BETTER SCIENCE, BETTER LEARNING THROUGH INCLUSIVE TEACHING

Teaching Arts Luncheon
December 9, 2016
Patricia DiBartolo, Faculty Director of the Sciences

THE WHAT AND WHY OF INCLUSIVE EXCELLENCE

Better teaching, better learning, better science

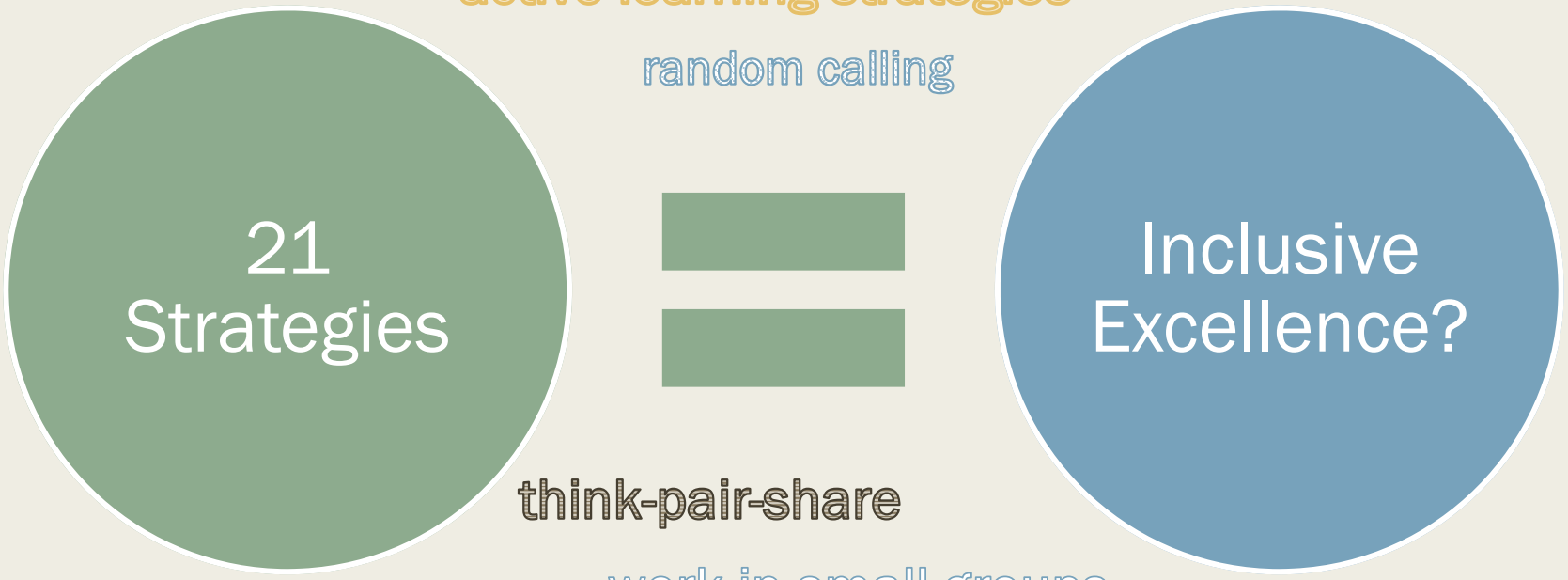
multiple hands, multiple voices

do not try to do too much

allow time to write

active-learning strategies

random calling



think-pair-share

work in small groups

know names

Assess every student, every class

do not judge responses

Based on Tanner (2013)

CRAFT KNOWLEDGE

multiple hands, multiple voices

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Assess every student, every class

do not judge responses

belongingness

identity

capacity

confidence

relevance

Based on Graham et al. (2013); Packard (2015)

SMITH COLLEGE

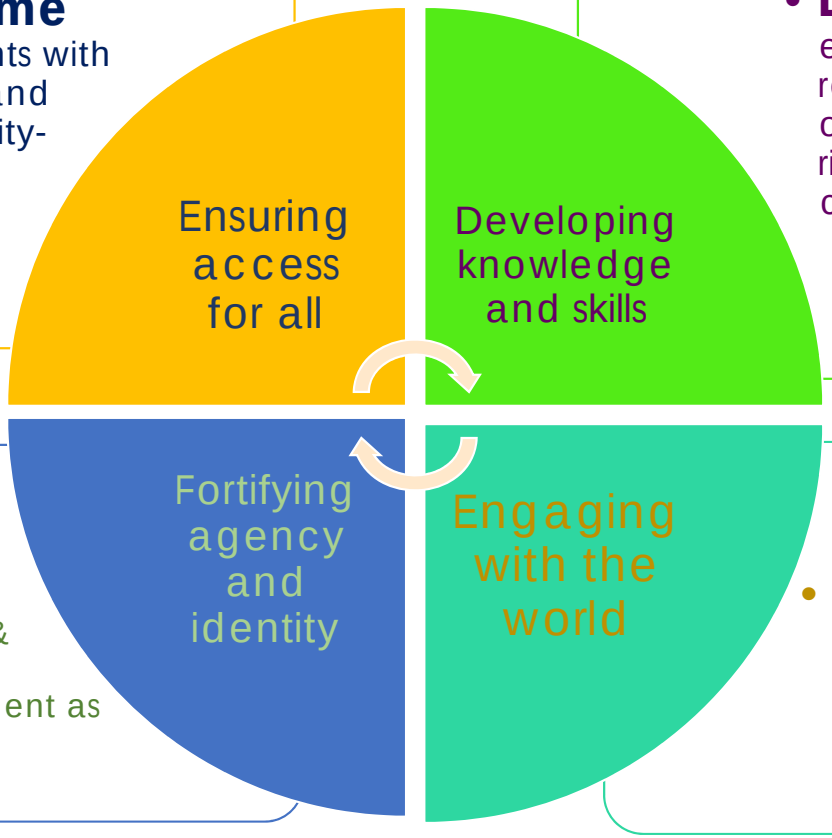
Cultivating the scientist

- **Welcome** *all* students with support and community-building

- **Develop** expertise through research opportunities & rigorous coursework

- **Fortify** mindsets & identity development as scientists

- **Connect** students to real-world problems through multiple disciplines



Vision for the Future (November, 2014).

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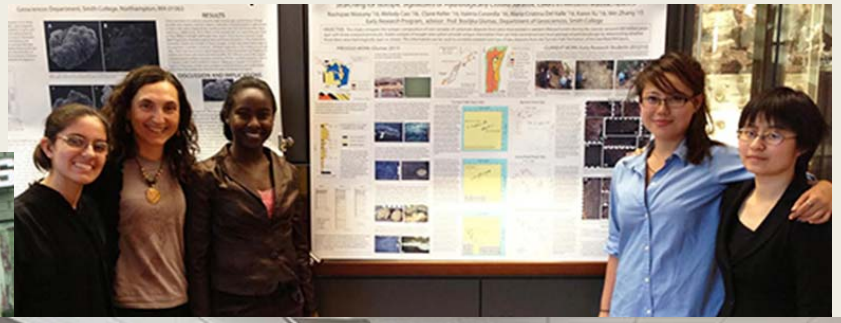
WHOA!

WHOA!

DEEP BREATH...

authentic



welcoming

engaging

messy

challenging

active

collaborative

interdisciplinary

WHAT NEXT?

Common Sticking Points

COURSE CONTENT & SCAFFOLDING

Content first

COURSE CONTENT & SCAFFOLDING

- Use active learning and formative assessment
  - *More reading, studying, & community (Eddy & Hogan, 2014)*
- We can't get rid of stuff, can we?!
- Keep important stuff and make it relevant and engaging
  - *Core content and competencies (AAAS, 2010)*
  - *Difficult and Misconceptions*

belongingness

relevance

capacity

confidence

identity

Engagement through Active Learning

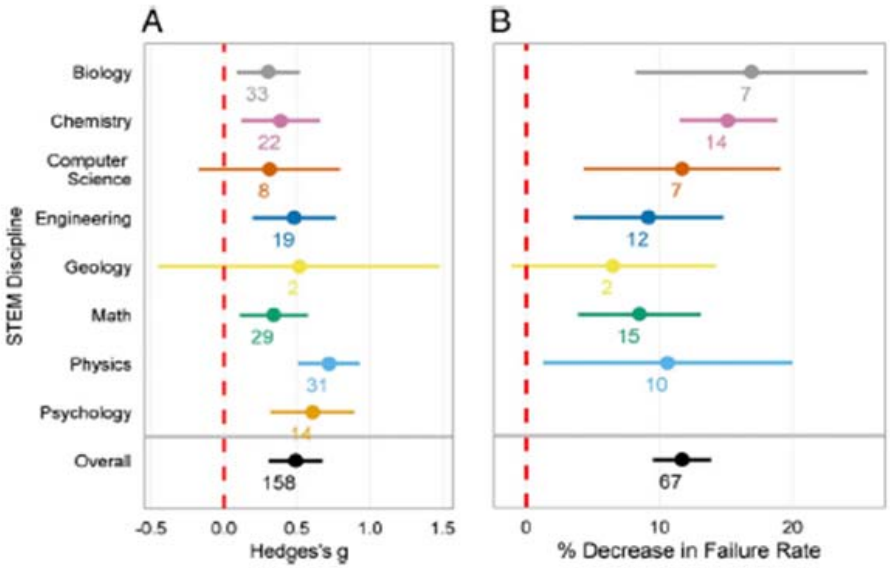
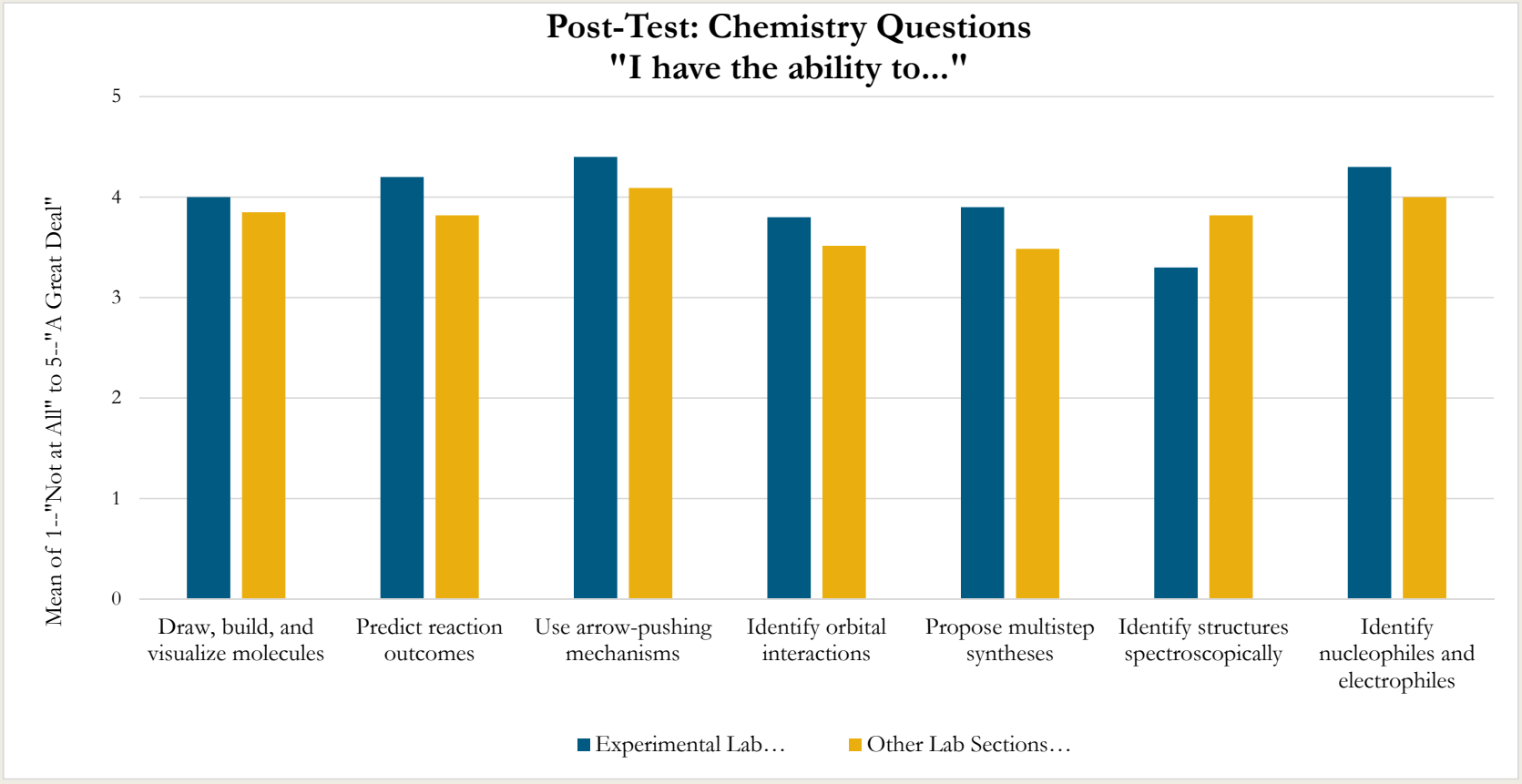


Fig. 2. Effect sizes by discipline. (*A*) Data on examination scores, concept inventories, or other assessments. (*B*) Data on failure rates. Numbers below data points indicate the number of independent studies; horizontal lines are 95% confidence intervals.

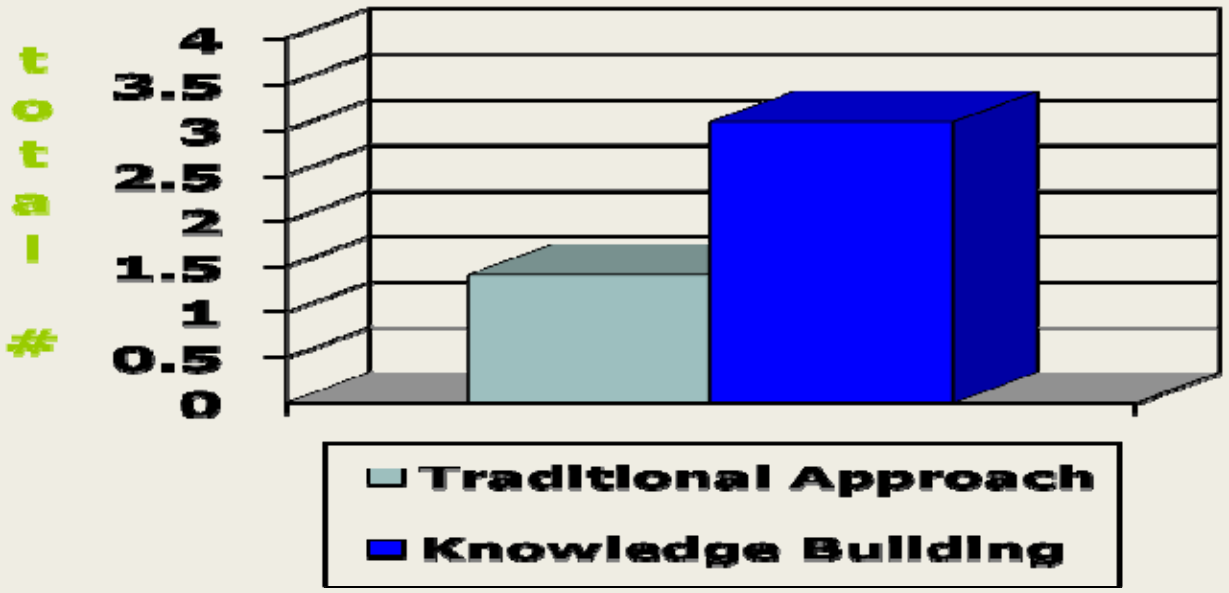
Freeman et al. (2014). *PNAS, 111*, 8410-8415.

Get Rid of Stuff?!



Shea, McGeough, Trotta, & Williams. (under review).

Better Lab Reports with Less Practice



$F(1, 20)=13.31$, $p<.01$

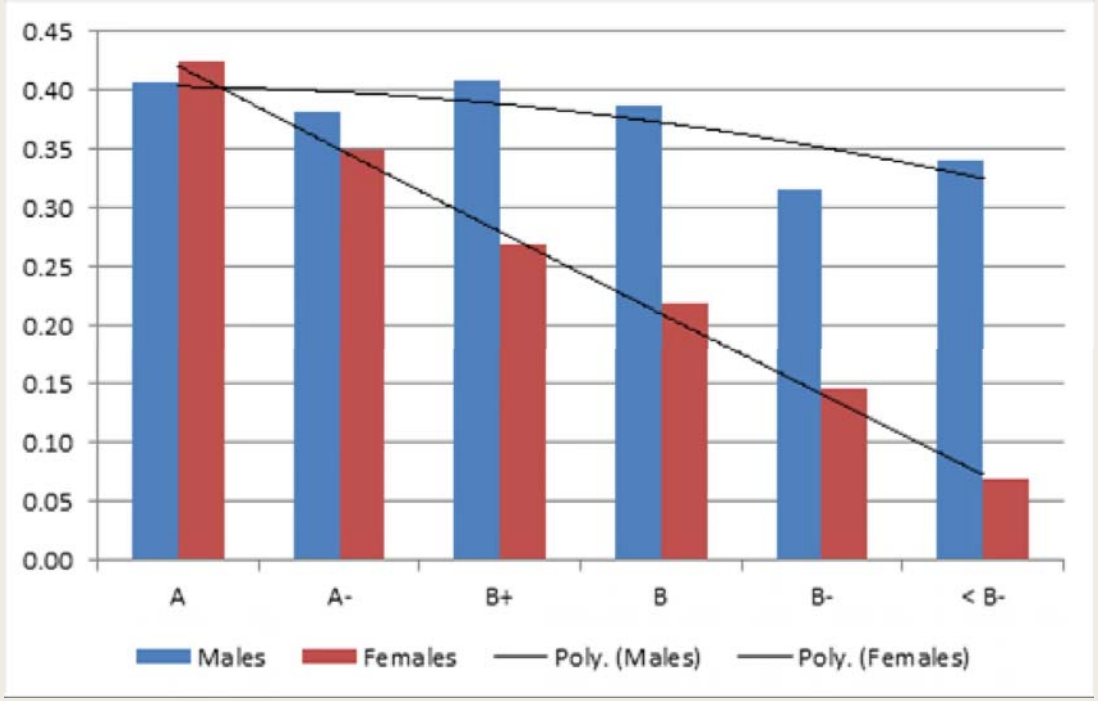
From DiBartolo & Rudnitsky (2011).

Student reflection

I think the experiment-based lab section is good for us in the kinda hellish, mostly intangible, and probably wishful way that eating spinach and waking up early is good for us - in the long run, I believe it will make us better (scientists, people, whatever).

FEEDBACK

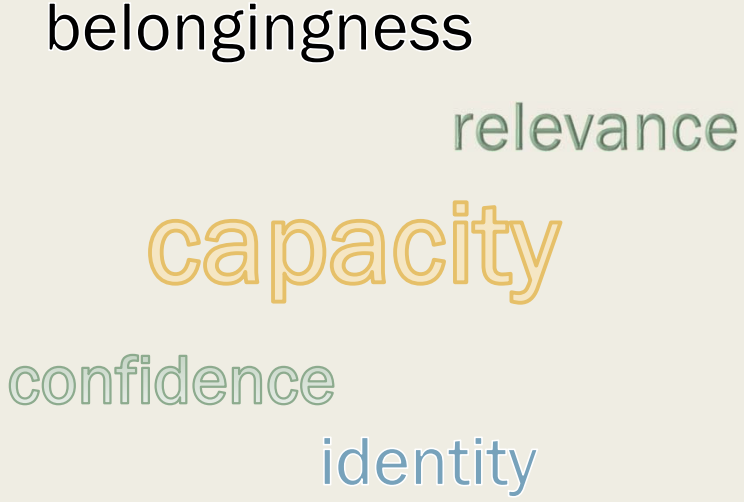
Equal Feedback, Inequitable Outcomes?

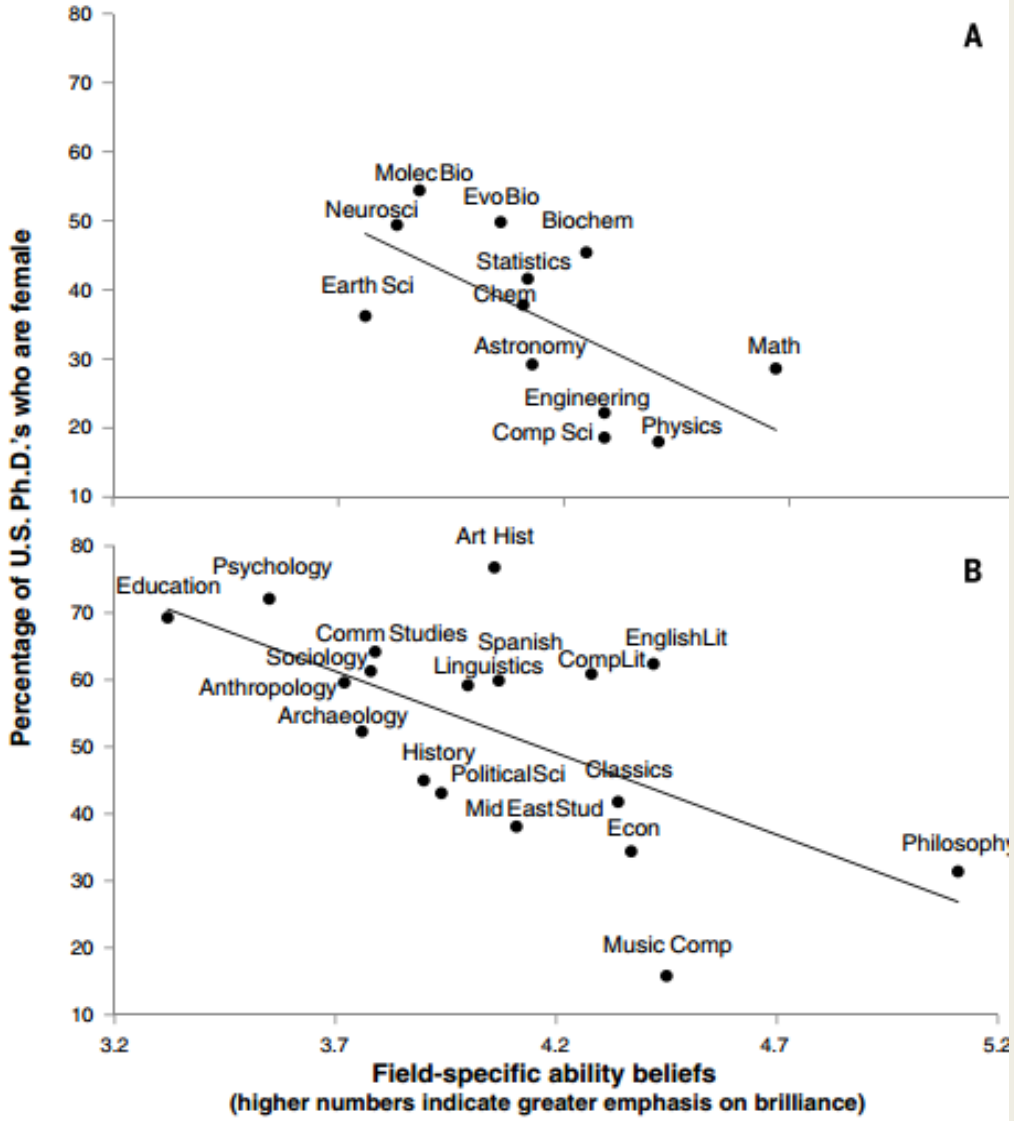


This chart shows the percentage of students who received a given grade in introductory economics course and later majored in economics. (Claudia Goldin/Harvard University)

FEEDBACK

- Wise Schooling (Cohen, Steele, & Ross, 1999)
  - *Criticism + high expectations + capacity*
- Growth mindset versus brilliance
- Reframe failure (DT)
- Remediation (implied) versus enrichment/opportunity
- Formative and summative assessment





Field-Specific Ability Beliefs About Brilliance Related to Lack of Inclusion

From Leslie et al. (2015). *Science, 347,* 262-265.

Future Directions

- Student- and idea-centered work
- Core content and competencies (cf. AAAS, 2010)
- Institutionalization
- Collaboration and partnership

- *Calculus course sequence as a gateway to sciences*
- *Expanding early research experiences*
- *Building learning communities*

Selected Resources

Alvarado, C., & Dodds, Z. (2010). Women in CS: An evaluation of three promising practices. *SIGCSE'10,* March 10-13, Milwaukee, Wisconsin.

American Association for the Advancement of Science (2010). *Vision and change in undergraduate biology education: A call to action.* Washington, DC: Author.

Bradforth, S.E. et al. (2015). Improve undergraduate science education. *Nature, 523,* 282-284.

Cohen, G.L., Steele, C.M., & Ross, L.D. (1999). The mentor's dilemma: Providing critical feedback across the racial divide. *Personality and Social Psychology Bulletin, 25,* 1302-1318.

DiBartolo, P.M. et al. (2016). Principles and practices fostering inclusive excellence: Lessons from the Howard Hughes Medical Institute's Capstone Institutions. *CBE-Life Sciences Education, 15: ar44,* 1-11.

Eddy, S.L., & Hogan, K.A. (2014). Getting under the hood: How and for whom does increasing course structure work? *CBE-Life Sciences Education, 13,* 453-468.

Freeman, S. et al. (2014). Active learning increases student performance in science, engineering, and mathematics. *PNAS*, *111(23)*, 8410-8415.

Graham, M.J., Frederick, J., Byars-Winston, A., Hunter, A.B., & Handelsman, J. (2013). Increasing persistence of college students in STEM. *Science, 341,* 1455-1456.

HHMI Capstone Institution website, "Supporting STEM Success in a Liberal Arts Context," found at: *http://serc.carleton.edu/liberalarts/index.html*

Leslie, S.J. et al. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. *Science, 347(6219),* 262-265.

National Research Council (1999). Key findings. In *How people learn: Bridging research and practice* (pp. 10-24). Washington DC: National Academies Press.

Packard, B.W.L. (2015). *Successful STEM mentoring initiatives for underrepresented students: A research-based guide for faculty and administrators.* Sterling, VA: Stylus Publishing.

Tanner, K.D. (2013). Structure matters: Twenty-one teaching strategies to promote student engagement and cultivate classroom equity. *CBE-Life Sciences Education, 12*, 322-331.