The Nuclear Workforce And Excellence

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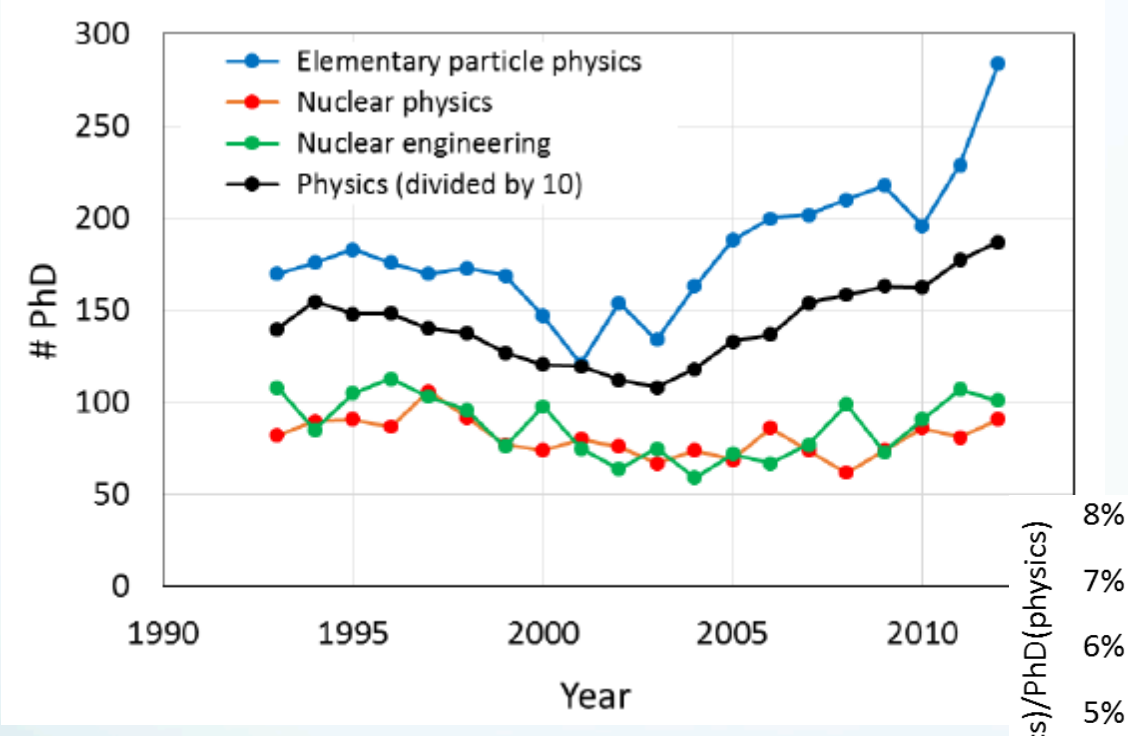
Key Points (TL; FA)

- Nuclear science community and DNP Education Committee are doing great work in recruiting to fulfill workforce needs
- Diversity in workforce can lead to innovation
- People aren't particles

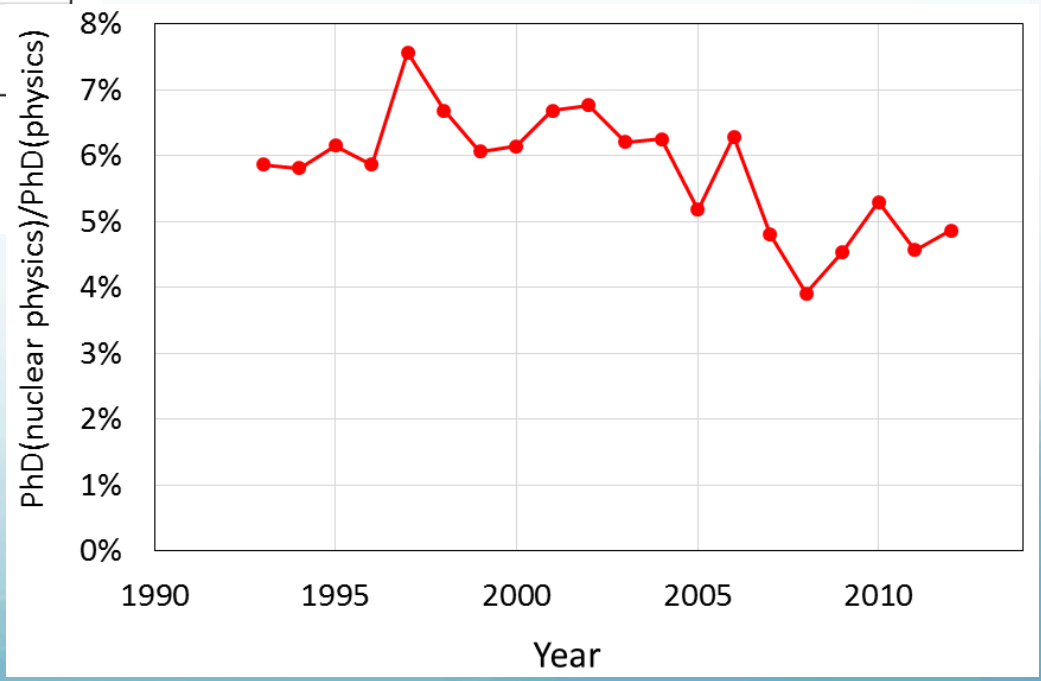
Status of Nuclear Workforce Development

Number of PhDs per year



83 Nuclear PhD Granting Institutions in 35 states

Fraction of PhDs in Nuclear Physics

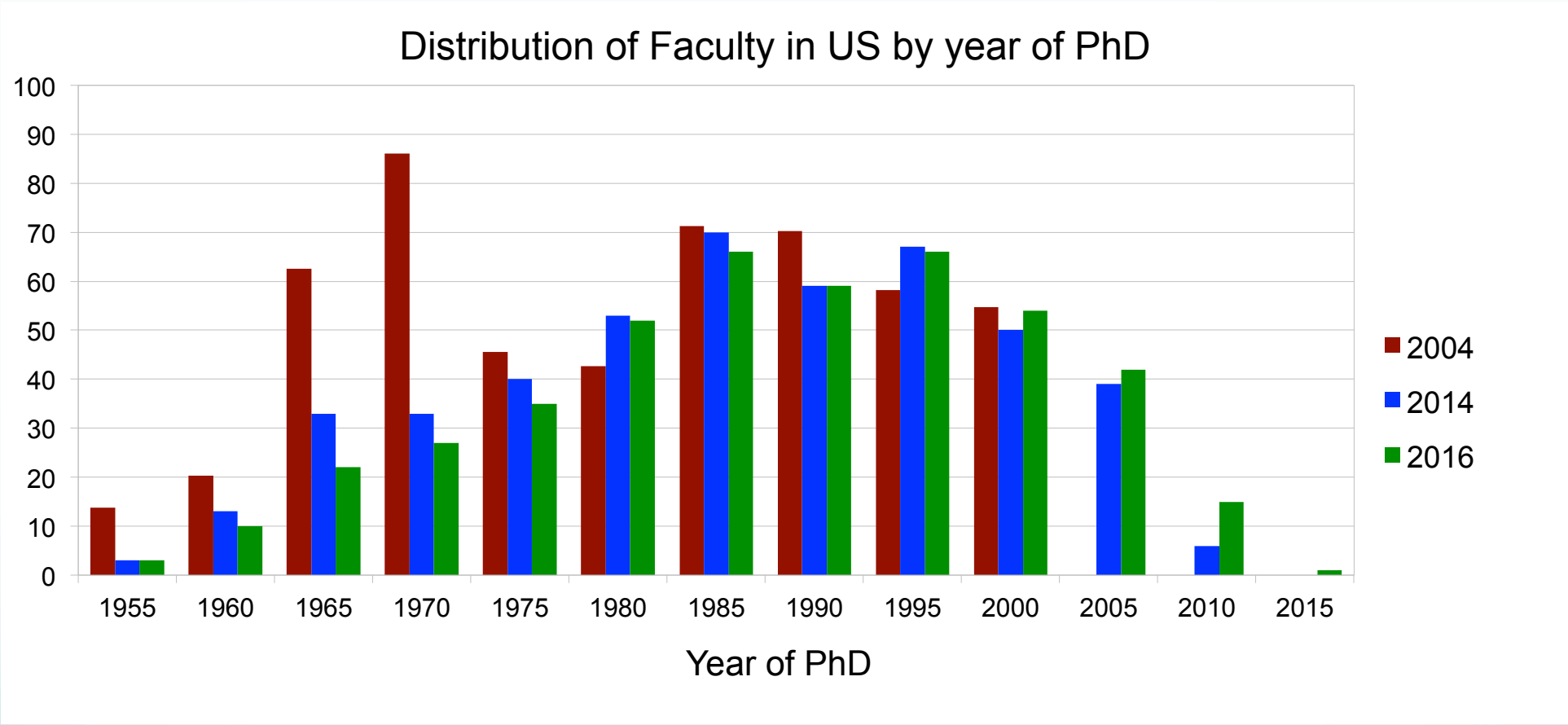


http://www.nsf.gov/statistics/sed/2013/data-tables.cfm

DNP Education Committee

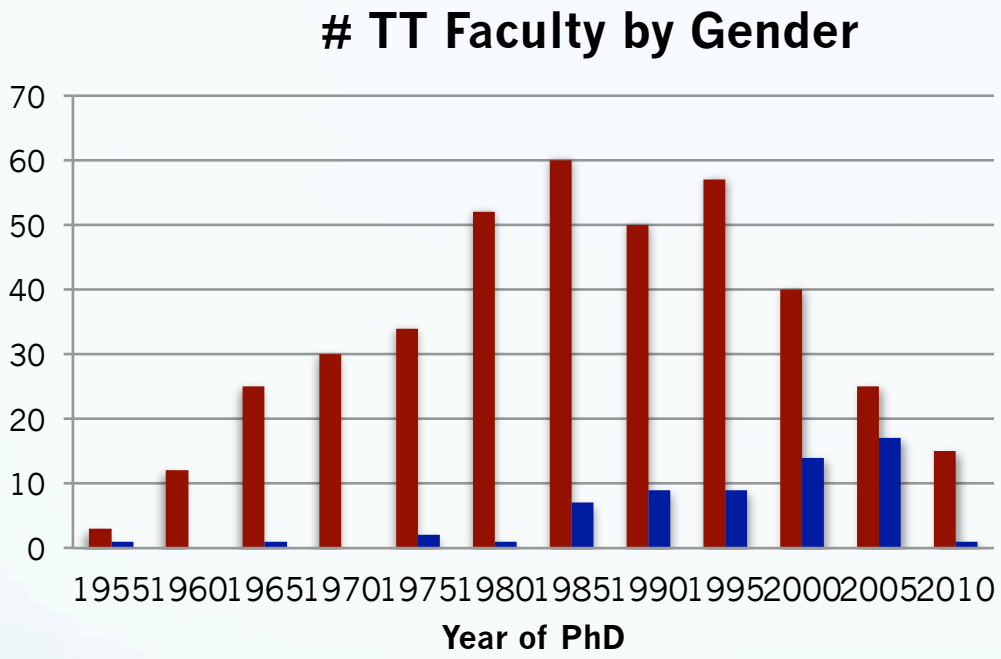
- Faculty Database
- CEU 20th Anniversary
- Diversity Workshops at annual DNP Meeting

US Workforce Status

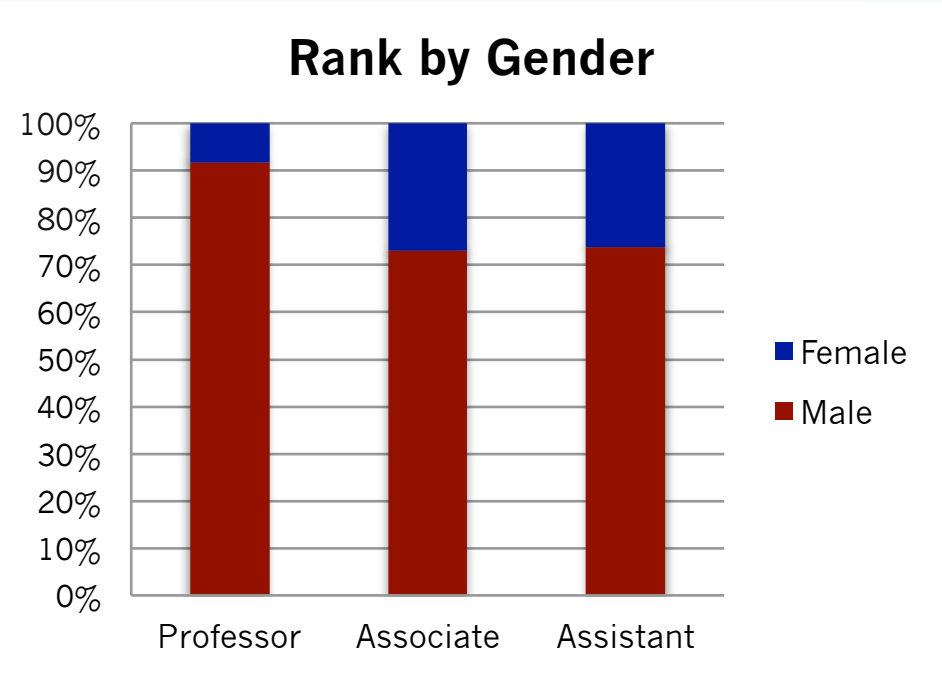


2014 N = 466
2016 N = 452

Faculty Diversity



Only 26/35 states have women among their Nuclear Tenure Track Faculty



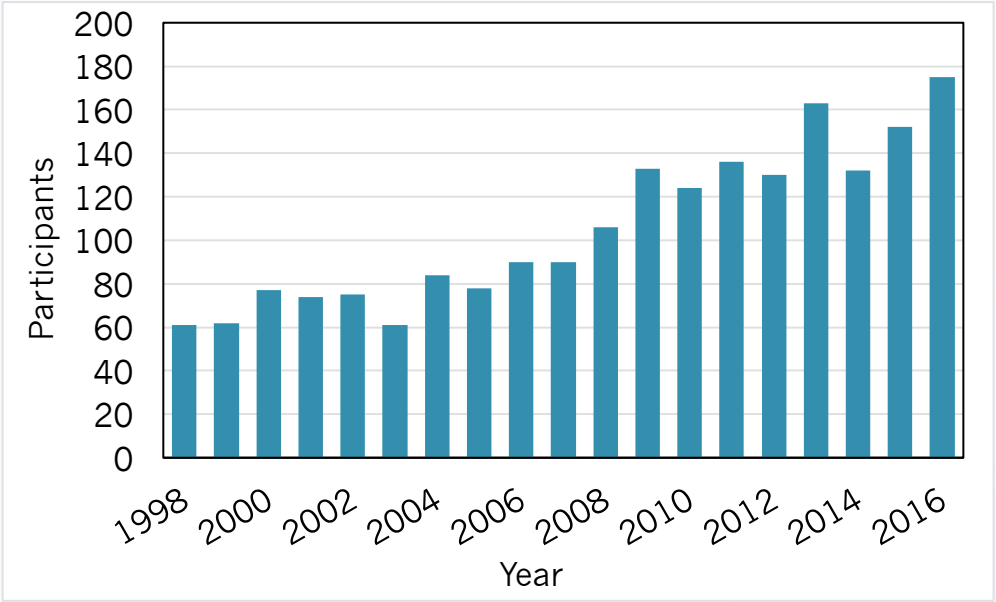
Nuclear Workforce

- 80% of PhD students work in applied fields (medicine to homeland security) while only 20% continue in fundamental research in nuclear science
- The 2012 NRC report stressed that the increasing needs for a nuclear workforce for medicine, health physics, and energy come at a time when the nuclear force is shrinking

Report from the DNP town meeting on Education and Innovation. Thoennessen, Peaslee

Conference Experience for Undergraduates

- 20th Anniversary!
- DNP Events
  - Plenary session includes talks by CEU alumni
  - Mini-Symposium
- CEU now directed by alumna, Shelly Lesher
- 40% who go to graduate school choose nuclear



This year, 223 applicants!

Biggest complaint: Not enough schools at graduate fair
Free, National Labs can join, contact slesher@uwlax.edu

DNP Diversity Workshops

- 2015 Valerie Purdie-Vaughns - Stereotype Threat
  - Sponsored by Brookhaven, JINA-CEE, DNP
- 2016 Laura Liswood – Moving Beyond Diversity
  - Sponsored by JINA-CEE, DNP, TRIUMF
- 2017 Mary James – Access (planned)

Nuclear Science is a Leader in Education

- K-12 Outreach inc Lab tours
- REU
- CEU
- Graduate Brochure
- Summer Schools

1. Inspire
2. Educate
3. Recruit
4. Train
5. Hire the BEST

Why Diversity?

Does Nuclear Science need diversity?

What is a diverse group?

What if I just want to hire (or be hired) for excellence?

Problem Solving

Homogeneous

- Faster
- Members happy with solution
- Good solution

Heterogeneous

- Slower
- Members not as happy with solution
- Better solution

The Loudest Duck by Laura Liswood

Diversity in Business

Pros

- Skill complementarities
- Different information
- Stimulates efficiency
- More innovation
- Diversity in ideas, hobbies, culture

Cons

- Less cohesive
- More conflict
- Communication problems
- Less in common to talk about over the water cooler

Gender and race are often indicators of diversity of thought, but if you only hire women/URM who “lean in” and conform to the existing culture, you’re missing out on the benefits

Kets, Willemien and Sandroni, Alvaro, Challenging Conformity: A Case for Diversity (September 11, 2016). Available at SSRN: https://ssrn.com/abstract=2871490 or http://dx.doi.org/10.2139/ssrn.2871490

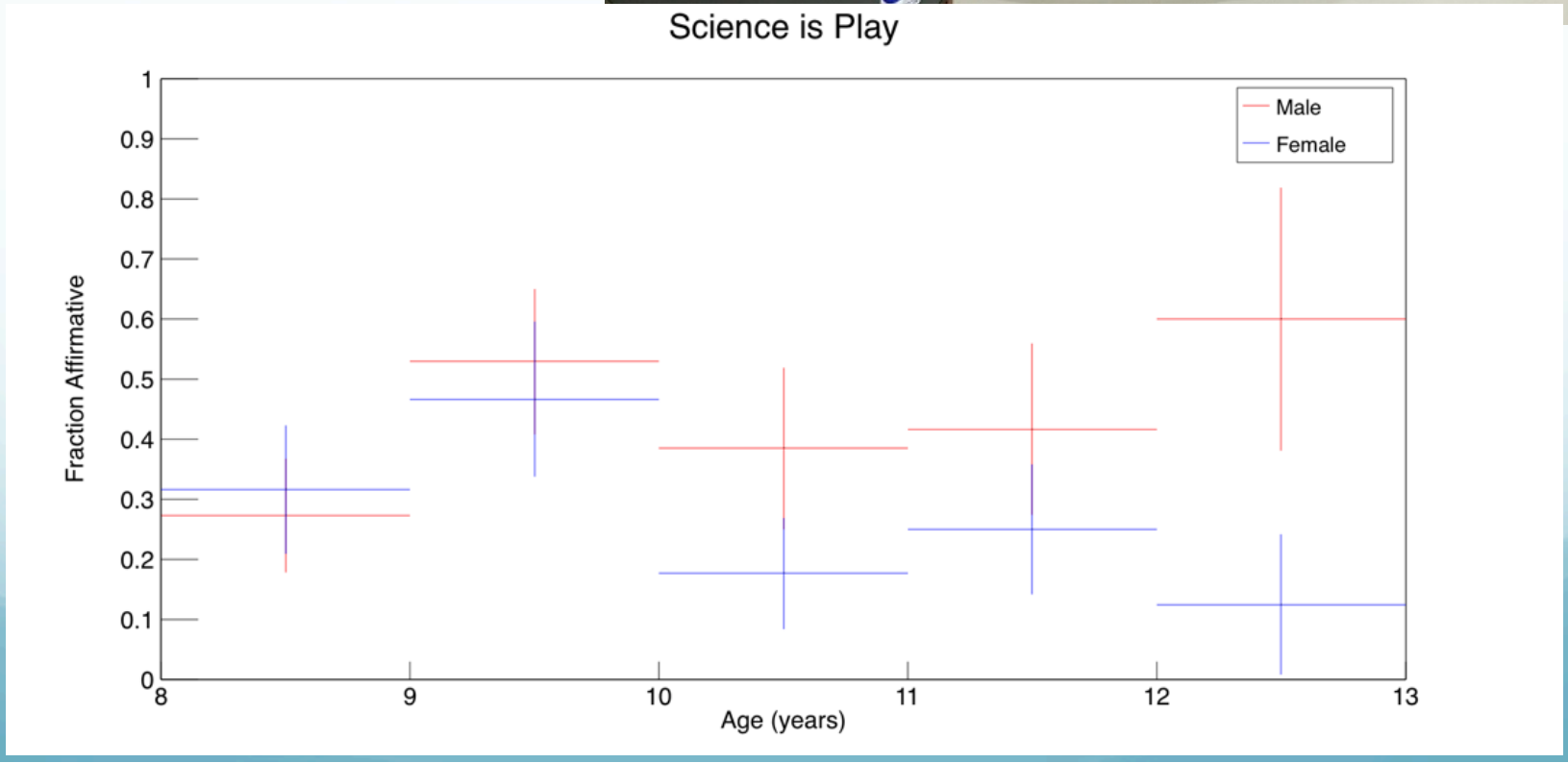
People != Particles

- We quantify and categorize for efficiency
- Societies do this through stereotypes
- People don’t stay in boxes as nicely as particles do
- Boxes can blind us to excellence

Art 2 Science Camp

Large-enrollment camp
120-190 students
Ages 8-12

Pre and post surveys =
lots of data!



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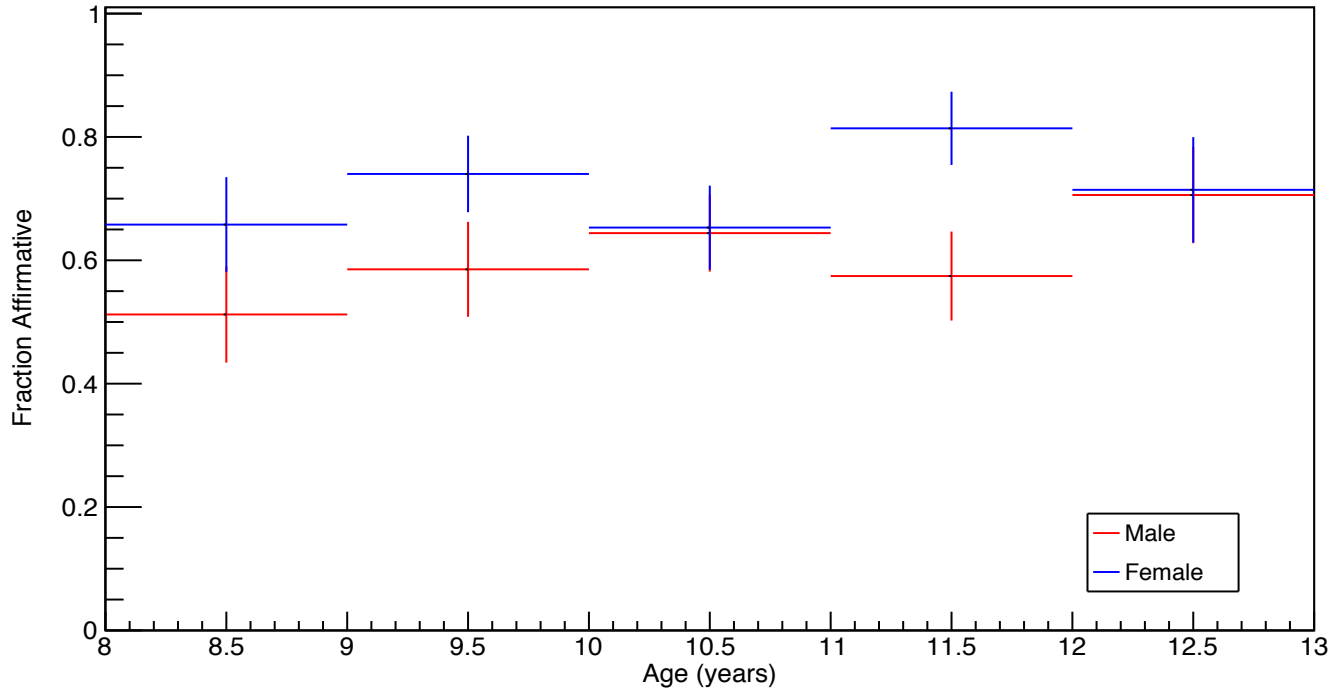
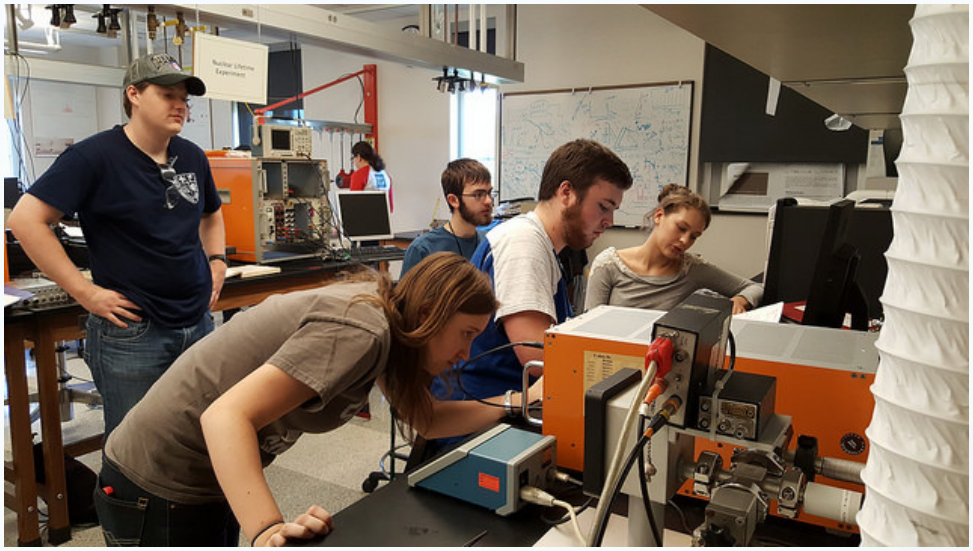
Science is Reading



Physics of Atomic Nuclei

- Training camp for highly interested HS students
  - 24 years at MSU
  - 9 years at ND
- Free, week-long residential program
  - Lectures from experts
  - Nuclear science experiments



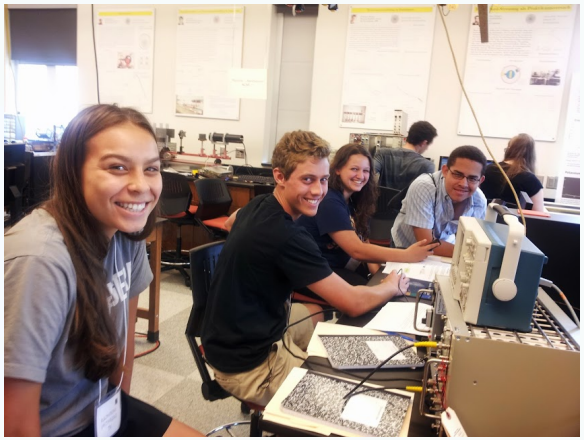
Physics of Atomic Nuclei

- 200+ applicants
  - Accept 24 MSU, 20 ND
  - Average 25% female applicants in 2012
  - 33% female applicants this year – they're getting the message!

My parents and teachers have especially encouraged me to pursue my love of science because there are so few women in science, engineering, and technical fields, and I am sure the physics of atomic nuclei is no exception.

Science needs women….
These women have energized my interest in science and I hope to do the same for other young women in the future.

PAN Research



- Longitudinal Study
  - 9x more likely to major in STEM
  - Being able to *see themselves doing science* is key
  - Students score equally on knowledge pre/post test but female students *rate own ability lower*

Maximizing Future Potential in Physics and STEM: Evaluating a Summer Program Through a Partnership Between Science Outreach and Education Research. Zachary Constan, Justina Judy Spicer ***Journal of Higher Education Outreach and Engagement[1]s*** **issue 19(2),** pp. 117-136 **June 2015**

JINA Outreach Pipeline

If students don't see people like themselves* as scientists, they're less likely to view themselves as a possible scientist

Art 2 Science → Art 2 Science Junior Counselors

Boy/Girl Scout Nuclear Badge Workshops → PAN

Math, Science and Technology at MSU → PAN

PAN → Undergraduate Research → Graduate School

PAN Research

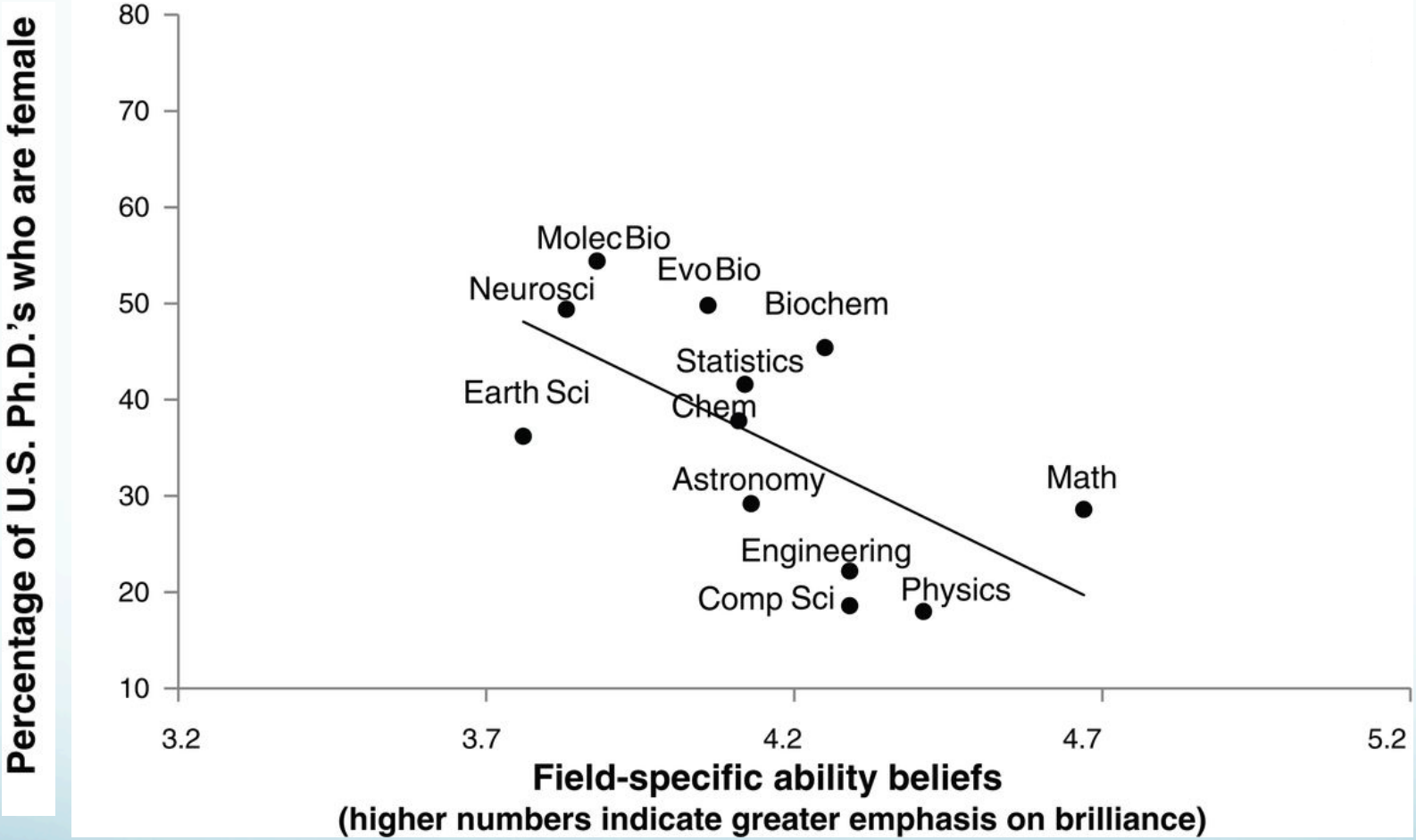
- Follows previous work across STEM (eg. Medical - Trix 2003, Chem - Schmader 2007)
- PAN applications require two recommendations
  - Quantitative and qualitative
- Study on implicit bias in recommendation letters
  - Males described as having “innate talent/ability”
  - Females described as ”trying hard”
  - Comments on females' personality
  - Not enough statistics for racial analysis

Recommendation

- In my sixteen years of teaching at X School, they are one of about four students (with the same gender) who have shown great promise as a future leader in Science.
- I appreciate X's confidence in their abilities. Coupled with an innate, intrinsic motivation to learn, I am confident that they will thrive in a rigorous science summer program.
- X is a leader, and although they can be soft-spoken, they are never overlooked by their peers. I do not think they know what a role model they are to others, and their actions often speak louder than their words.
- I found X to be consistently hard-working, tackling all assignments with dedication and a smile. Their performance in my AP Chemistry class last year proves that they will be a valuable addition to any program.
- X is quiet but friendly and always has a smile on their face. They are respectful to both peers and the faculty at the high school.

We all have bias, and need to keep it in mind if we want excellence!

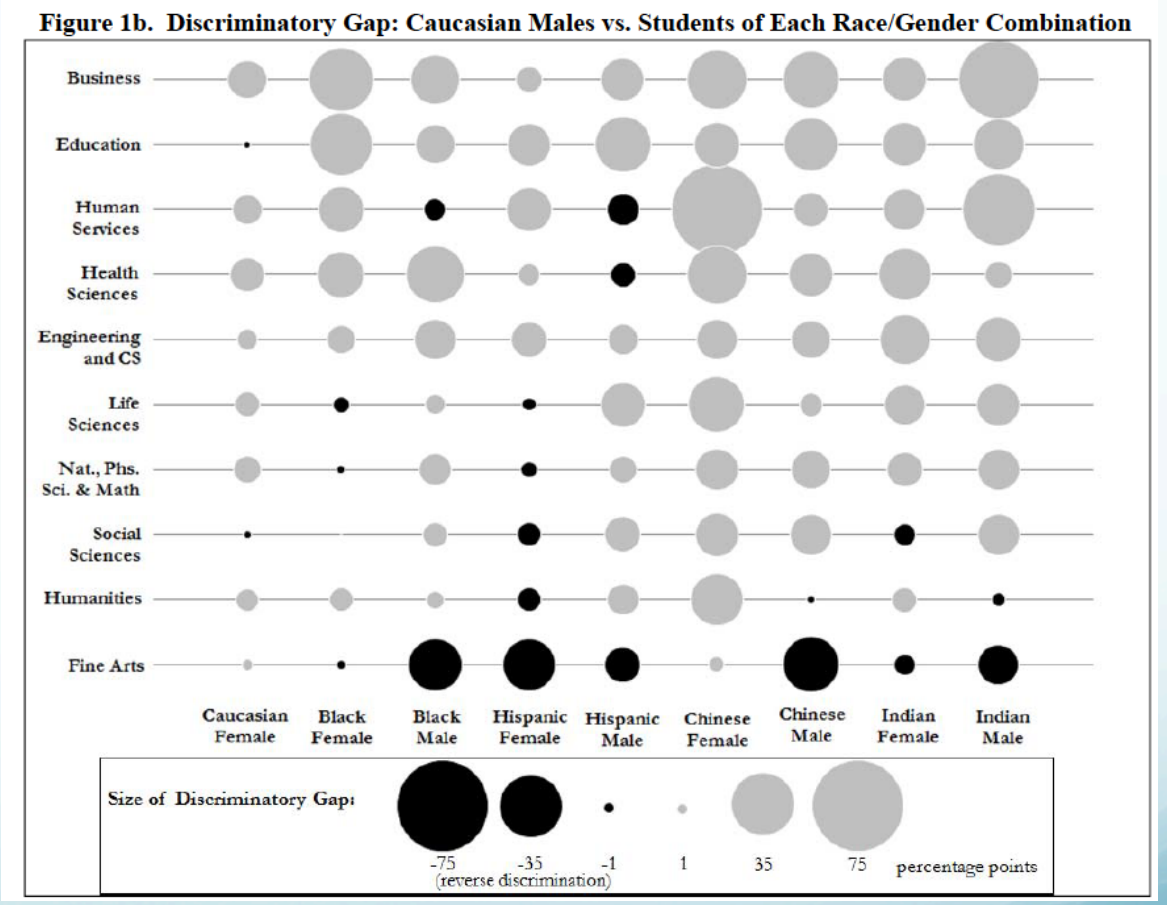
Brilliant or Dedicated?



Sarah-Jane Leslie. Andrei Cimpian, Meredith Meyer, Edward Freeland
Science 16 Jan 2015: Vol. 347, Issue 6219, pp. 262-265 DOI: 10.1126/science.1261375

Pathways of Grad Students

- Prospective Graduate Student" emails professor asking to talk about their research.
  - 6,548 TT professors
  - 259 Universities
  - 109 disciplines
- "Frequency of response rate by race and gender



"What Happens Before? A Field Experiment Exploring How Pay and Representation Differentially Shape Bias on the Pathway into Organizations." K. L. Milkman, Journal of Applied Psychology, Forthcoming

Who's the Best Candidate?

Yale researchers asked 127 Bio, Chem, Physics Faculty to rate identical application materials from John/Jennifer for a laboratory manager position

Suggested Average Salary

$26,507.94
$30,238.10

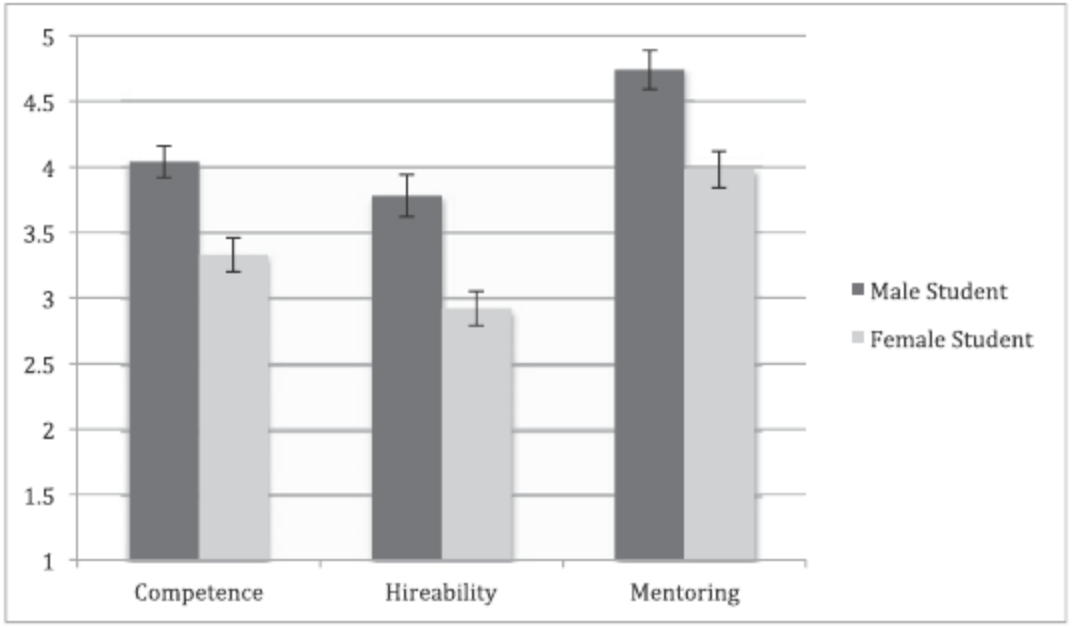
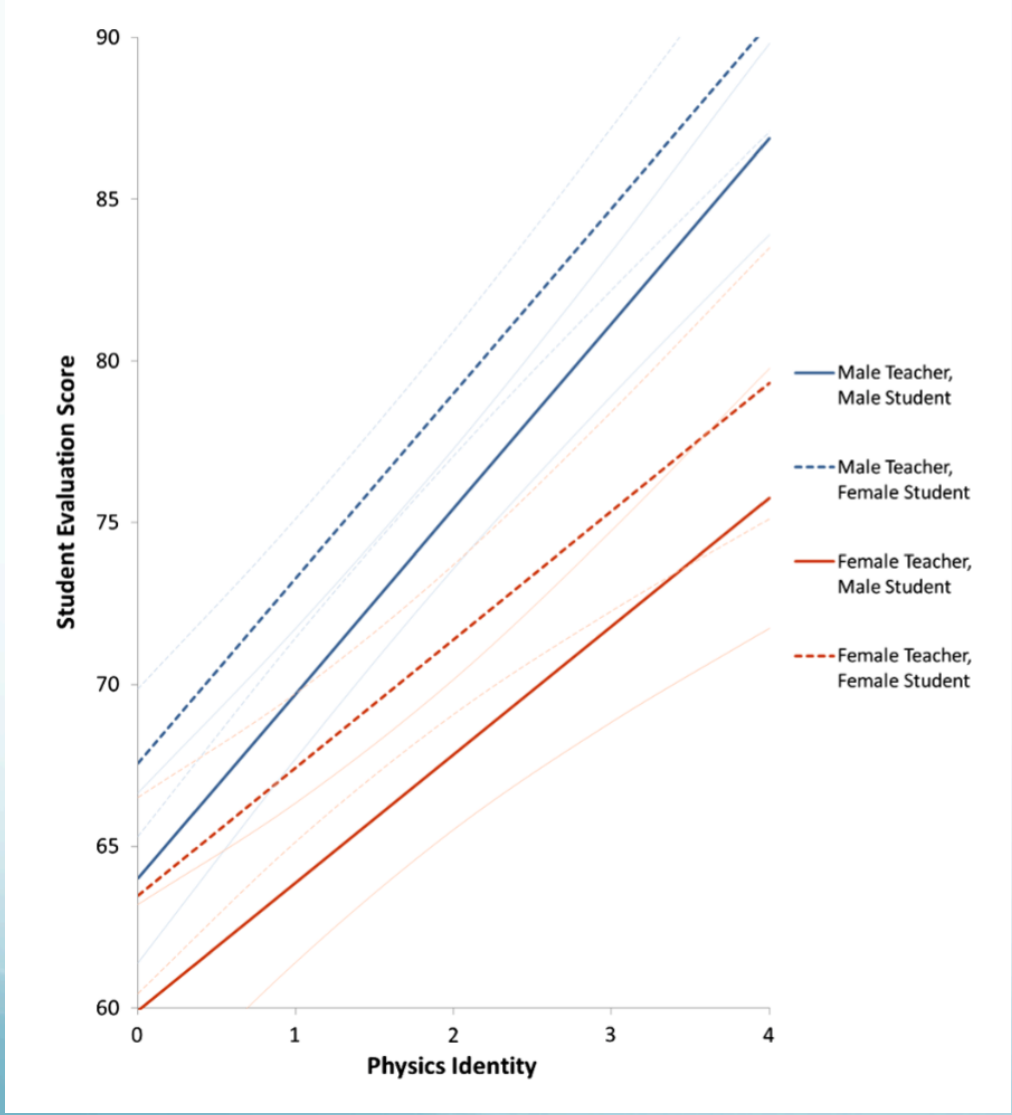
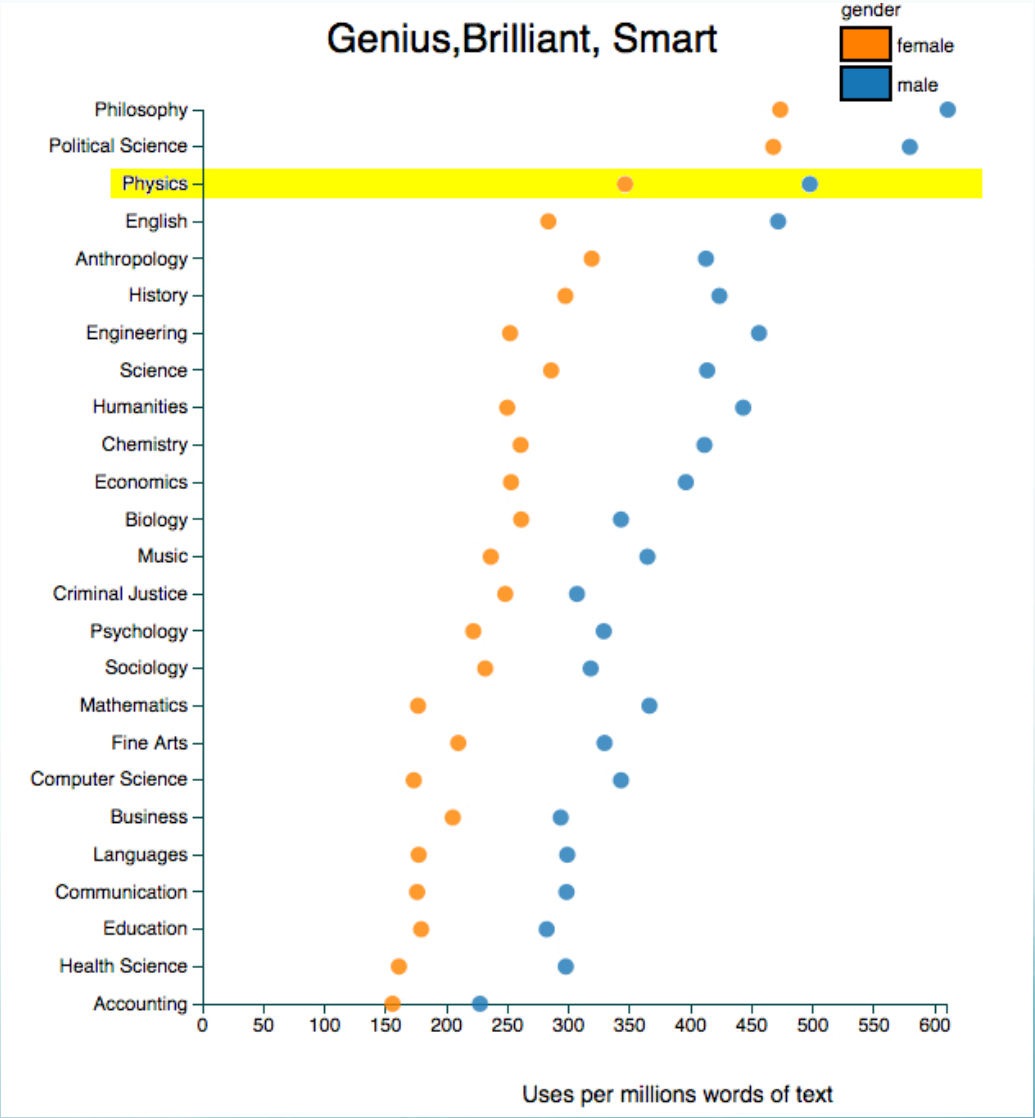


Fig. 1. Competence, hireability, and mentoring by student gender condition (collapsed across faculty gender). All student gender differences are significant ($P < 0.001$). Scales range from 1 to 7, with higher numbers reflecting a greater extent of each variable. Error bars represent SEs. $n_{\text{male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

Moss-Racusina,et al. PNAS, October 2012

Who's the Best Candidate? Student Evaluations

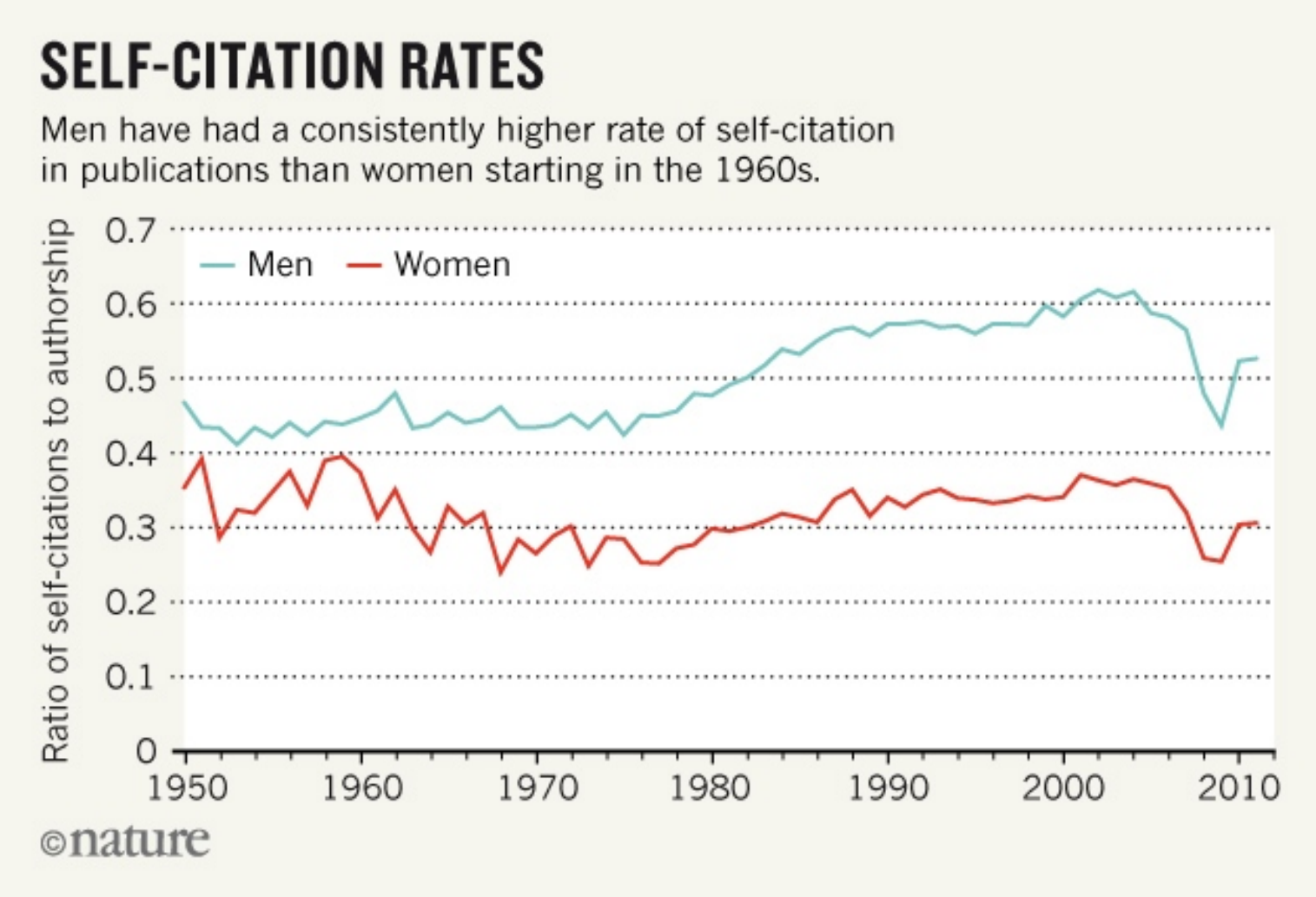




Geoff Potvin and Zahra Hazari. Student evaluations of physics teachers: On the stability and persistence of gender bias. Phys. Rev. Phys. Educ. Res. 12, 020107. August 2016

http://benschmidt/profGender

Who's the Best Candidate? Citations



Nature 535, 212 (14 July 2016) doi:10.1038/nature.2016.20176

Who's the Best Candidate? Grants

TABLE 1. TWO-SAMPLE SUMMARY STATISTICS COMPARING NUMBER AND PROPORTIONS OF WOMEN AND MEN PRINCIPAL INVESTIGATORS AND GRANTS THEY SUBMITTED

Variable	*Both sexes*	*Women (%)*	*Men (%)*	p *value*[a]
Mean number of submissions per person[b] (±SD)	2.6 (2.1)	2.3 (2.0)	2.7 (2.5)	<0.001
Number and % of PIs submitting >1 grant	1357 55%	361 50%	996 57%	0.002
Mean number of years requested (±SD)	3.3 (1.6)	3.1 (1.6)	3.4 (1.6)	<0.001
Median amount requested (direct costs, year 1)	$134,494	$115,325	$150,000	<0.001
Grants that were resubmissions	969/6312 (15%)	227/1636 (14%)	742/4676 (16%)	0.09
Number of grants funded (% success rate)	2792 (44%)	678 (41%)	2114 (45%)	0.002
Number of first submissions funded (% success rate)	2320/5343 (43%)	581/1409 (41%)	1739/3934 (44%)	0.06
Number of resubmissions funded (% success rate)	472/969 (49%)	97/227 (43%)	375/742 (51%)	0.05
Number of investigators funded for at least one grant (%)	1569 (63%)	428 (59%)	1141 (65%)	<0.001

Gender differences in research grant applications and funding outcomes for medical school faculty. J Womens Health (Larchmt). 2008 Mar;17(2):207-14. doi: 10.1089/jwh.2007.0412.

Summary

- Nuclear Science does a lot of things well in recruiting future generations of our workforce
  - Be sure to get a table at the CEU Graduate Fair!
- People are bad at judging quality in other people
- Life would be easier if people were particles