SWPS 101

Why do we need SWPS?

Kate Kamdin
September 2013
Outline

1. The Gender Gap(s): What is it?
2. The Gender Gap(s): Possible Explanations & Contributing Factors
3. Why It Matters
4. Solutions
The Gender Gap

Women are underrepresented in the physical sciences.

Figure 7. Percent of PhDs earned by women in selected fields, 1958-2003.

National Science Foundation. Compiled by AIP Statistical Research Center.
The Gender Gap

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Figure 7. Percent of PhDs earned by women in selected fields, 1958-2003.

Why so few?

1837 - Oberlin - becomes first American co-ed institution
1880 - Cornell - grants 1st PhD to American woman (Philosophy)
1930's - more than 40% of undergrads are women
1969 - Yale and Princeton accept first women undergraduates

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http://beatl.barnard.columbia.edu/learn/timelines/women.htm
Another Gender Gap

“Leaky Pipeline” - women disproportionately leave the physical sciences despite equal enrollment at the beginning of college.

Figure 11. Actual and expected percentage of women and men in physics in the US.

- Actual 2001, 2002
- Expected is based on percent bachelor’s degrees in the past

AIP Statistical Research Center.
Another Gender Gap

“Leaky Pipeline” - women disproportionately leave the physical sciences despite equal enrollment at the beginning of college.

Question becomes: why the drop?
Possible Explanations for the Gender Gap

1. Lower aptitude
2. Higher variance in males
Lower aptitude?

“Like many women and minorities, however, I am suspicious when those who are at an advantage proclaim that a disadvantaged group of people is innately less able.”

-Ben Barres

References:
Ben Barres. Does Gender Matter?
Lower aptitude?

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Figure 1 | Maths-test scores for ages 4 to 18. In the United States there is little to distinguish the maths-test scores of boys and girls throughout school.
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Higher Variance?

Larry Summers, President of Harvard (2005)

The under-representation of women in the top levels of academia is due to a "different availability of aptitude at the high end."
Higher Variance?

TIMSS & PISA = standardized math tests
VR = male variance:female variance

Let VR = 1.19

If this were true, then the ratio of males to females would be:
@95th percentile = 1.34:1
@99.9th percentile = 2.15:1

@99.9th percentile - theoretically 68% men and 32% women
Reality in engineering - 82% men and 18% women

To accommodate reality with this model, would require all engineers to be >4-sigma (1/20,000) from average on math tests.

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JS Hyde and JE Mertz. Gender, culture, and mathematics performance.
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Table 2. Differences in variability in math performance between boys and girls among some selected nations

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<th>Country</th>
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<th>1995 TIMSS 17 year olds (SD_M − SD_F)/SD_M²</th>
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<tbody>
<tr>
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<td>1.24*</td>
<td>0.05</td>
</tr>
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¹VR significantly different from 1.0, P < 0.05. ND, not determined.
²Variance ratios taken from table S2 of Machin and Pekkarinen (19).
³Calculated from data presented in table 2 of Penner (20); P values are not known.

Let VR = 1.19

![Diagram showing theoretical normal distributions for males and females.](image.png)

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More Likely Explanations for the Gender Gap

Socio-Cultural Influences:
1. Stereotype threat
2. Cultural Representations of Scientists
3. Implicit bias
Stereotype Threat

- Term coined in 1999 paper by Spencer, Steele, and Quinn.
- Describes anxiety & impaired performance that occurs when a person has the potential to confirm a negative stereotype about their social group.

Study 0: “...[Replicates] the pattern found in the literature—that women underperform in comparison to men on difficult tests, but perform equally with men on easy tests—in a sample of highly qualified equally prepared men and women. The men and women were selected to have a very strong math background.”

Easy math test = GRE general level
Hard math test = GRE subject level

![Graph showing performance on a math test as a function of sex of subject and test difficulty](image)

FIG. 1. Performance on a math test as a function of sex of subject and test difficulty

References:
SJ Spencer, CM Steele, and DM Quinn. Stereotype threat and women’s math performance.
Stereotype Threat

Study 1: Half the test subjects are told test shows no gender difference, the other half are told that women score lower.

Study 1 Results:
Explicitly eliminating stereotype = equal scores.
Reinforcing stereotype = women underperformed.

References:
SJ Spencer, CM Steele, and DM Quinn. Stereotype threat and women’s math performance.
Stereotype Threat

Study II: Half the test subjects are told test shows no gender difference, no mention of gender to other half.

Study II Results:
Explicitly removing stereotype = equal scores
Stereotype not even mentioned = women underperformed
Not mentioning stereotype gives same results as reinforcing it!

References:
SJ Spencer, CM Steele, and DM Quinn. Stereotype threat and women’s math performance.
Cultural Representations of the Scientist

Who is the Scientist?

Seventh graders describe scientists before and after a visit to Fermilab

“I think of a scientist as very dedicated to his work. He is kind of crazy, talking always quickly. He is constantly getting new ideas. He is always asking questions and can be annoying. He listens to others’ ideas and questions them.”

“I know scientists are just normal people with not so normal job.... Scientists lead a normal life outside of being a scientist. They are interested in dancing, pottery, jogging, and even racquetball. Being a scientist is just another job which can be much more exciting.”

-Amy

Gendered Advertising: Yesterday

1953

You mean a woman can open it?

1970

The Mini Automatic. For simple driving.

1970

THIS IS A COMPUTER?

1970

YOU BET YOUR SWEET TELEX OPERATOR IT IS!

Beneath that Telex keyboard is a full-fledged 16-bit word-length digital computer with the most powerful I/O structure available today. It's the DATACOMP 404. Hardware decimal arithmetic, including multiply and divide with automatic scaling, eliminates binary/decimal conversion. On I/O automatic formatting eliminates expensive editing software. Word-length operating modes that are built into the 404's hardware can be programmed for 16, 32, 48, or 64 bits, doing away with multi-precision routines.

Sixteen addressing modes, including double-index and relative hardware-streamline the most complicated routines and permit you to relocate object programs.

The 404 executive hardware time shares its own terminals while acting as the INTELLIGENT TERMINAL in a time-shared network. If you're an OEM and you're thinking of force-holding a binary bit switcher to solve decimal problems, talk to us before you make a bad mistake. The 404 starts at $6800.
Gendered Advertising: Today

2012 Land’s End Catalog

Gendered Advertising: Today

2009 Toys ‘R Us Catalog
http://thesocietypages.org/socimages/2009/12/29/girls-need-less-power/
Gendered Advertising: Today
Implicit Biases

“...individuals are not necessarily withholding their "true" attitudes and beliefs but rather that they are unable to know the contents of their mind.”


Some Results from the IAT (Implicit Association Test):
75% of men and women do not associate ‘female’ with career as easily as they associate female to family.
75% of Whites (and 50% of Blacks) show anti-Black bias.

Further study indicated that implicit bias correlates with real-world behavior.
Implicit Biases

2012 study: “...[to] experimentally investigate whether science faculty exhibit a bias against female students that could contribute to the gender disparity in academic science.”

- Randomized double-blind study (n = 127), nation-wise science professors (bio, chem, & physics) from research-intensive universities.

![Graph showing competence, hireability, and mentoring by student gender condition](image)

*Fig. 1.* Competence, hireability, and mentoring by student gender condition (collapsed across faculty gender). All student gender differences are significant ($P < 0.001$). Scales range from 1 to 7, with higher numbers reflecting a greater extent of each variable. Error bars represent SEs. $n_{\text{male student condition}} = 63$, $n_{\text{female student condition}} = 64$.

References:
Moss-Racusin, et al., Science faculty’s subtle gender biases favor male students
Implicit Biases

Starting salary offered to applicant by gender.

All biases in this study were found to be independent of faculty’s age, gender, tenure status, & discipline. (i.e. everyone seems to harbor implicit bias against women).

Fig. 2. Salary conferral by student gender condition (collapsed across faculty gender). The student gender difference is significant ($P < 0.01$). The scale ranges from $15,000 to $50,000. Error bars represent SEs. $n_{\text{male student condition}} = 63$, $n_{\text{female student condition}} = 64$.

References:
Moss-Racusin, et al., Science faculty’s subtle gender biases favor male students.
Why do we care?

For science!

As good scientists, we aim to control for bias.
Not correcting for these biases = vastly smaller talent pool.
This is not a “women’s issue” - this is a science issue.

Training scientists and engineers at current rates will result in a deficit of 1,000,000 workers to meet United States workforce demands over the next decade.
- President’s Council of Advisors Report on Science and Technology, 2012

“Maintaining a strong workforce in the physical sciences is of critical importance to the national economy, health care, defense, and domestic security. Increasing the participation of women in these sciences can strengthen that workforce....”
- Gender Equity Report, 2007
What Can We Do?

What ‘The Academy’ Can Do:

Increase leadership diversity in academic and scientific institutions.

- Example: sample of 10 people with SAT scores > 1200 solved problems more effectively than the 10 people who scored a perfect 1600

Best practices for ‘judging.’

- Example: Double-blind peer review increased the acceptance rates of female first-author papers.

What We Can Do:

Mentoring

- Mentors can help you navigate the social norms.
- Women who participate in mentoring programs:
  - Publish more papers
  - Publish more papers in top journals
  - Earn more federal grant money

Organizing, Self-Advocating, & Outreach!

References:


Budden et al. Double-blind review favours increased representation of female authors.

Stalker. Athene in academe- women mentoring women in the academy.

Jaschik. Proof that Mentoring Matters.
Mentoring

SWPS Mentoring Meetup - 6pm next Wednesday, 4th floor LeConte

Collaboration with Compass on AWESOME workshops:
  Saturdays, 11am - 2pm
  - September 21: Mentor/Mentee Relationships
  - October 19: Growth Mindset
  - November 16: Resumes and CVs

Questions about SWPS Mentoring? Contact our mentoring coordinators:

  Jenni  Sylvia
  jlbarnes@berkeley.edu  sylviakl@berkeley.edu
Outreach

“To support the pipeline, we must reach back and out.”
- Pathways to Science

CRS: Community Resources for Science -- simple goal of helping teachers give students more opportunities to do science.
- Scientist volunteers teaching in the classroom (BASIS)
- Interested? October SWPS dinner

EYH: Expanding Your Horizons -- conference in the spring that provides hands on activities for middle school aged girls.
- Volunteering opportunities for teaching and lesson planning

Contact our outreach coordinators for more info / to volunteer:
Kayleigh kcassell@berkeley.edu
Vivian vtnnguyen94@berkeley.edu
Sophia sophiaelia@berkeley.edu
Thanks for listening!

swps.berkeley.edu