

Gender, Culture, and Science

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Gender, Culture and Science:

The Issue:

- Women are under-represented in some fields of science, technology and engineering.
- This under-representation varies by country and field of science.



The Good News..

In the U.S. women are represented in many fields of studies

- In fields that in the U.S. are seen as more “feminine”

	Percent Women		
	Bachelor's	Master's	Doctorate
Foreign Languages	71.2%	69.2%	59.0%
Nursing	90.9%	88.6%	94.3%
Education	77.4%	76.4%	66.5%
Psychology	77.5%	76.4%	68.2%

All data from Babco & Bell (2004) *Professional Women and Minorities: A Total Human Resources Data Compendium*



The Good News: Progress

In the U.S. women are represented in many fields of studies

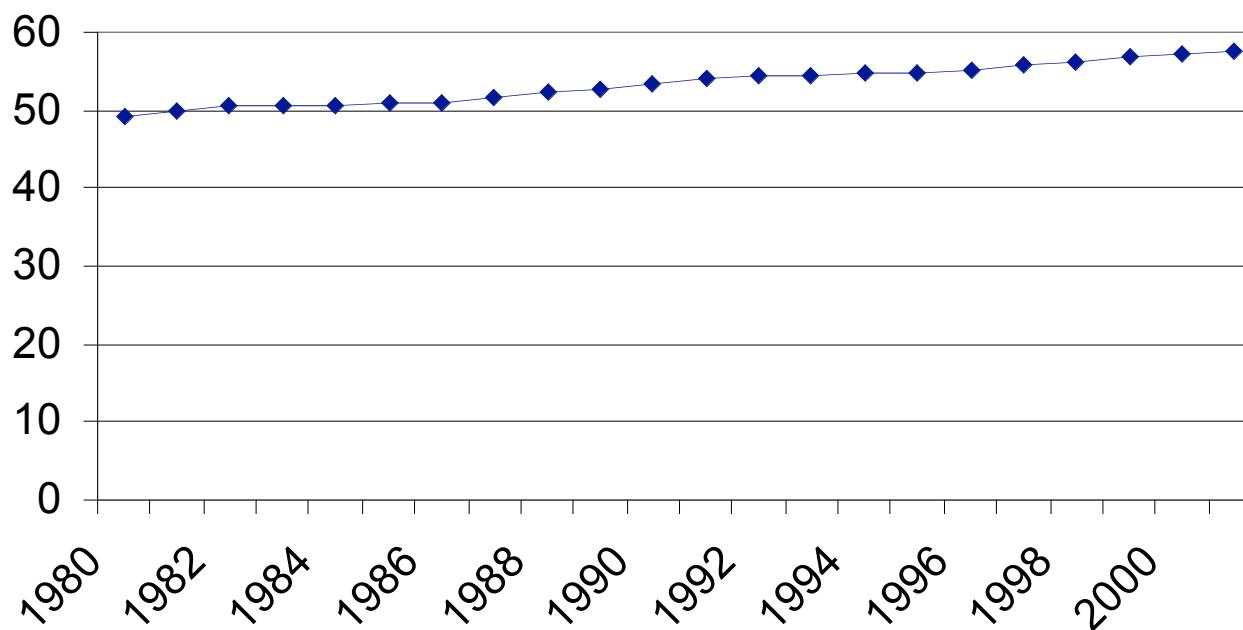
- and in fields that in this country are considered less “feminine”

	Percent Women	
	1986-1987	2002-2003
Veterinary Medicine	53.0%	74.7%
Medical Schools	33.4%	46.6%
ABA Approved Law Schools	40.7%	49.0%



Women in the U.S. earn half of all undergraduate degrees

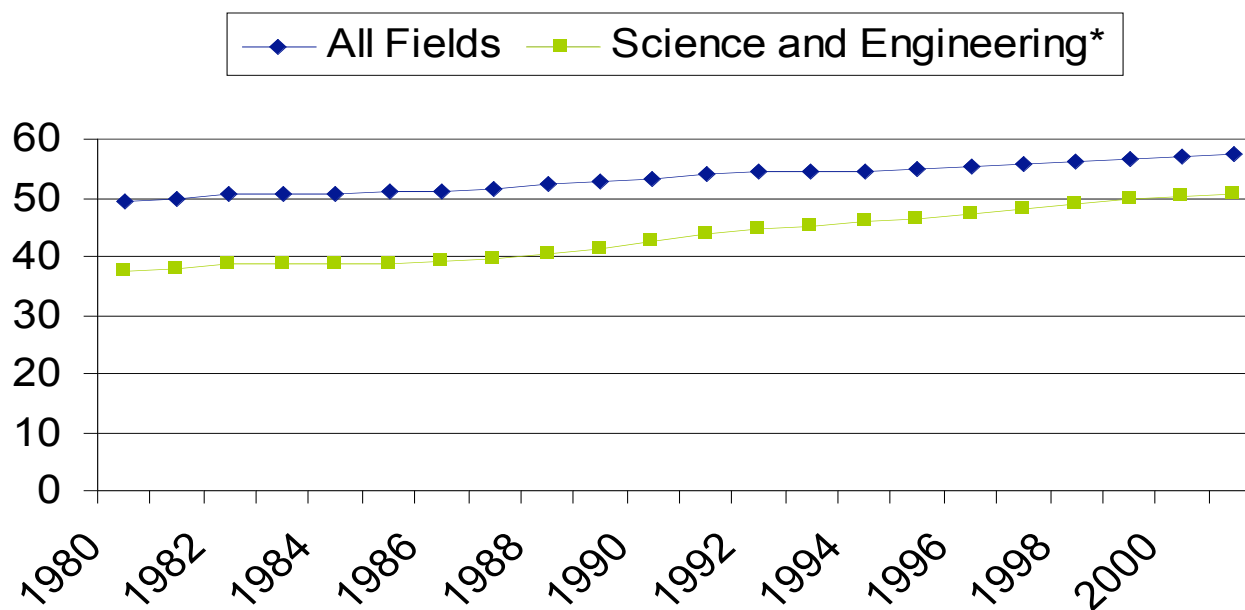
Percent of Bachelor's Degrees in All Fields Earned by Women



*All data from Babco & Bell (2004) *Professional Women and Minorities: A Total Human Resources Data Compendium*

Women in the U.S. earn half of the undergraduate degrees in science and engineering

Percent of Bachelor's Degree Earned by Women



*Note: Science and Engineering includes physical, biological, and social sciences

All data from Babco & Bell (2004) *Professional Women and Minorities: A Total Human Resources Data Compendium*



Historical Perspective on Women and Education in the U.S.

- In the US women first admitted to higher education in the 1800s
 - Oberlin College: first U.S. college to admit (in 1837) women
- In 1849, Elizabeth Blackwell became the first woman to receive an M.D.
 - Medical Institution of Geneva, NY
- Women were officially admitted to 6 major graduate schools between 1890 and 1892
 - Before 1890, admitted only as special students and not given degrees
- By 1889, 10 colleges and universities had awarded 25 Ph.D.s to women

First Woman to Get a University Degree ...



Elena Cornaro Piscopia
University of Padova
in 1678



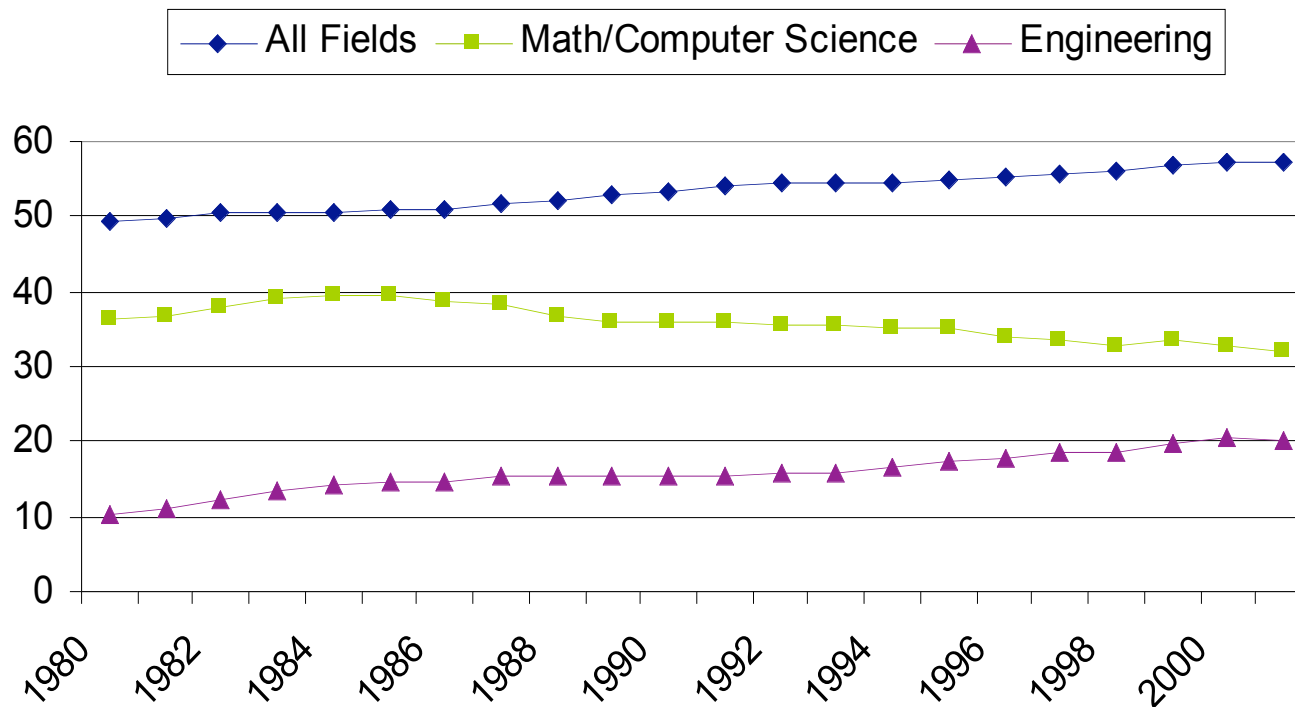


The Bad News: Uneven Progress

- The progress of U.S. women in math/ computer science, physical sciences and engineering has been slow

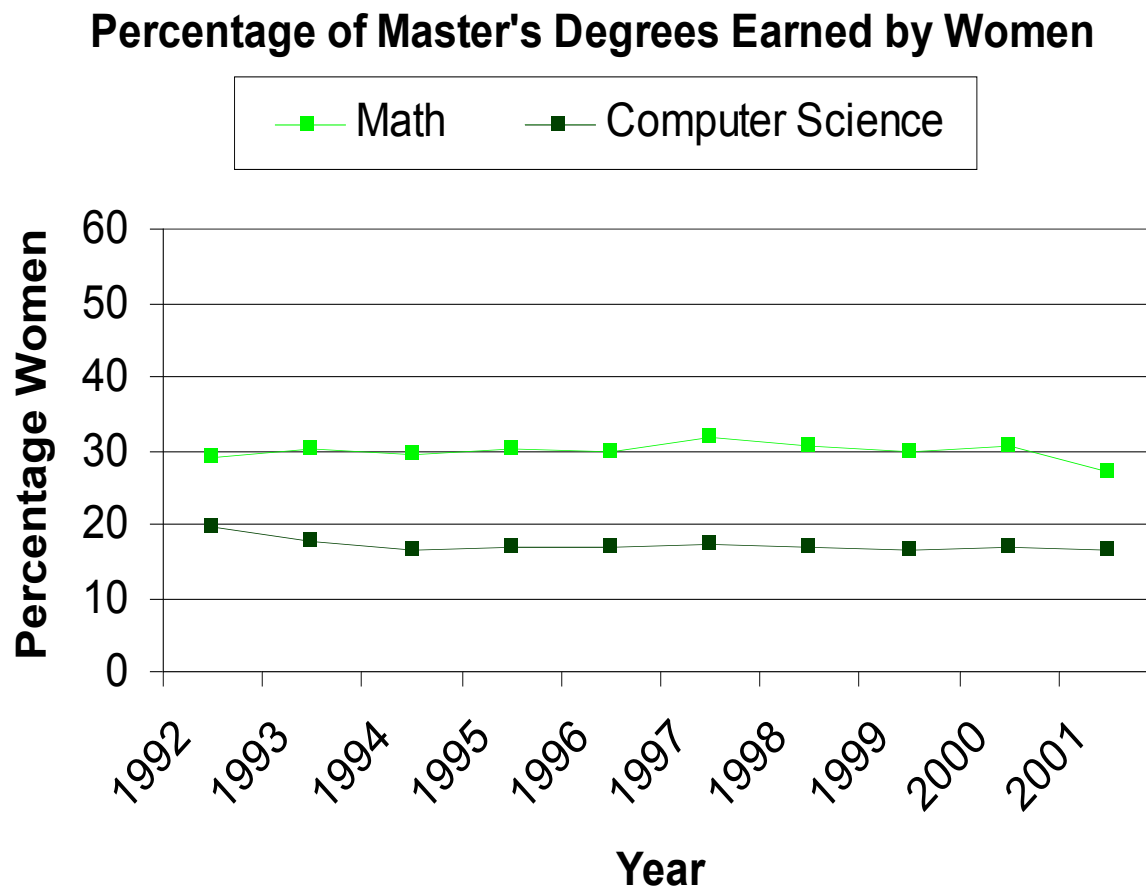
Increases in the Proportionate Representation of U.S. Undergraduate Women Has Been Slow or non-Existent in Some Fields

Percent of Bachelor's Degree Earned by Women



All data from Babco & Bell (2004) *Professional Women and Minorities: A Total Human Resources Data Compendium*

And Equally Slow at the Master's Degree Level



All data from Babco & Bell (2004) *Professional Women and Minorities: A Total Human Resources Data Compendium*

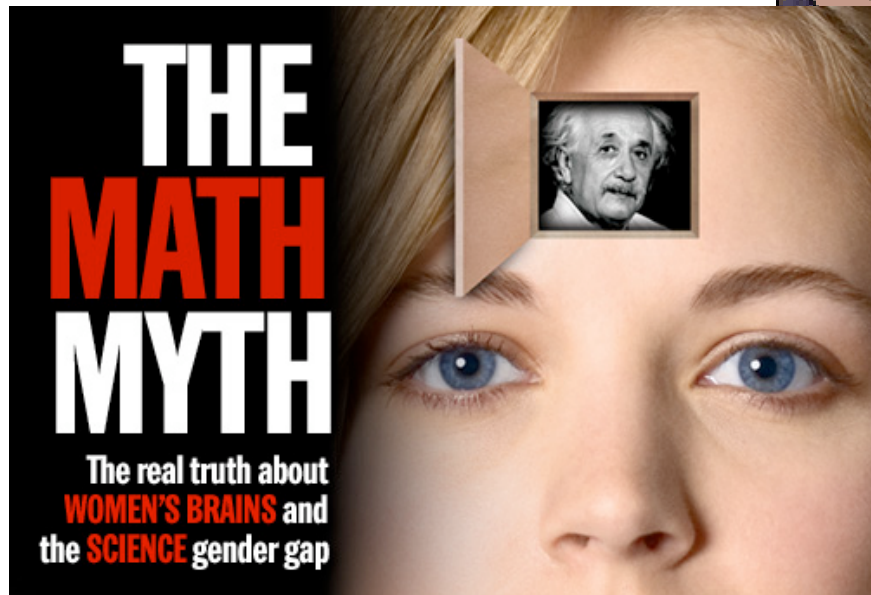
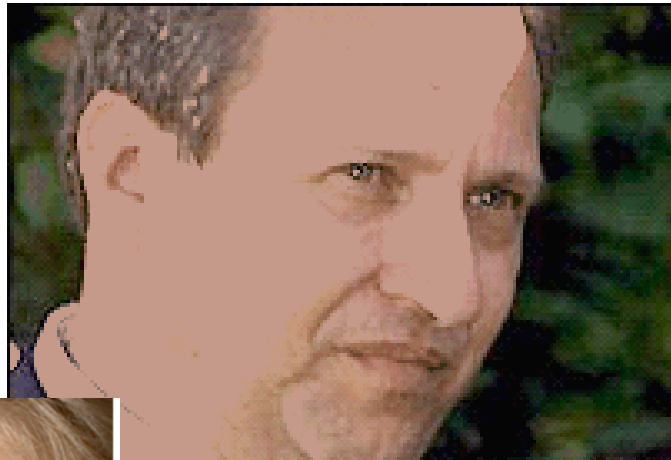
Why is Progress so Slow in These Fields?



Nature...

– Harvard row over sex and science

The president of Harvard University has caused a stir among academics by suggesting women have less innate ability at science and maths than men.



nder diffe



Or Nurture?



[From:www.fortworth.com/01visitors/0106museums/010604ftworthsciencehist/010604ftworthsciencehist.shtml](http://www.fortworth.com/01visitors/0106museums/010604ftworthsciencehist/010604ftworthsciencehist.shtml)



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What Do We Mean by Nurture?





What do we mean by nurture?

- **The social environment**

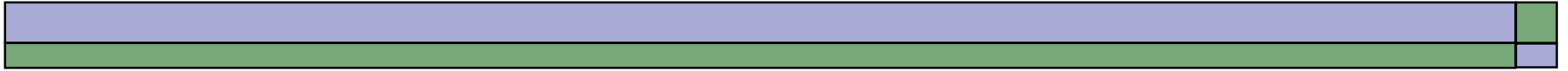
Beliefs about gender and science

Experiences with science that women and men have



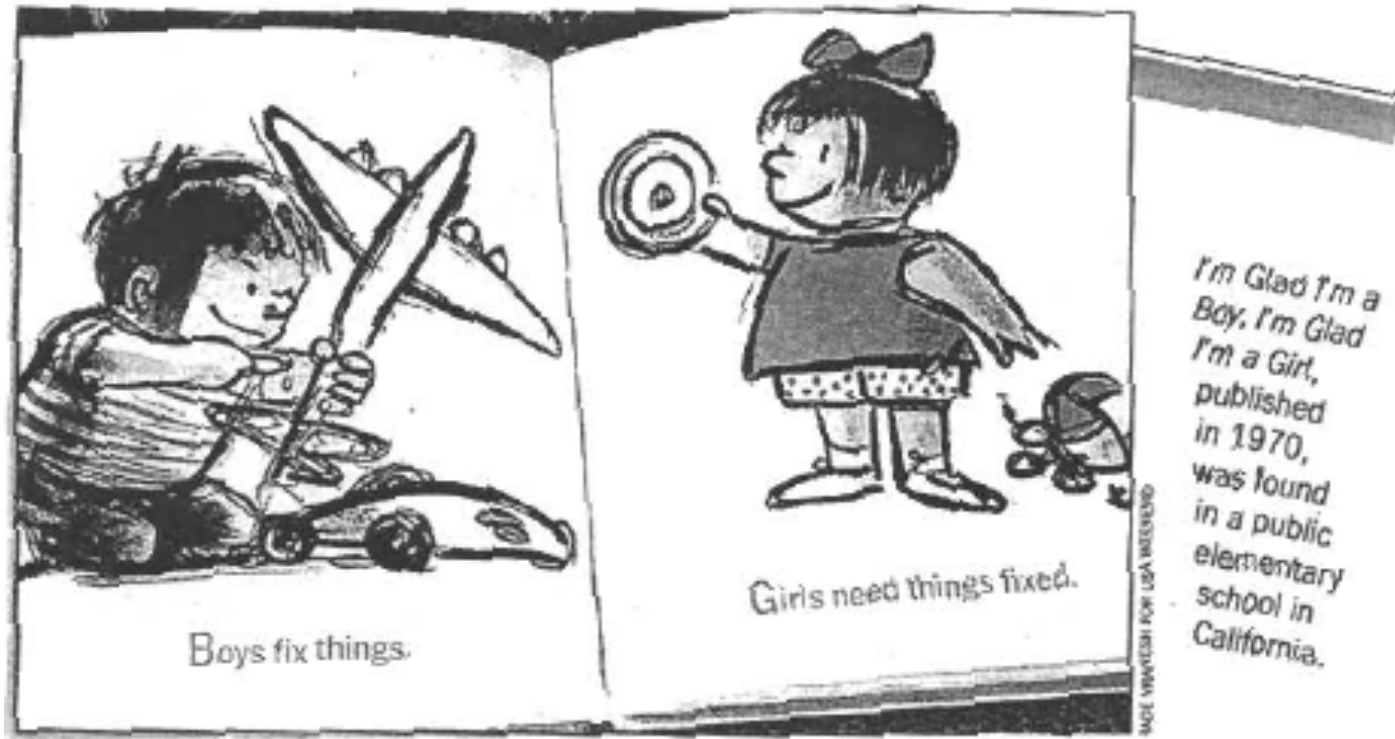
Gender and Science in the U.S.

- What is the culture of gender and science in the U.S.?
- What are the lessons about gender and science we learn in the U.S.?
- What are the experiences of U.S. girls and boys with science?



Gender and science discourse

Boys fix things Girls need things fixed



The Scientist is Always White and Male



Even Computers are Gendered

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Taxes, Shipping and Handling extra.
or \$14.98 per month!
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Barbie® Digital Camera!

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• Intel® Celeron™ Processor 333MHz • 3Gb Hard Drive • 32MB SDRAM Memory • 32X CD-ROM Drive • 56K Fax/Modem • 15" Color Monitor • Speakers • Windows® 98 • Hot Wheels Steering Wheel and Pedals

Hot Wheels

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Taxes, Shipping and Handling extra.
or \$14.98 per month!
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Hot Wheels™
Steering Wheel
and Pedals!

INCLUDED! 20 software titles worth over \$500!

Picture shown with 17" monitor upgrade.

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Is the Problem of Under-Representation
of Women in Science and Engineering Universal?



Women in Engineering around the World

Proportion of women earning engineering Ph.D.s
varies widely by country

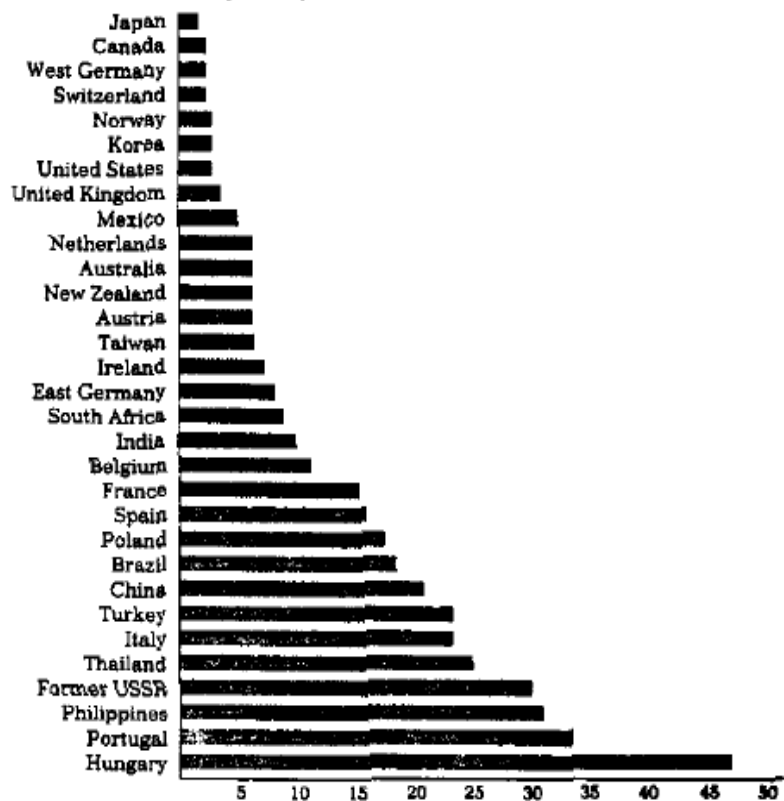
	<u>% female</u>	<u>(#)</u>
•Taiwan	2.3%	(12)
•Japan	8.9%	(269)
•Canada	13.5%	(78)
•U.S.	16.9%	(925)
•France	25.4%	(234)
•Bulgaria	27.6%	(16)
•Italy	35.0%	(251)



Women in Physics around the World

Proportion of female Physics Professors varies widely by country

International Percentage of Physics Professors Who Are Women





Is the Problem of Under-Representation of Women in Science and Engineering Universal?

- It is not universal
- This suggests that nurture (social, cultural factors) plays a role in gender variability in science and engineering participation



Our Research on Gender, Culture and Science

- Examines nurture issues that may be related to the gender gap in participation and success in some fields of science, technology and engineering in specific countries, cultures, milieux.



Science and Technology Center Program Goals

- *The objectives of the Science and Technology Center Program are to: engage the Nation's intellectual talent, robustly drawn from its full human diversity, in the conduct of research and education*
- *The Science and Technology Center also aims at increasing the participation of diverse U.S. citizens including women and underrepresented minorities*



Theoretical Framework

- Social factors influence gender participation and advancement in science/technology/engineering



Relevant Empirical Evidence

- Stereotype Threat Evidence
- Theory of Mind Evidence
- Attribution Evidence

Attribution Evidence

My Turn

A Woman Can Learn Anything a Man Can

I worried that my gender was holding me back, until I realized the boys were studying just as hard

BY CAROLYN TURK

WHEN I WAS A KID, EVERYTHING in my bedroom was pink. I have two sisters and we had a complete miniature kitchen, a herd of My Little Ponies and several Barbie and Ken dolls. We didn't have any toy trucks, G.I. Joes or basketballs. We did have a Wiffle-ball set, but you would have been hand-pressed to find it in our playroom. Tomboys we weren't.

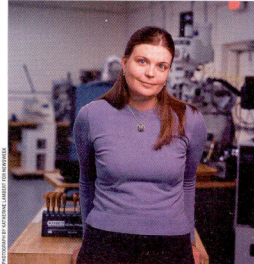
So some people may find it ironic that I grew up to be a mechanical engineer. In fact, I am the only female engineer at my company. In order to get my college degree, I had to take a lot of math and science classes. I also had to work with a team of students as part of a national competition to convert a gas-guzzling SUV into a hybrid electric vehicle—that's where I learned how to fix cars. I'm proud to say that I got A's in all my classes, including multivariable calculus and differential equations. I've always been pretty good at math and design, but I didn't understand where that could take me. I was expected to go to college, but no one ever told me I'd make a good engineer someday.

When I was in high school, I didn't know the first thing about engineering. I couldn't have distinguished a transmission from an alternator. The car I drove needed some work but I was afraid to take it to the mechanic. Because honestly, the mechanic could have shown me an electric car opener and said, "This is part of your car and it's broken—pay me to fix it," and I wouldn't have known any better.

At the end of my junior year of high school, I heard about a summer program designed to interest girls in engineering. The six-week program was free, and students were given college credit and a dorm room at the University of Maryland. I ap-

plied to the program, not because I wanted to be an engineer, but because I was craving independence and wanted to get out of my parents' house for six weeks.

I was accepted to the program and I earned six engineering credits. The next



WOMAN'S WORK? I was expected to do well and go to college, but no one ever told me I'd make a good engineer

year I entered the university as an engineering major. Five years later I had a degree and three decent job offers.

I can't help shuddering when I hear about studies that show that women are at a disadvantage when it comes to math. They imply that I am somehow abnormal. I'm not, but I do know that if I hadn't stumbled into that summer program, I wouldn't be an engineer.

When I was growing up I was told, as many students are, to do what I am best at. But I didn't know what that was. Most people think that when you are good at something, it comes easily to you. But this is what I discovered: just because a subject is difficult to learn, it does not mean you are

not good at it. You just have to grit your teeth and work harder to get good at it. Once you do, there's a strong chance you will enjoy it more than anything else.

In eighth grade I took algebra. On one test I got only 36 percent of the answers correct. I failed the next one, too. I started to think, Maybe I'm just not good at this. I was lucky enough to have a teacher who didn't take my bad grades as a judgment of my abilities, but simply as an indication that I should study more. He pulled me aside and told me he knew I could do better. He let me retake the tests, and I pulled my grade up to an A.

I studied a lot in college, too. I had moments of panic while sitting underneath the buzzing fluorescent lights in the engineering library on Saturday afternoons,

when I worried that the estrogen in my body was preventing me from understanding thermodynamics. But the guys in my classes had to work just as hard, and I knew that I couldn't afford to lose confidence in myself. I didn't want to choose between my femininity and a good career. So I reminded myself that those studies, the ones that say that math comes more naturally to men, are based on a faulty premise: that you can judge a person's abilities separate from the cultural cues that she has received since she was an infant. No man is an island. No woman is, either.

Why are we so quick to limit ourselves? I'm not denying that most little girls love dolls and most little boys love videogames, and it may be true that some people favor the right side of their brain, and others the left. But how relevant is that to me, or to anyone, as an individual? In-

stead of translating our differences into hard and fast conclusions about the human brain, why can't we focus instead on how incredibly flexible we are? Instead of using what we know as a reason why women can't learn physics, maybe we should consider the possibility that our brains are more powerful than we imagine.

Here's a secret: math and science don't come easily to most people. No one was ever born knowing calculus. A woman can learn anything a man can, but first she needs to know that she can do it, and that takes a leap of faith. It also helps to have selective hearing.

TURK lives in Silver Spring, Md.



Three groups of studies

- One group of studies examines the discourse of gender and science/engineering/technology in various media.
- A second group of studies examines the presence and success of women in science/engineering/technology fields
- A third group of studies focuses on the experience of women and men in science/engineering/technology fields



Group 1: Gender Media Studies

- This group of studies assesses the discourse of gender and science/technology in different media.

One completed study examined computer advertisements, specifically narratives of gender, age, and ethnicity in in computer magazines advertisements.

A second study in progress focuses on the discourse of gender and science in leading US publishers science textbooks for grades 3 through 6.



Group 2: Women's Presence and Success in Science/Engineering/Technology Studies

- This group of studies examines the presence and success of women in scientific/engineering education and scientific/engineering careers

One completed study focused on the enrollment and graduation rates of women in U.S. graduate engineering programs

A second completed study examined the presence, productivity and advancement of women in scientific psychology university positions in Italy.



Group 3: Women's Experience in Science/ Engineering/Technology Education & Careers Studies

- This group of studies examines the experience of women and men in science/engineering/technology fields

One in-progress study focuses on the experience of women and men in the McNair Program, an undergraduate science enrichment program

A second in progress-study examines the experience of women and men in graduate engineering programs.



Highlights of a Group 2 Study

- Group 2 studies focus on the presence and success of women in scientific/engineering education and scientific/engineering careers
- In one specific study we examined enrollment and graduation rates of women and men in U.S. graduate engineering programs
- A innovative feature of this study was to consider students' nationality



Nationality Influences

Foreign nationals earning engineering degrees in the U.S. (2003):

- 56.6% of the individuals earning Ph.D.s
- 46.0% of individuals earning master's degrees
- 7.4% of individuals earning bachelor's degrees



Nationality Influences

- Over 50% of engineering doctoral students are foreign nationals
- Engineering “pipeline” is NOT a single pool of individuals that decreases in number with higher levels of education, as commonly depicted...



The Problem

□ **Few women**

in academic engineering



Our Question

- **Is Differential Attrition from Doctoral Engineering Programs a Factor in the Under-Representation of Women in Academic Engineering?**



Study authors

- Aki Hosoi, Ph.D. and Silvia Canetto. Ph.D.
Dept. Psychology
Colorado State University



Method

- Sample:
All students enrolled in graduate engineering programs at Colorado State University between 1990-2005 (n = 470)



Analysis Strategy

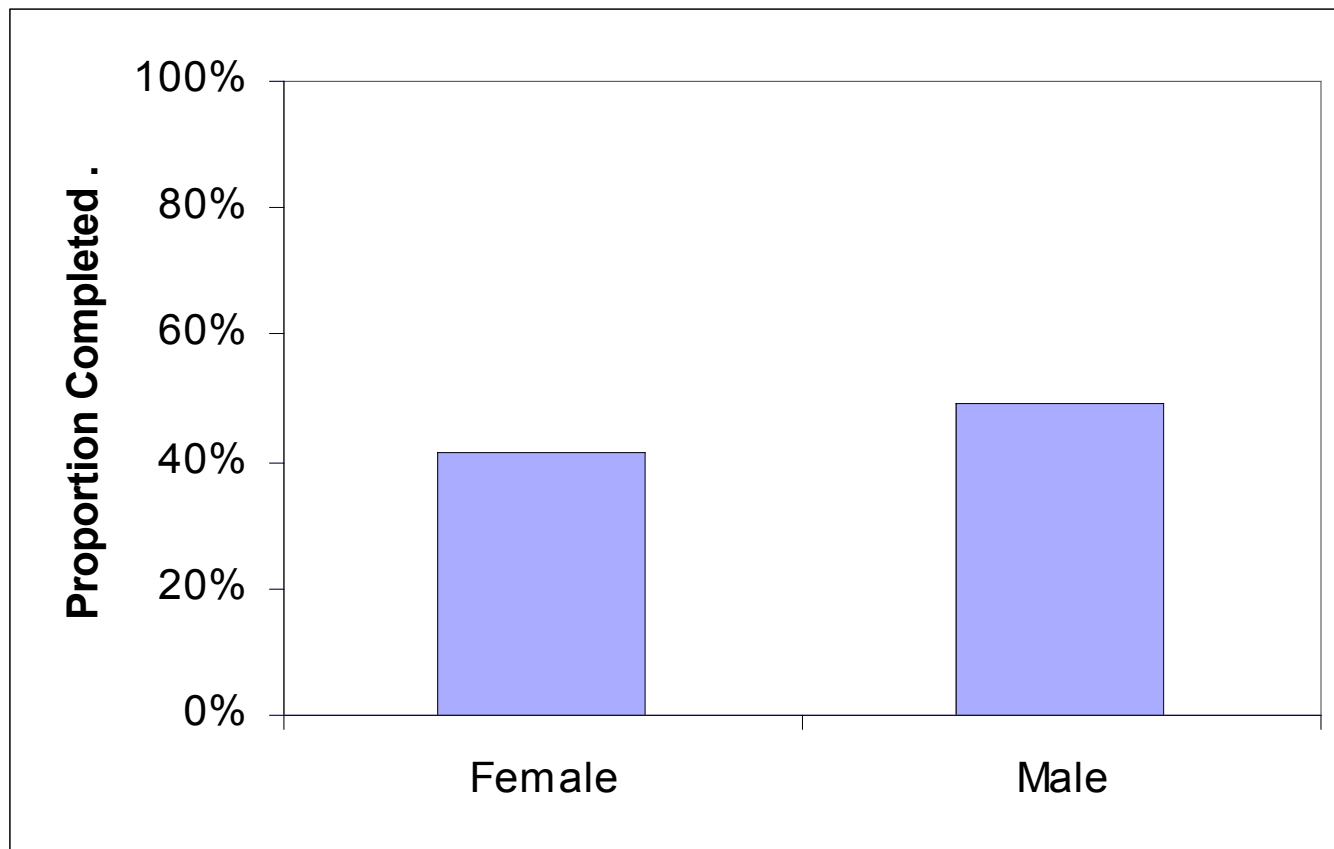
- A longitudinal analysis of enrollment and graduation data on engineering graduate students at Colorado State University (1990-2005) considering ¹
 - Sex
 - Marital Status
 - Ethnicity
 - Country of Origin
 - Age
 - Graduate GPA
 - Department
 - Start and end term
 - Degree earned

¹provided for each term the student was enrolled



Selected Results

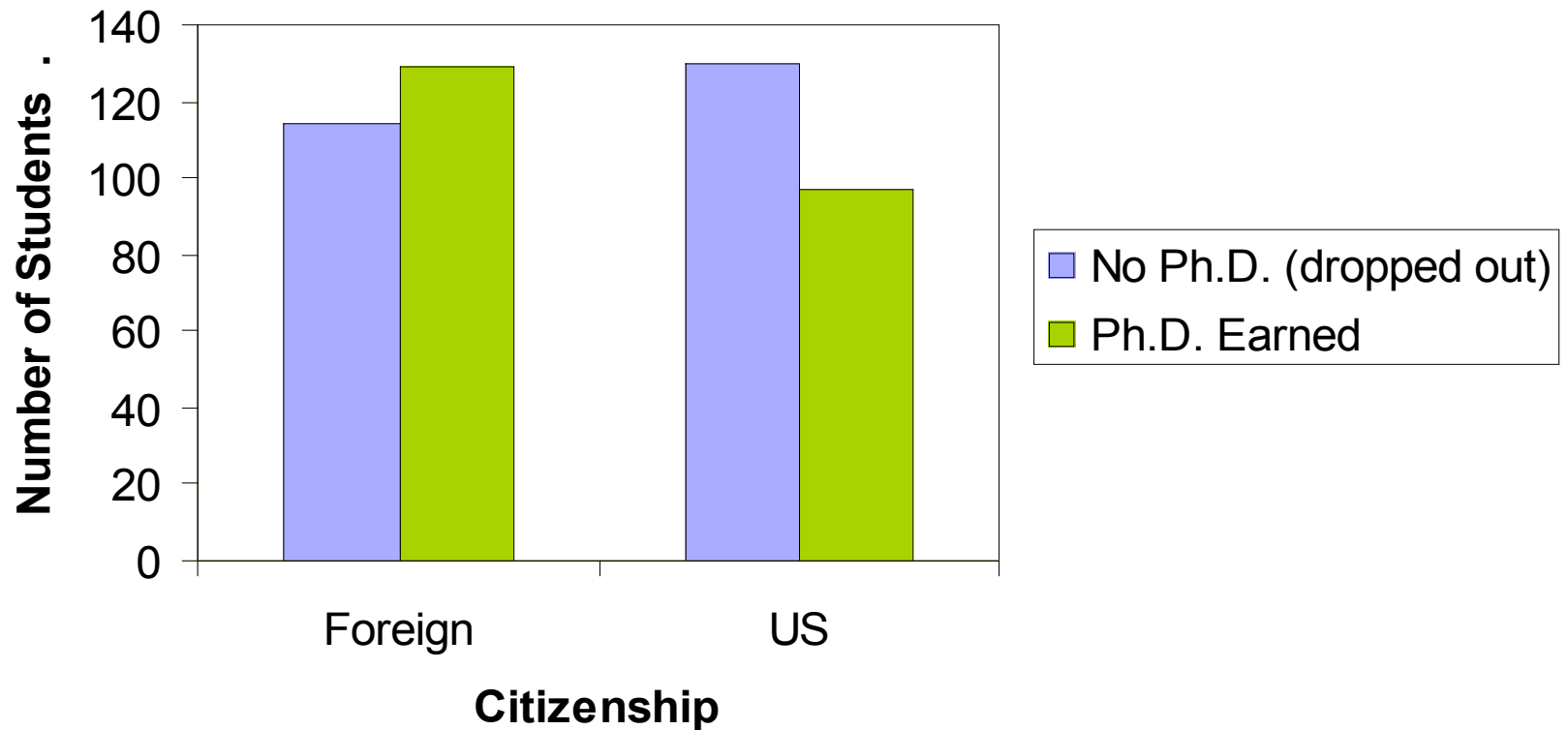
Females and males were equally likely to complete a Ph.D.





Selected Results:

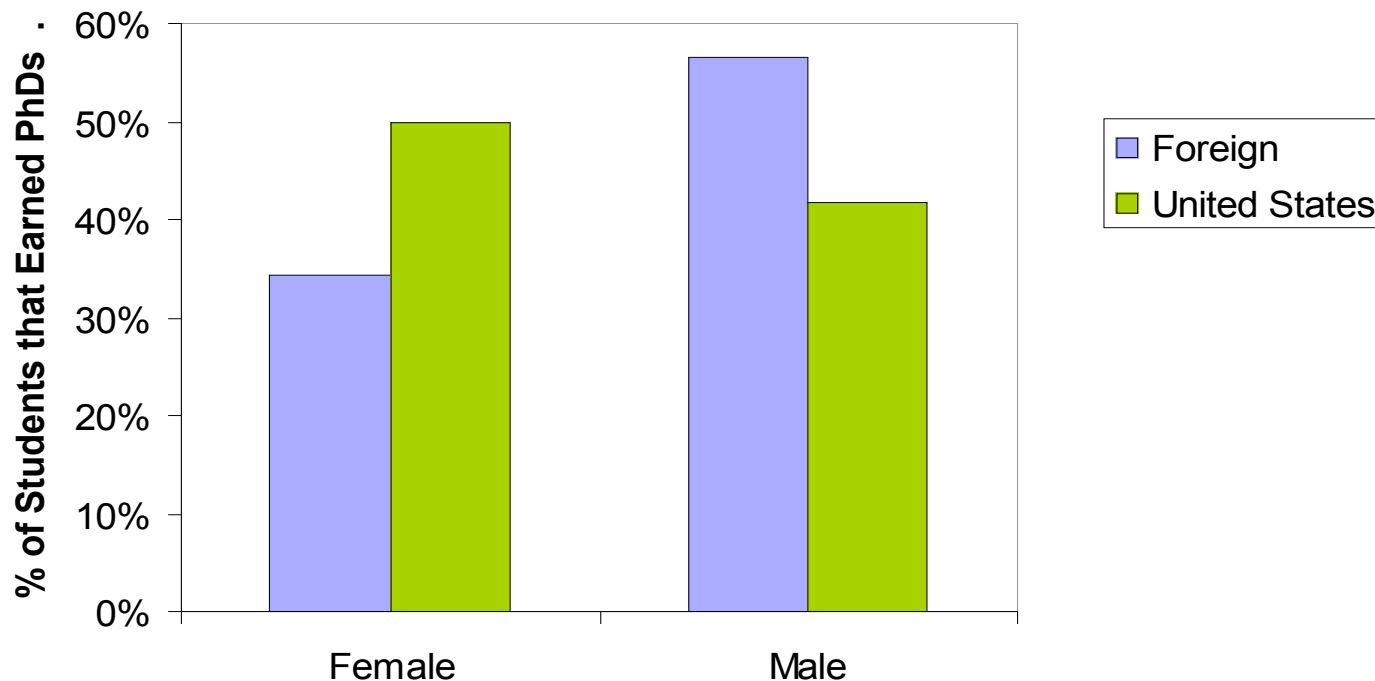
Foreign nationals were significantly more likely to
complete a Ph.D. as compared to U.S. citizens





Selected Results

There was a significant sex*nationality interaction:
Women from the U.S. were more successful at earning their
Ph.D.s than men, while the opposite pattern was found among
foreign nationals.





Other Selected Results

- GPA, start term, nationality and marital status all had significant effects on Ph.D. completion
- South/Central America and South/Southeast Asia had a relatively high representation of female students.
- The Middle East and Africa had a relatively low representation of female students



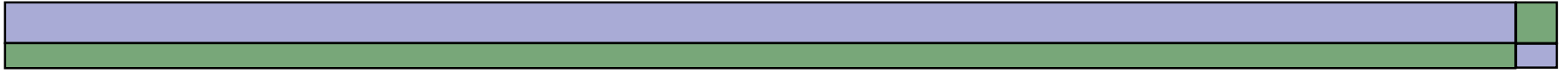
Conclusions

- Once in the graduate engineering pipeline women do as well as men in terms of getting doctoral degrees
- The problem is that there are too few women in the graduate pipeline
- Another issue is that too few stay in academia



Some Questions For Future Studies

- What is the role of culture/nationality in participation and success in engineering education and careers?
- What is the role of marriage and parenting in participation and success in engineering education and careers?
- What is the experience of women and men in engineering education and careers?



YOUR QUESTIONS?
