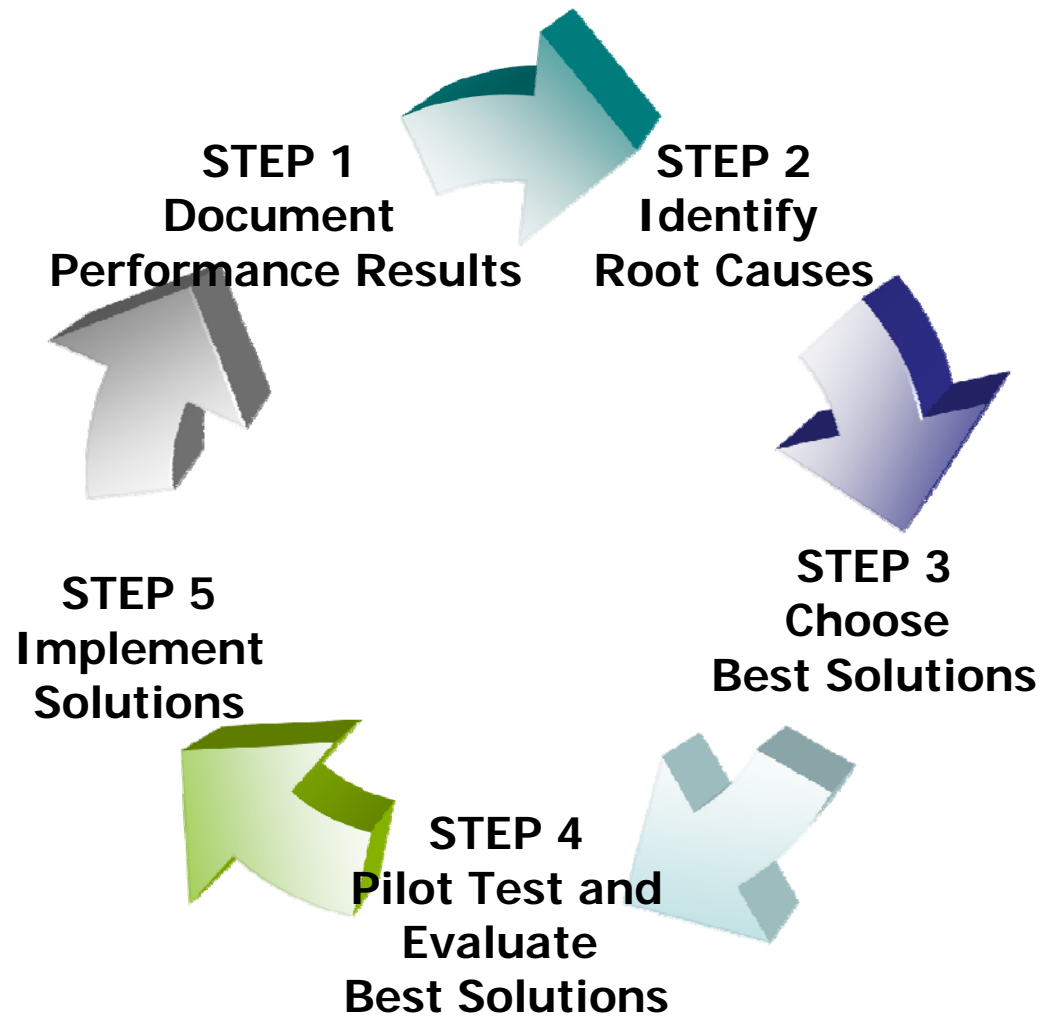


Professional Development

- Five Step Program Improvement Process Training
- Use of experts for specific professional development implementation
- Online professional development
- Outreach workshops



Five Step Program Improvement Process



**STEM
Equity
pipeline**



Virtual Learning Community

- Public portal for the STEM equity community
 - Listserv
 - Organization Links, Articles, Resources, Reports
 - Calendar of Events in STEM
 - Webcasts, Webinars, Video, Podcasts, Power Points
 - Online courses and Tutorials
 - Five Step Program Improvement Process Training Materials
 - Professional Development Needs Assessment
 - Participating State Pages
 - Expert portfolios and online request portal
 - “Extension Agent” report portal





Status of Women and Girls in STEM

Why Do We Need to Encourage Students to Study Science, Technology, Engineering and Math?

- **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)**
- **Twenty-five percent of our scientists and engineers will reach retirement age by 2010. (1)**
- **By the year 2050, 85% of the entrants into the workforce will be people of color and women. (2) In 2003, women were 26.1% of all STEM occupations. In 2004, African Americans and Hispanics were 6.2% and 5.3% of all STEM occupations respectively. (3)**
- **The National Bureau of Labor Statistics projects that our greatest needs will be in computer-related fields that propel innovation across the economy. (1) Female bachelors degree recipients dropped from 37% in 1985 to 27% in 2003. (2)**



Why Do We Care if Women and Minorities Become Engineers and Scientists?

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

- 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



Startling Statements

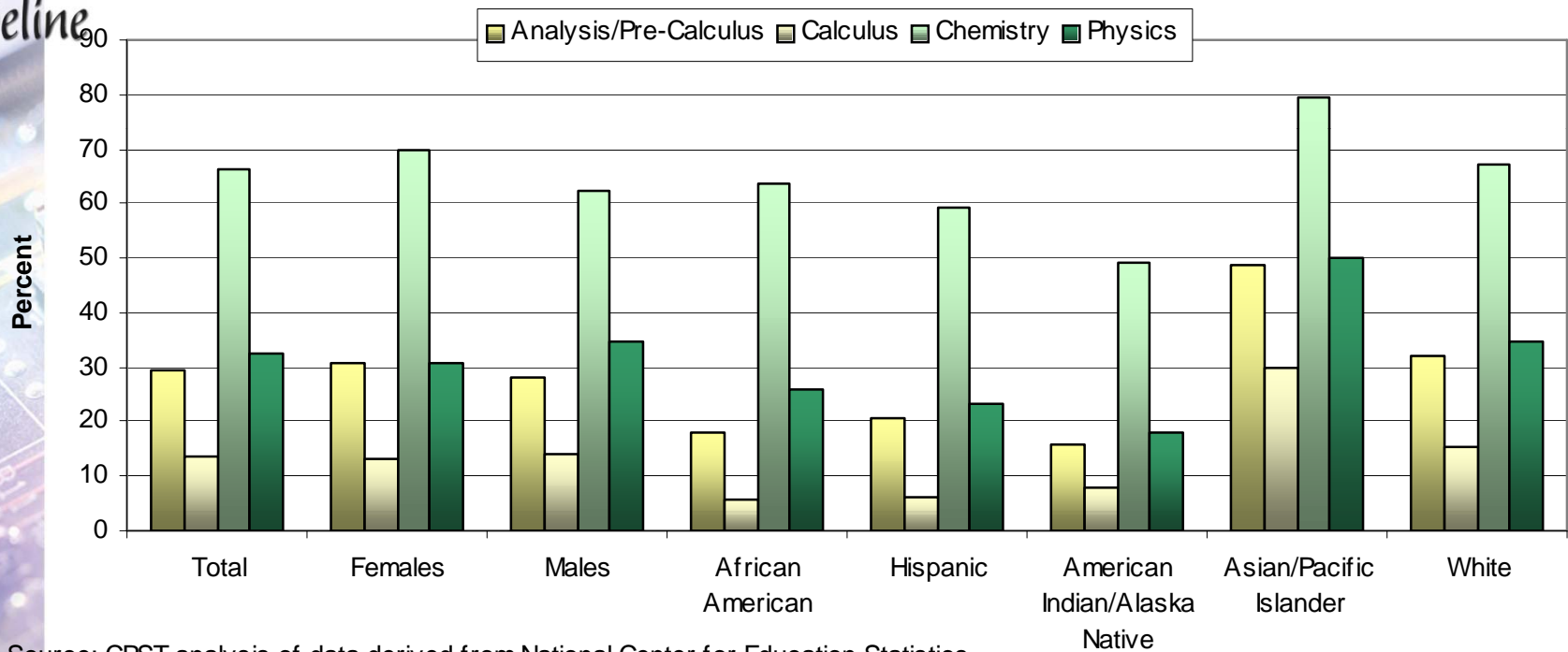
- Poll three people separately asking them to guess what number belongs in the blank in your assigned statement
- Average the three responses
- Be prepared to report out your average and your range





High school females are more likely to take chemistry and pre-calculus courses than male students; however, they are less likely to take physics.

Figure 1-7. High School Graduates' Science and Mathematics Course Taking, Selected Courses, 2005 by Gender and Race/Ethnicity



Source: CPST analysis of data derived from National Center for Education Statistics
Digest of Education Statistics, 2007.

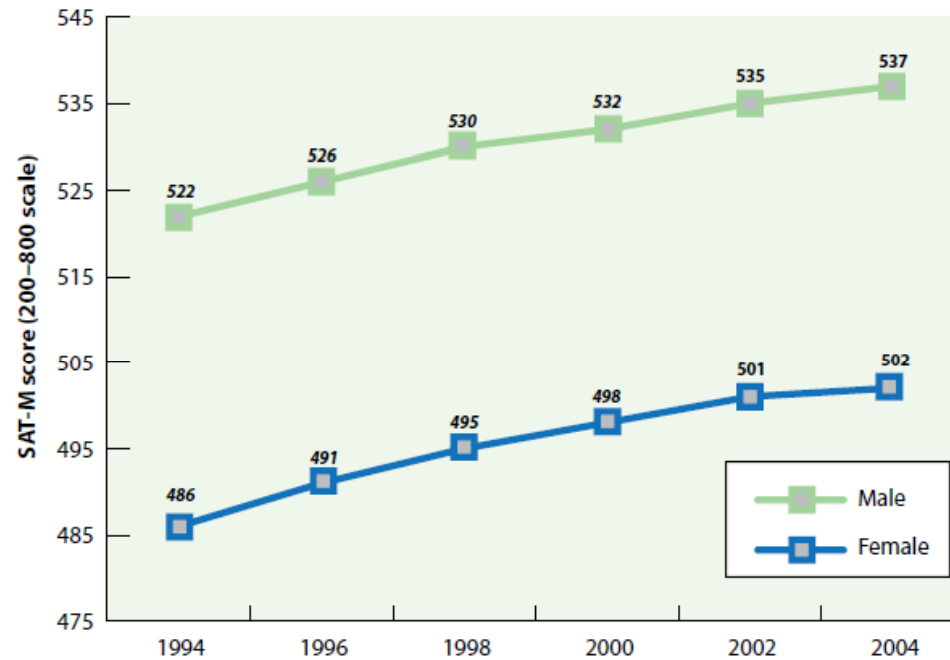


Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity

Where the Girls Are: The Facts About Equity in Education



FIGURE 15. SAT MATHEMATICS MEAN SCORE, BY GENDER, 1994-2004



Note: **Bold** indicates significant difference between boys and girls. *Italic* indicates significant difference from 2004.

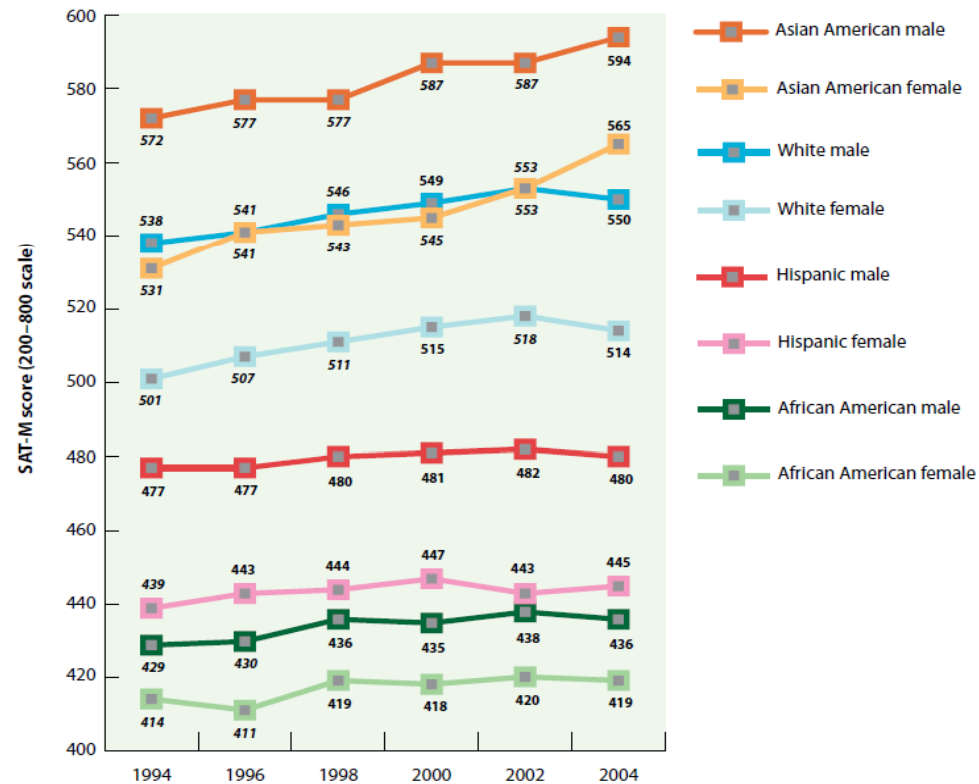
Source: AAUW Educational Foundation analysis of unpublished data provided by the College Board.

AAUW (2008). *Where the Girls Are: The Facts About Equity in Education*. Washington DC: Author.

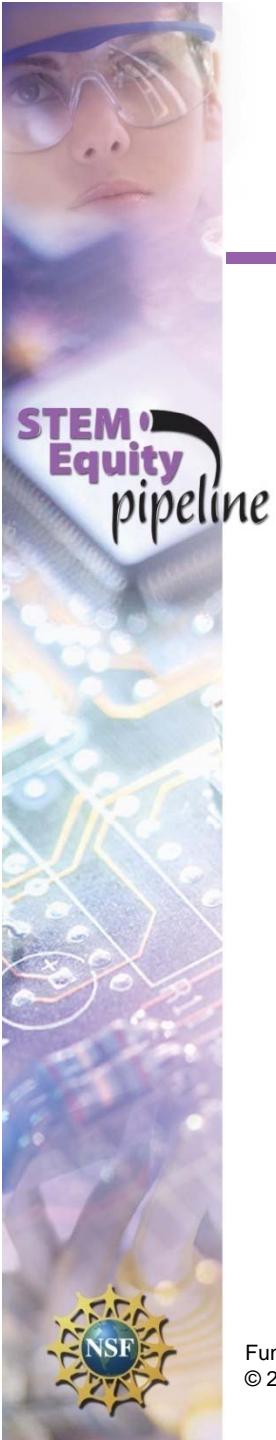
Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity

Across Race/Ethnicities, Boys Tend To Outscore Girls in Math

FIGURE 16. SAT MATHEMATICS MEAN SCORE, BY GENDER AND RACE/ETHNICITY, 1994-2004

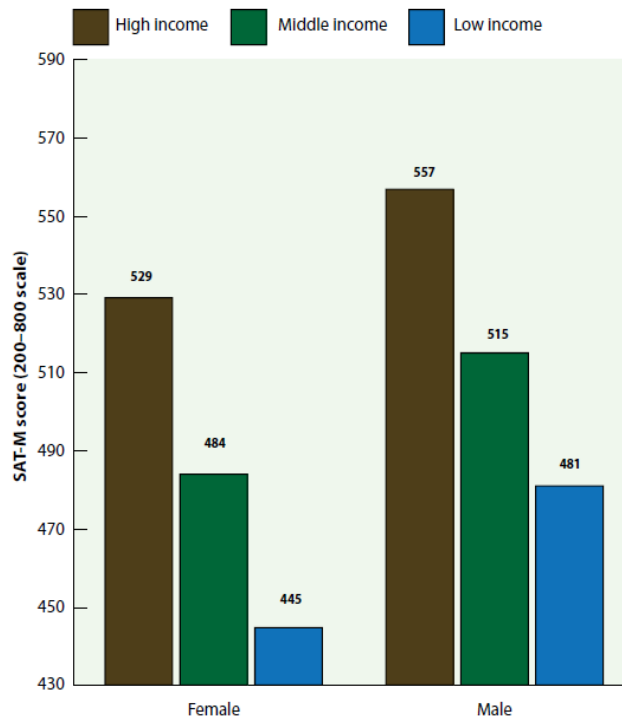


AAUW (2008) *Where the Girls Are: The Facts About Equity in Education*. Washington DC: Author



Gender Gaps Vary by Family Income Level

FIGURE 19. SAT MATHEMATICS MEAN SCORE, BY GENDER AND FAMILY INCOME LEVEL, 2004



Note: Low-income students reported an annual family income of less than \$30,000, middle-income students reported an annual family income of \$30,000 to \$70,000, and high-income students reported an annual family income of more than \$70,000. **Bold** indicates significant difference between boys and girls within income level.

Source: AAUW Educational Foundation analysis of unpublished data provided by the College Board.

AAUW (2008). *Where the Girls Are: The Facts About Equity in Education*. Washington DC: Author.

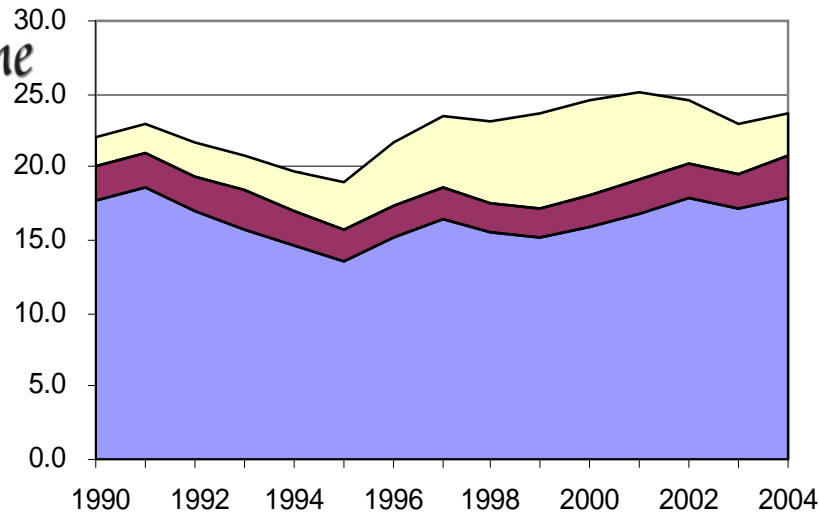
Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity



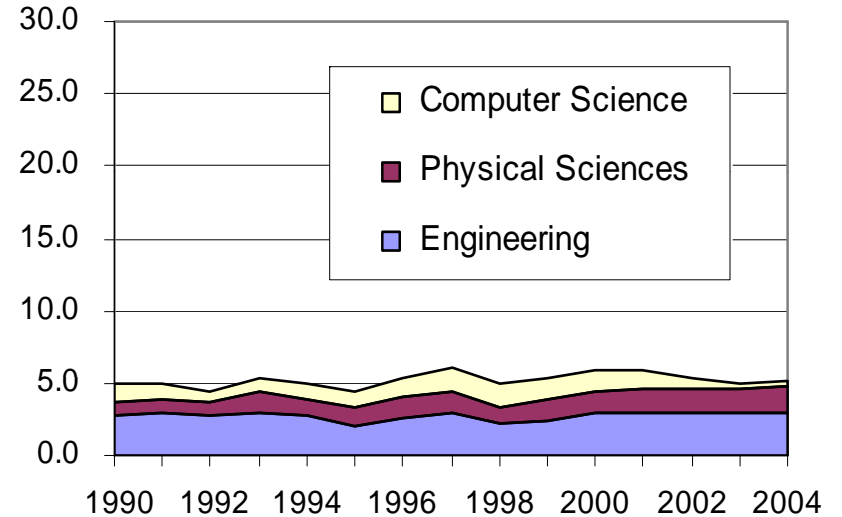
Males Far More Likely to Plan to Major in Technical Fields Than Are Females



Males



Females



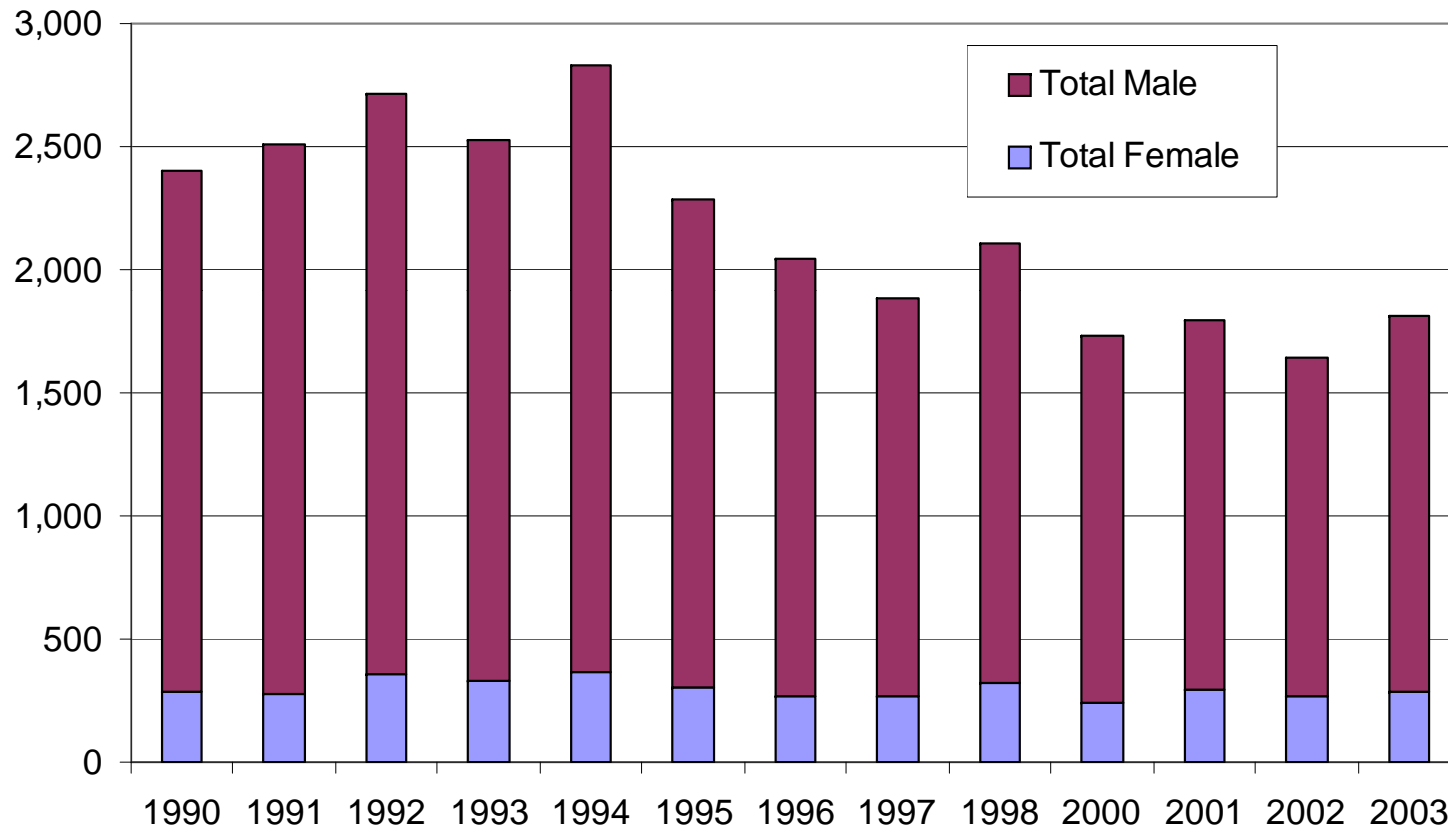
Source: CPST, data derived from Higher Education Research Institute

© 2006 WEPAN, www.wepan.org, prepared by CPST, www.cpst.org
Developed by WEPAN for member use only.



Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity

Women in Engineering at the 2-Year Level: Degrees Granted



Source: CPST, data derived from National Center for Education Statistics © 2006 WEPAN, www.wepan.org
Prepared by CPST, www.cpst.org

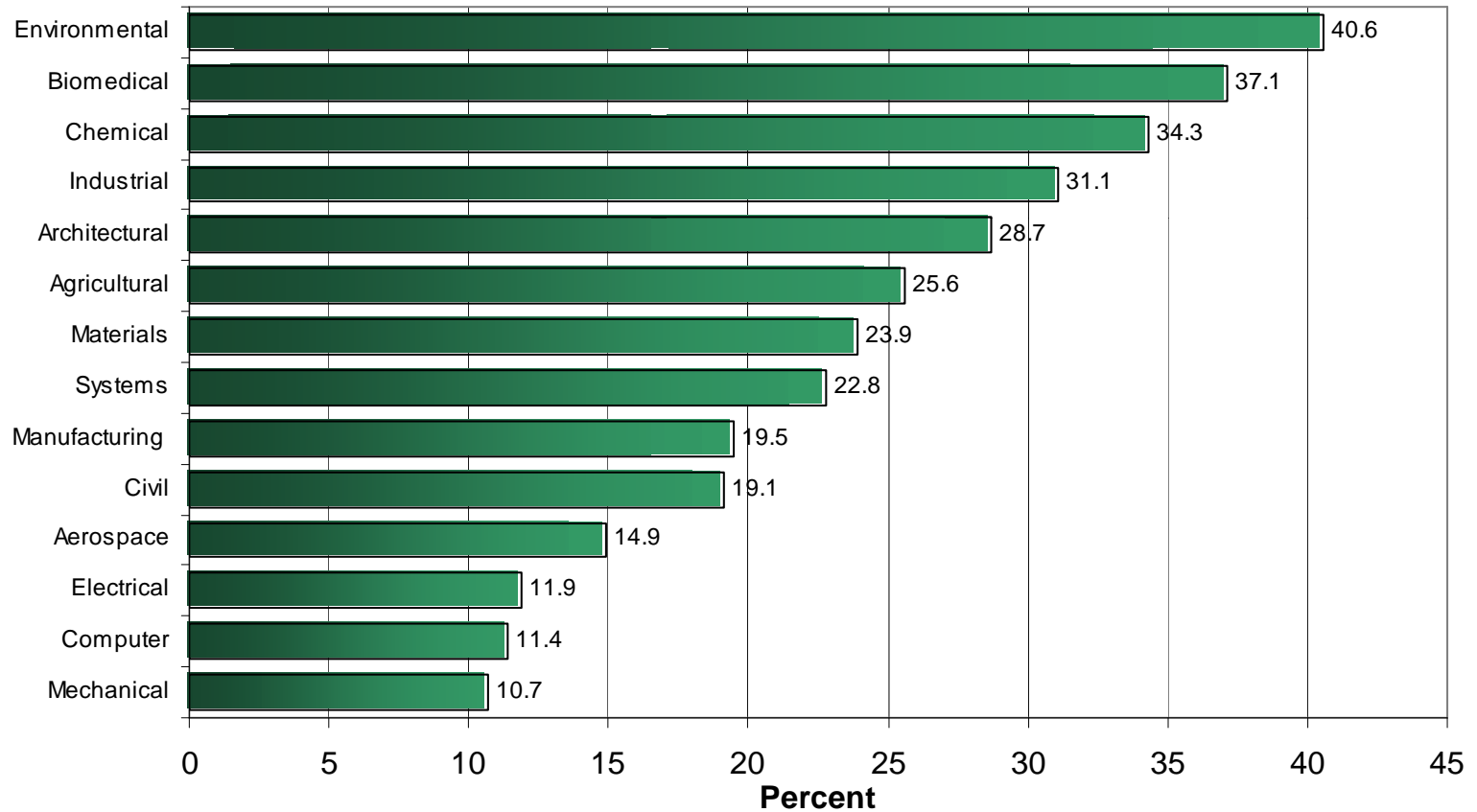




Women are most highly represented in the newer engineering disciplines of environmental and biomedical engineering. They have long been more highly represented in chemical and industrial than most other engineering fields.

Women in Engineering Fields

Figure 2-8. Women as a Proportion of Total Undergraduates in Selected Engineering Disciplines, Fall 2006



Source: CPST, data derived from Engineering Workforce Commission, *Engineering & Technology Enrollments, Fall 2006*.



Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity





California Participation Rates

California Secondary Participation Rates

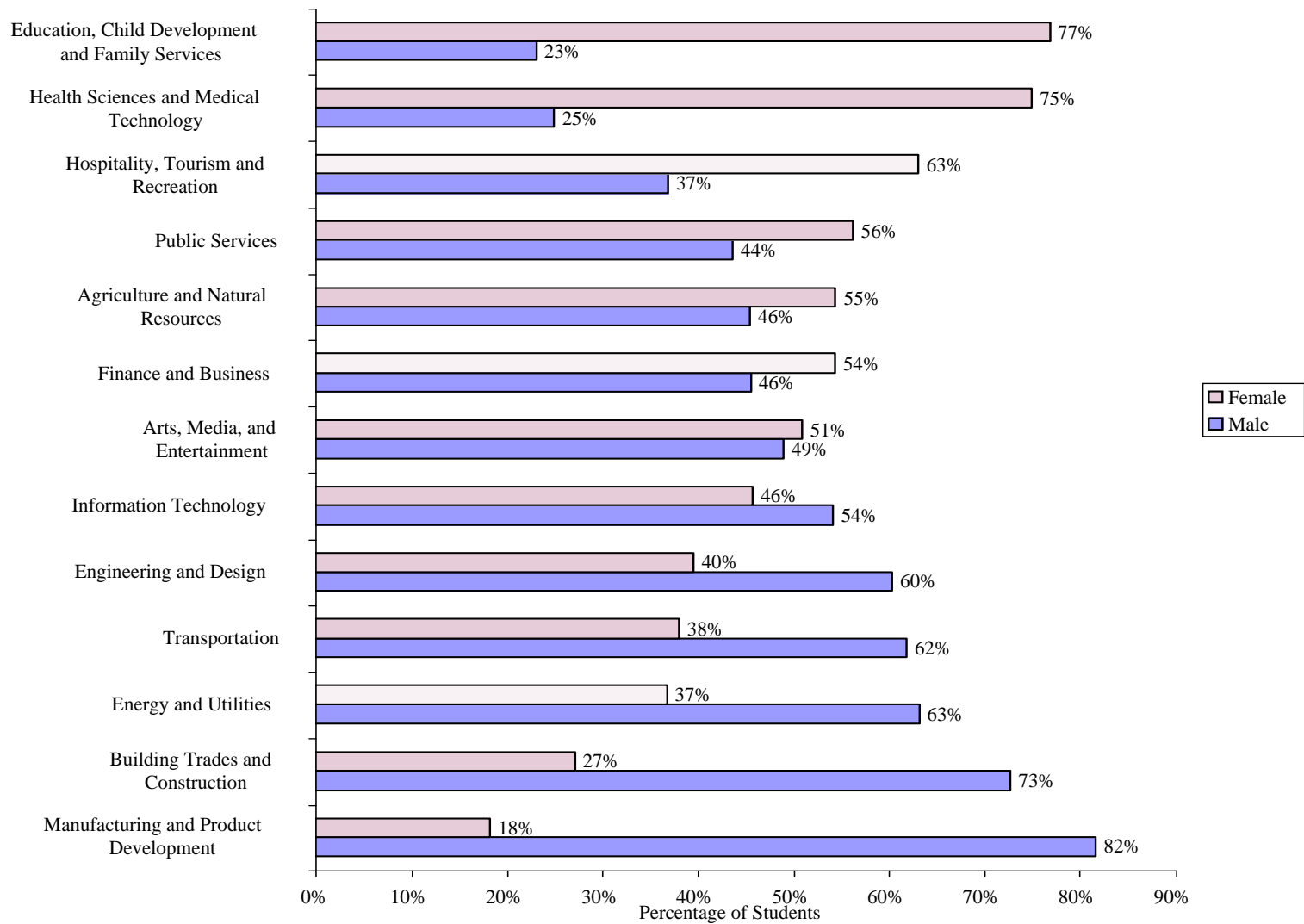
- Data Source: California Partnership Academies

(Profile of the California Partnership Academies 2004-2005, March 2007
Career Academy Support Network, U.C. Berkeley
ConnectEd, California Center for College and Career)





CPA Enrollment by Industry and Gender



Postsecondary Participation in California

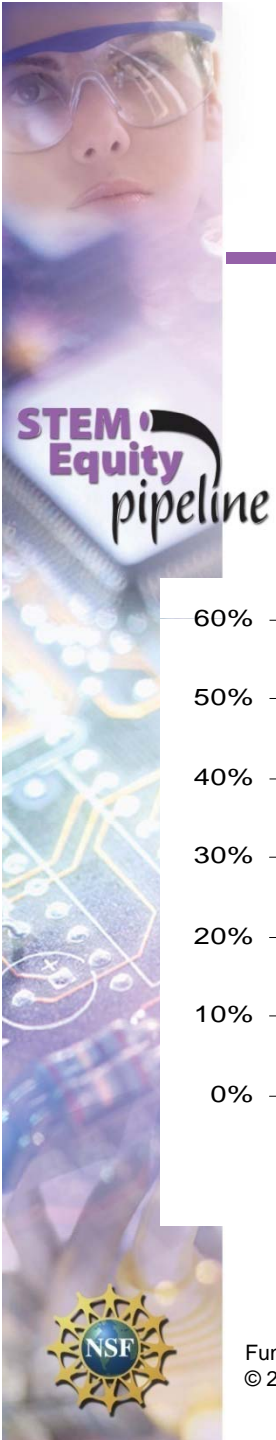
- Data Source: California Community College MIS Data for TOP Code 09: Engineering and Industrial Technology

(Compiled by the CCC Special
Populations Collaborative Project)

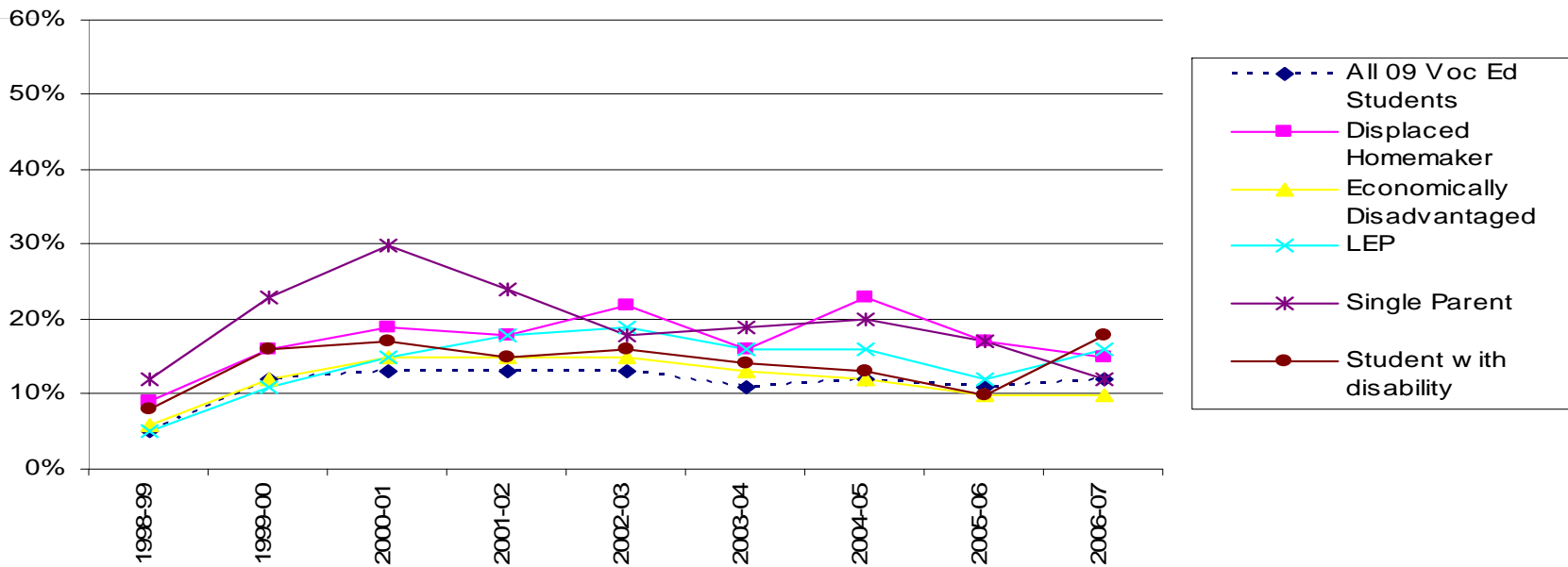


Female Participation in California CC Engineering/Industrial Technology

(see blue line - just over 10%)



STEM
Equity
pipeline





STEM
Equity
pipeline

Barrier Busters

What can teachers,
counselors and administrators
do to support student's
exploration of nontraditional
careers

Resource

- Nontraditional Career Preparation: Root Causes and Strategies
- www.stemequitypipeline.org/_documents/Root%20causes%20strategies4.20.09.pdf



Access to and Participation in STEM



- Shrinking gender gap in performance on national assessments in math and science between boys and girls
- Still significant gaps when looking at gender AND race/ethnicity or socio-economic status
- Girls not translating their academic success in STEM to careers in STEM

School Climate

- Nontraditional faculty and staff
- Acceptable behavior in hallways, cafeteria, school events, busses, etc.
- Administration and staff support and encouragement
- Extracurricular activities
 - Clubs, After School Program
 - Competitions
 - Summer Camp



School Climate

- Integrate equity into staff supervision process
- Support comprehensive professional development for all staff on gender and race equity
- Develop professional learning communities
- Include equity goals and objectives in school improvement plans



Student Isolation

- Cohort of underrepresented students in a program are more likely to complete than a single individual
- Individuals more likely to
 - Have trouble integrating effectively in to social structure
 - Suffer decreased performance
 - Drop out
- Schedule students in cohorts when possible



Student Isolation

- Schedule students in cohorts when possible
- Create peer support groups
- Recognize student success
- Offer a personal invitation
- Provide personal positive reinforcement



Curriculum Materials

- Invisibility
- Stereotyping
- Imbalance/Selectivity
- Unreality
- Fragmentation/Isolation
- Linguistic Bias
- Cosmetic Bias
- Relevance



Instructional Strategies

- Questioning level and wait time
- Student/teacher interaction and feedback
- Classroom management
- Cooperative learning design
- Expectations and assessment



Classroom Climate

STEM
Equity
pipeline

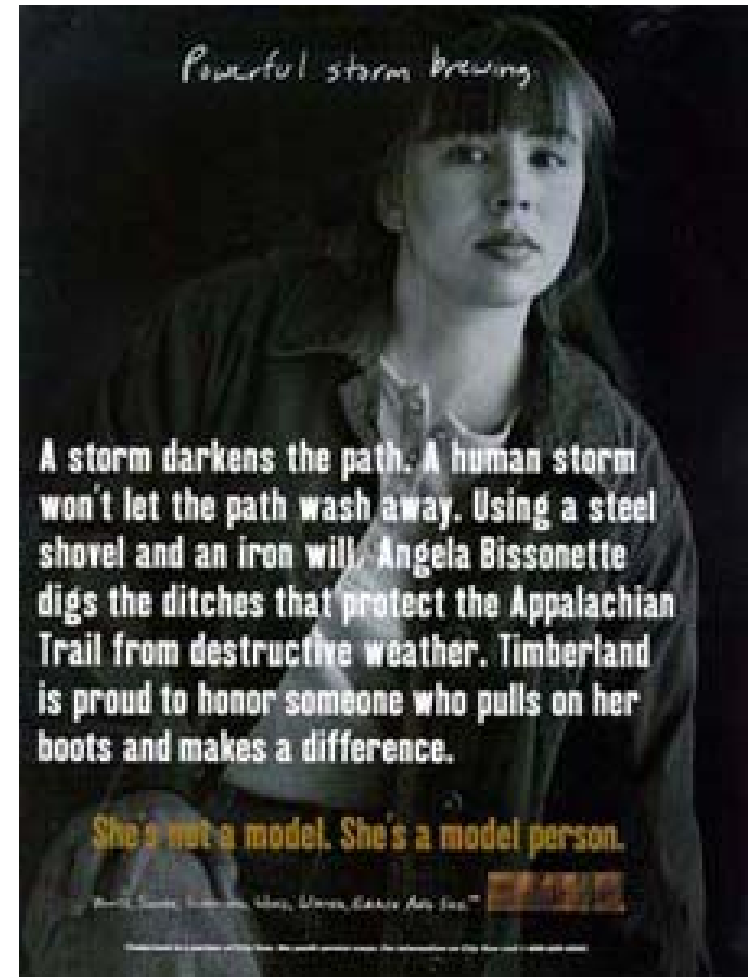
- Fair treatment
- Sexual harassment not tolerated or ignored
- Supportive learning environment
- Subtle messages
- Classroom location on campus
- Physical environment



Media Representation



About-face.org



Support Services

- Tutoring
- Child care
- Transportation
- Financial Aid
- Books, Equipment, Tools, Clothing
- Tuition
- Modification of Curriculum, Equipment
- Student/Teacher Aides
- More



Career Guidance Materials and Practices



- More than just brochures and posters
- Get beyond the images
- Beware of subtle messages
- Be careful about how you use interest inventories
- Design career exploration in all clusters without self-selection

Career Guidance Materials and Practices

- Create opportunities to spark student interest
 - Pre-enrollment exploration programs
 - Tours that include hands-on activities
 - Nontraditional program exploration days (ex. Diva Tech Day)
 - Targeted recruitment activities
 - Send a personal invitation (ex. Focus on Your Future event)



Early Exposure

- Most students pursuing a nontraditional career have had a friend or family member influence them
- Spark an interest that would otherwise not be evident
- Informal experiences supported by formal experiences
- The earlier the better



Parental Support

- Parents are the #1 influence of student college major and career choice
- Negative messages from people with emotional influence difficult to overcome
- Educate parents
 - Newsletter articles
 - Website information
 - Parent night program
 - Open House demonstrations
 - Student award programs



Self-efficacy

- Attribution Theory
 - Girls more likely to attribute success to external factors and failure to internal factors
- Stereotype Threat
 - Stereotype that girls are not as capable as boys in math affects their performance
- Locus of Control
 - When students feel they are in control of their lives and their futures they are more likely to select nontraditional options



Student Attitudes/Peer Influence

- Encourage valuing diversity
- Acceptance of differences
- Dispel bias and stereotypes
- Stop peer harassment
- Create peer support groups
- www.tolerance.org



Nontraditional Role Models

- Strongest evidence in the research
- Need to see someone that looks like them in the career
- Family members are significant
- Teachers
- Mentors



Nontraditional Role Models

- Career speakers
- Job shadowing
- Field trips
- Mentoring
- Online career exploration
- Print images
- Video selection



Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity





How can you get involved?

Funded by a grant from the National Science Foundation, GSE/EXT: STEM Equity Pipeline Project, Grant No. HRD-0734056
© 2009 National Alliance for Partnerships in Equity

How can you get involved?

- Communicate with your state contact
- Get involved in state activities
- Become a Five Step Program Improvement Process Trainer
- Host a pilot site
- Attend the Professional Development Institute – April 12-15, 2010 – Washington, DC





How can you get involved?

- Attend the Joint Special Populations Conference – December 2010 - Sacramento
- Use the resources on the STEM Equity Pipeline website

www.stemequitypipeline.org


[Register to Participate](#)
[Upcoming Events](#)
[NAPE Website](#)
[NAPE Ed Foundation Website](#)

Make this web site talk:
get **textHELP**

Upcoming Events

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

March 16, 2010
2pm EST, 1pm CT,
12pm MT, 11am PT

Webinar - How to Market Your CTE STEM Program: Tell Your Story to the Right People the Right Way and Get the Right Results

Presenter: Jill Chan, MBA, Account Executive, Phillips Design, Sacramento, CA

Phillips Design has done extensive work in education.

www.phillipsdesign.com

This webinar will help you to understand the dos and don'ts of successful marketing and to learn a focused strategy to create communication pieces that work! It will provide marketing strategies and examples to recruit and retain females in CTE STEM programs.

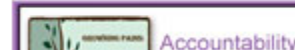
Learn to:

- Determine your marketing objective
- Identify your target audience
- Consider the appropriate message
- Decide the best method to communicate

[\(please register for this webinar before the event is supposed to start - once you register, you will be sent an e-mail with a link to the webinar\)](#)

April 12-15, 2010

NAPE Professional Development Institute and STEM Equity Pipeline Leadership Institute





“Expanding Options for Women and Girls in Science, Technology, Engineering and Math”



- About Us
- Contact Us
- Experts
- State Teams
- Resources
- Professional Development

Archived News

Online Resources

Pipeline Press

Five-Step Program Improvement Process Training Resources

Training Modules

Brochures/Pamphlets

Curriculum

General

Organizations

Posters

Programs

Publications

Reports

Scholarships

Videos



Archived News

January 25, 2010

Girls' math fears may start early
WASHINGTON - Little girls' fears of math are their earliest teachers.

Despite gains in recent years, women still trail men in some areas of math achievement, and the question of why has provoked controversy. Now, a study of first- and second-graders suggests what may be part of the answer: Female elementary school teachers who are concerned about their own math skills could be passing that along to the little girls they teach.

[\(More information\)](#)

January 11, 2010

President Obama Announces New Partnerships Under Educate to Innovate Campaign

NSTA and PBS Initiatives Acknowledged at White House Event

Last week at a special event to honor the winners of the Presidential Awards for Excellence in Mathematics and Science Teaching held at the White House, President Obama announced several more public-private partnerships totaling over \$250 million as part of his Educate to Innovate campaign to improve science and math instruction.

The public-private partnerships announced were Intel's Science and Math Teachers Initiative; expansion of the National Math and Science Initiative's iTEach Program; a commitment to support more than 75 public

Participate

Events

Education Website



“Expanding Options for Women and Girls in Science, Technology, Engineering and Math”



Register to Participate

Upcoming Events

NAPE Website

NAPE Ed Foundation Website

Archived Webinars/Webcasts

Subtle Micro-Messages Impact the Success of Women and Girls in STEM

(Presenter: Dr. Robbin Chapman, Manager of diversity recruiting for the School of Planning, Massachusetts Institute of Technology, Cambridge, MA)

Micro-inequities are those subtle “micro-messages” that devalue, discourage, and marginalize women and girls as exceptional scholars, scientists, and engineers. To increase women and girls’ participation in STEM fields requires examining practices to ensure equitable treatment in the classroom. During this webinar, participants learn:

- About micro-messaging, micro-affirmation, and micro-inequity.
- Practical, hands-on techniques to recognize, challenge and educate others about micro-inequities.
- Strategies for sending micro-messages that fuel positive behaviors and outcomes for women and girls in STEM fields.

Session 1 provides the building blocks to understanding micro-messaging and its impact on communication and performance.

Session 2 delves deeper into the core concepts plus gives participants tools for taking action to diagnose and devise interventions in micro-inequities that they perceive in the classroom and workplace.

- STEM Equity Pipeline Calendar
- Archived Webinars/Webcasts
- Online Courses
- General Resources
- Promising Practices
- The Five Step Program Improvement Process
- Needs Assessment
- Research
- Tools
- Materials Use Policy



Engineering Equity Extension Service (EEES)





“Expanding Options for Women and Girls in Science, Technology, Engineering and Math”



Home About Us Contact Us Experts State Teams Resources Professional Development



Five-Step Program Improvement Process Training Resources

Five-Step Program Improvement Process Summary Handout

A one page summary description of each of the steps in the Five-Step Program Improvement Process.

[\(Five Step Program Improvement Process Handout\)](#)

Improving Performance - A Five Step Process

A guide designed to help state education agencies, schools and colleges use data to improve performance on the Perkins III core indicators. This guide provides a comprehensive generic explanation of the Five-Step Program Improvement Process.

[\(Improving Performance – A Five Step Process\)](#)

Step Three: Best Solutions Resource list

This flyer contains tips, organizations, programs and resources to help find the best solutions for your program.

[\(Step Three: Best Solutions Resource list flyer\)](#)

Guide for Program Improvement for Perkins IV: Nontraditional CTE Program Participation and Completion

A step by step guide for using the Five-Step Program Improvement Process to analyze Perkins performance data, identify root causes, select appropriate strategies, pilot test and evaluation and

Search



Register to Participate

Upcoming Events

NAPE Website

NAPE Ed Foundation Website



“Expanding Options for Women and Girls in Science, Technology, Engineering and Math”



Register to Participate

Upcoming Events

NAPE Website

NAPE Ed Foundation Website

Archived Webinars/Webcasts

Subtle Micro-Messages Impact the Success of Women and Girls in STEM

(Presenter: Dr. Robbin Chapman, Manager of diversity recruiting for the School of Architecture and Planning, Massachusetts Institute of Technology, Cambridge, MA)

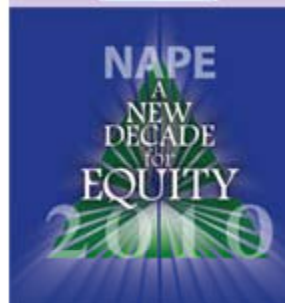
Micro-inequities are those subtle “micro-messages” that devalue, discourage, and dismiss women and girls as exceptional scholars, scientists, and engineers. To increase women in STEM careers requires examining practices to ensure equitable treatment in the classroom. During these two webinars learn:

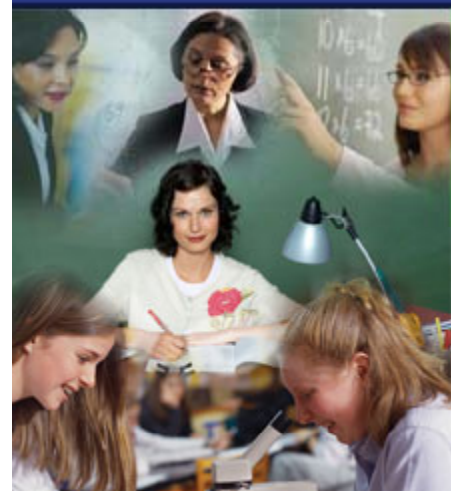
- About micro-messaging, micro-affirmation, and micro-inequity.
- Practical, hands-on techniques to recognize, challenge and educate others about micro-inequities.
- Strategies for sending micro-messages that fuel positive behaviors and outcomes for women and girls in STEM fields.

Session 1 provides the building blocks to understanding micro-messaging and its impact on communication and performance.

Session 2 delves deeper into the core concepts plus gives participants tools for taking action to diagnose and devise interventions in micro-inequities that they perceive in the classroom and workplace.

Search





Register to Participate

Upcoming Events

NAPE Website

NAPE Ed Foundation Website



Training Modules

18 Ways to Warm Up a Chilly Climate

In the current environment of global competitiveness, and cannot afford to have individuals in any segment of the population consider themselves not eligible for any career field because of their race/ethnicity, gender, disability or other characteristics. Teachers need to have a set of skills that is as diverse as the students they are working with. It is a challenge to reach all the students in their classroom; but there are some simple tips to help ensure that teachers are engaging everyone. This module contains a presentation and materials to give teachers ways to include all students in their classroom.

- [\(18 Ways Presentation Plan\)](#)
- [\(18 Ways PowerPoint Presentation\)](#)
- [\(Student Teams in Engineering\)](#)
- [\(Classroom Tips for Non-Sexist, Non-Racist Teaching\)](#)
- [\(What Can I Do?\)](#)
- [\(18 Ways Article\)](#)
- [\(18 Ways Poster main points\)](#)
- [\(18 Ways Poster with descriptions\)](#)
- [\(Evaluation\)](#)

Increasing the Diversity of the STEM Workforce: Strategies for Counselors

Counselors play a pivotal role in providing opportunities for students to explore nontraditional career options. Often seen as gatekeepers, counselors can open or close doors for students. This presentation introduces counselors to the status of women and girls in STEM, why public policy regarding nontraditional career preparation exists in the Perkins Act, and provides strategies they can implement to remove barriers for students access and success in nontraditional STEM related CTE programs.

- Archived News
- Online Resources
- Pipeline Press
- Five-Step Program Improvement Process Training Resources
- Training Modules



Questions?

National Alliance for Partnerships in Equity
Education Foundation

www.napequity.org

www.stemequitypipeline.org

610-593-8038

Mimi Lufkin

mimilufkin@napequity.org

