



# **Teaching Girls in STEM Fields – A Discussion on Recent Research and Findings**

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## Why is this so important?

“It is impossible to predict in advance what difference women would make to the culture and practice of [STEM fields], I believe they have an important role to play in helping to make both more ethical. It is not insignificant that it is, in fact, women who are spearheading this call for change. At the beginning of Mathematical Man’s story in the time of Pythagoras, he was primarily an ethical being. One of the reasons he has lost his ethical grounding is that he has been largely without female company for so long. I do not suggest that a greater presence of women would suddenly turn physics into an ideal science; I only propose that women would provide – as do women in all communities – a balancing influence. As in any society, the best goals emerge from the dreams of men and women together. After two and half thousand years, the time has come for Mathematical Man to embrace the partnership of Mathematical Woman. The time has come for a mathematically based science envisioned and practiced equally by both sexes.”

Margaret Wertheim, *Pythagoras’ Trousers* (1996)



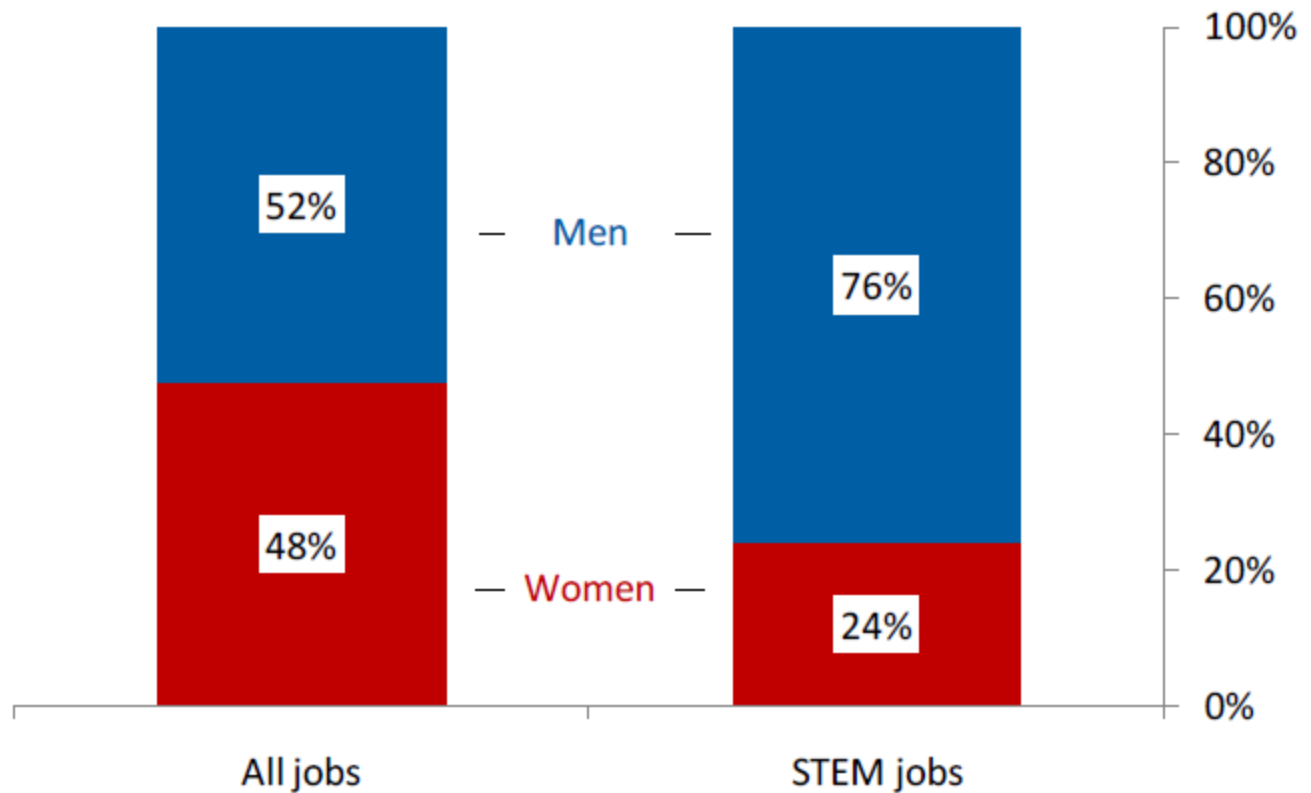
# What's Happened since the AAUW report in 2010?

- AAUW, *Why so few?*, recommendations for
  - **cultivating girls' achievement and interest**
  - **creating better environments at the college level for female students and faculty**
  - **Counteracting implicit/explicit bias in classroom and workplace**
- US Department of Commerce report, *A Gender Gap to Innovation*, 8/11
- Girls Scout Research Institute, *Generation STEM: What Girls say about Science, Technology, Engineering and Math*, 1/12
- "Brain-based" battle continues – Halpern, et al, *Pseudoscience of Single-Sex Education*, *Science Magazine* 10/11



# Total Shares of STEM Jobs 2009

Figure 1. Gender Shares of Total and STEM Jobs, 2009



Source: ESA calculations from American Community Survey public-use microdata.

Note: Estimates are for employed persons age 16 and over.

# Summary of Commerce Data

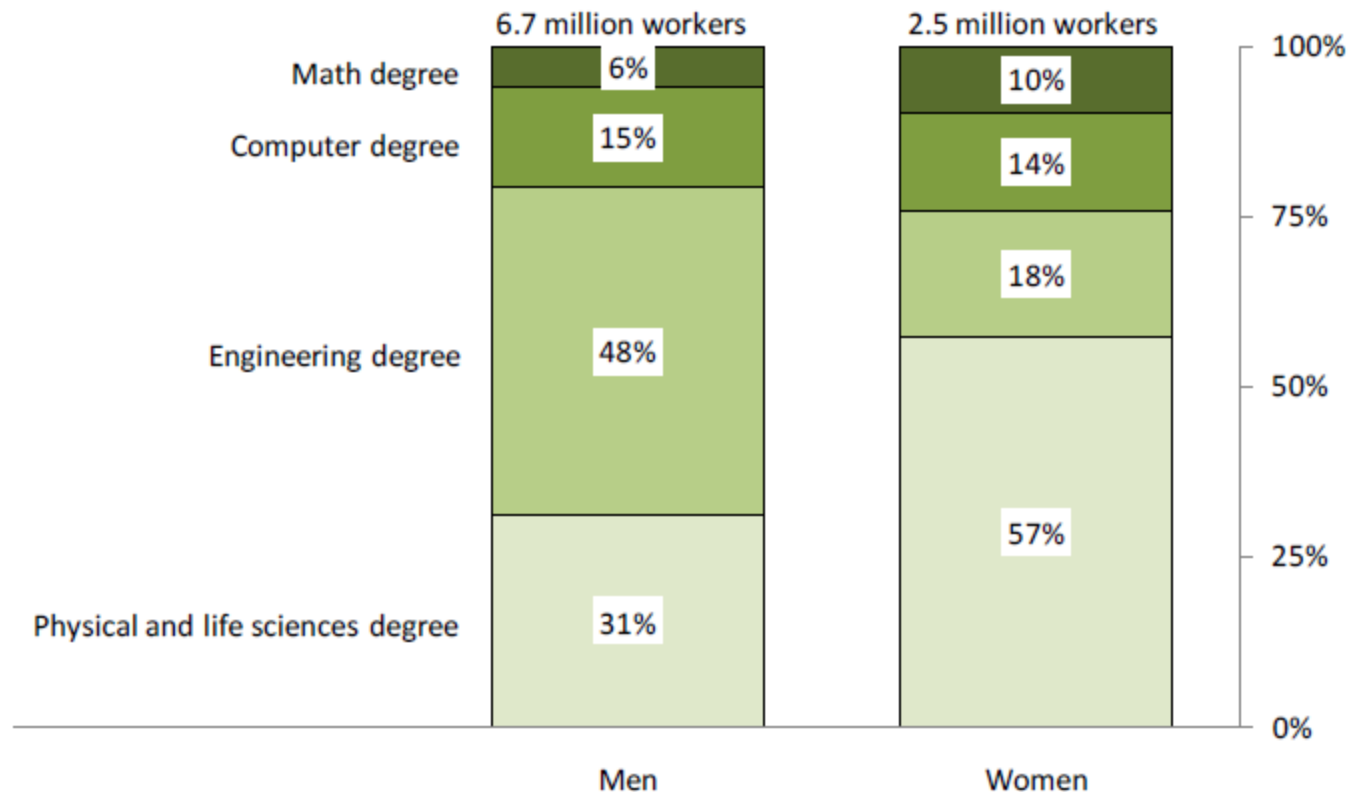


- Although in the US, women hold about 50% of the jobs, only 24% of STEM
- Women with STEM jobs earn 33% more than women with comparable non-STEM jobs
- Women hold a disproportionately low percentage of STEM undergraduate degrees
- Women with a STEM degree are less likely to work in a STEM field than their male counterparts



# Percentages of Genders by Degree

Figure 5. College-educated Workers with a STEM Degree by Gender and STEM Degree Field, 2009



Source: ESA calculations from American Community Survey public-use microdata.

Note: Estimates are for employed persons age 25 and over. The shares for men and women do not add up to 100% due to rounding.



# Girl Scout Research Institute



- Qualitative interviews – 140 girls
- Quantitative – 852 adolescent girls
- Focus on cultural reasons – (p.5)
  - *Outdated stereotypes and feelings of insufficiency can hold girls back.*
  - *The subtleties of society and culture reflect the stereotype that girls are not good at or suited for math and science and unconsciously discourage girls.*
  - *Compared to boys, girls with the same abilities are more likely to give up when the material is difficult and to talk themselves out of pursuing the field*

# Percentage of Girls Interested in STEM fields vs. Not interested in STEM

<b>% WHO AGREE...</b>	<b>STEM</b>	<b>NON-STEM</b>
Whatever boys can do, girls can do.	97	91
If I try really hard at something, I know I will succeed.	95	88
I'm a hard worker.	93	87
When someone tells me I can't do something, I try to prove them wrong.	94	89
Obstacles make me stronger.	91	85
I get frustrated if something is too hard.	79	86
I try to pursue things I'm naturally good at and avoid things that are hard for me.	66	79
I'm smart enough to have a career in STEM.	92	68
I am smarter than other girls my age.	71	51
I am more driven than other girls my age.	64	48





# Some of the qualitative responses:

*I think some girls don't want to do [STEM] because they don't think it's something girls should do. It's a boy subject; they should stay far away from it.*

—teen girl, Indianapolis, Indiana

*I think sometimes girls don't want to go into STEM careers because women who do that are nerds and not the kinds of girls that guys are looking for sometimes.*

—teen girl, Seattle, Washington

*My dad always tells me this is where you have the potential... not arts, but engineering. Having parents that push you or let you think about it. Support you with whatever you do. If you have the support it makes you believe in it, even if nobody else does.*

—teen girl, Austin, Texas



# General Conclusions from GSRI report

- Girls are interested in the process of learning, asking questions and problem solving
- The majority of girls find STEM fields interesting
- The girls who are interested in STEM are high achievers who have a supportive network of adults, but often do not consider it their first career choice
- African American and Hispanic Girls have high interest and work ethic, but fewer supports, lower academic achievement and lower exposure to STEM fields.



# The latest in the “Brain-Based” battle

- Science Magazine, September 2011
- Claims that single-sex classrooms in public schools showed no evidence of academic advantage (required by Title IX)
- “few sex differences in children’s brains” which do not justify separate classrooms or teaching styles
- Separating by gender only exaggerates sex-typed behaviors



*Institutional Sexism Disguised as Choice*

*No Evidence from Brain Research*

*Negative Impacts of Highlighting Gender*

EDUCATION

## The Pseudoscience of Single-Sex Schooling

Diane F. Halpern,<sup>1\*</sup> Lise Eliot,<sup>2</sup> Rebecca S. Bigler,<sup>3</sup> Richard A. Fabes,<sup>4</sup> Laura D. Hanish,<sup>4</sup> Janet Hyde,<sup>5</sup> Lynn S. Liben,<sup>6</sup> Carol Lynn Martin<sup>4</sup>

Single-sex schooling lacks scientific support and may exaggerate sexism and gender stereotyping.

# Girls' Attitudes Towards PBL

“I could be on the side where I like to solve it this way and someone else could be on the side where they like to solve it that way, and the fact that we both get to express our opinions - and even if one of us is wrong and one of us is right, or even if both of us is right. It's changed my identity and given me kind of like a voice in math. Whereas I didn't really have one before. It was a silent voice.”

-Leona, sophomore



# Girls' Attitudes Towards PBL

“When you’re at the board and they’re asking you questions of like other ways how to do it...because sometimes there’s more ways, like alternate ways to solve a problem, so other people have like different viewpoints on it rather than just the teacher standing up there telling you how to do...telling you the steps how to find it.”

-Sarah, freshman





# Girls' Attitudes Towards PBL

"I like to think about like compared to me throwing the shot put without the technique. Because like you could just do it with just brute strength but it...and you could do it faster. But you would have to backtrack and go through the steps through the technique and learn it like down from...like start from the bottom, and build yourself back up and it goes slower, but in the end you'll like throw it so much farther. Just like when you do geometry, it takes like...it's a slower process...but it's so much better in the end. And you feel smarter...I didn't really understand what is the point of math, I didn't want to go in any career involving math, but I feel like once you understand the connection, you actually become smarter and you can make connections in other things as well."

-Kacey, sophomore





Isabelle: And then the teacher talked and you took notes sometimes and then you went home and did your homework, so there wasn't much interaction with others in the class then so it wasn't very fun

Ms. S.: What was, what was more enjoyable about the interaction do you think?

Isabelle: Um... Well you got to like speak your ideas out loud so it's in the- it's easier to think, at least for me, when I'm talking about it, because then I just have to make up random stuff but sometimes like it actually works...

Ms. S.: And so like when it works [both laugh] you're like "oh that was fun"

Isabelle: Yeah

Ms. S.: [laughs] What about when it doesn't work, is it still fun? Or is it kind of like...

Isabelle: Um, yeah, because it's kind of like a puzzle, and I like puzzles [laughs]



“[It allows] you [to] kind of add in your perspective and it kind of gives this sense like ‘Ooh, I helped with this problem’ and then another person comes in and they helped with that problem and by the end no one knows who solved the problem. It was everyone that solved the problem. Like, everyone contributed their ideas to this problem and you can look at this problem on the board and you can maybe only see one person’s handwriting, but behind their handwriting is everyone’s ideas. So yeah, it’s a sense of ‘our problem’: it’s not just Karen’s problem, it’s not just whoever’s problem, it’s ‘our problem.’”

*-Kacey, sophomore*

## So far what I've found

- Desire for more agency in learning community
- Unfilled, unsatisfied in mathematical learning environments that are disagentic
- Appreciative of opportunities for share and hear others' ideas, multiple perspectives are not confusing in most of cases
- Appreciative of sense of collaboration and non-authoritative community



## Theory and Practice (Boaler, 2003)

- Encourage Agency and Voice – agency should move between discipline and student
- Ask students to present ideas before they are finished working on problems – allows for building on ideas
- Change role of “audience” to feedback – gives authority
- Encourages collaboration and sharing with connected knowledge





# Resources



- STEM Equity Pipeline at <http://www.stemequitypipeline.org/>
  - **Archived webinars, newsletters**
- National Girls Collaborative Project <http://www.ngcproject.org/>
- National Coalition of Girls' Schools Advancing Girls in STEM: An NCGS Symposium (2011) <http://www.ncgs.org/stem-symposium-2011/post-symposium-materials/>
  - **Powerpoints, videos, handouts from all of the speakers and workshops**