Using Research to Inform Policies and Practices in STEM Education

Stereotype Threat

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Research to policy, practice

1. Stereotype Threat (ST) research: Discovery of how social factors (stigma, stereotype) affect performance

2. Promising findings in the laboratory: 4 selected approaches to intervention

3. Complexities of translation to higher education practice: The challenge of next generation research and implementation

4. Progress at Berkeley : Proceed with care, but proceed now, to scale

5. Q &A

ST research progression

- Jane Elliott's "Eye of the Storm"
- Women students and math: Spencer, Steele & Quinn. 1999.
- Black students and verbal reasoning: Aronson & Steele, 1995
- Jollett, Steele: academic strength makes one most susceptible to stigma pressure

ST research findings*

- Identity contingencies
- Constraints on the ground: e.g., discriminatory laws, practices interact with threats in the air: stereotypes, stigma,
- ST is universal, but stereotypes vary
- Cues can signal competence, belonging; ST can be primed and lowered
- Effects include: over-efforting; extra cognitive load—vigilance, racing mind, self-monitoring "choking", suppressing threatening thoughts; physiological signs of anxiety.

*From: Steele, Claude. *Whistling Vivaldi.* 2010. Norton

Stereotype Threat —definition

Stereotype threat is a phenomenon whereby *negative stereotypes* place people from the stereotyped groups **in a state of** *physiological threat & cognitive overload* that then

interferes with performance

Research on interventions asks:
Can/how can psychological interventions interrupt ST? Can seemingly small psych interventions help students take advantage of opportunities, relationships in higher ed?

Applicability to STEM

In STEM often the stereotype that is primed is about limited intellectual capacity of particular groups in STEM related disciplines (e.g. minorities, women). STEM is the area from which many of the ST findings emerge and many of the ST experiments with interventions have been performed.

Promising social psychology experiments impact grades & reduce performance gaps

- ## Malleability and expansion of ability
  - Example: Blackwell et al. (2007); Dweck (2006)

- ## Values affirmation
  - Example: Cohen et al. (2006, 2009); Miyake et al.(2010)

- ## Attribution & belonging interventions
  - Example: Wilson & Linville(1982); Walton & Cohen (2007, 2011)

- ## Relationships: ethnic identification & race-sensitivity
  - Example: Mendoza-Denton et al (2002, 2008)

Taking stock so far…

- Early ST experiments "bottled" effects of stigma to reproduce real world responses to ST in the lab

- ST studies replicated in a variety of settings for different populations (college, middle school, women, students of color) & ST shown to affect grades, performance gaps—all under experimental conditions

- Subsequent experiments try to bottle psychological interventions to lower ST

Next generation research: translation to practice

- Mixed results are reported on replication of specific interventions to functionally lower ST effects on performance

- Mechanisms for translating the interventions to everyday practice are not yet well understood

Effective translation to practice raises new, next generation questions...

1. **How much can lowering ST accomplish?**
How much variance in performance is ST, how much can intervention be expected to do?
2. **In which contexts is ST most salient?**
Where are interventions applicable? Most likely:
      a. High stakes tests (standardized tests, exams, finals, quals, prelims)
      b. Gateway STEM lower division courses ?
3. **How best to craft interventions?**
Who should craft them? Collaborative teams, psychological researchers, psychological engineers*? (*Yaeger &Cohen, 2011)

4. Can it scale? How?

- If we succeed in releasing (some of) the pressure that interferes with access to other enabling conditions & opportunities for success, *how will we measure the effects when we go to scale*? (no control)

- What are the other learning opportunities, conditions for success that must be present? *How do we measure the effect of these vs the ST interventions*?

Proceed with care*

- Psychological interventions are finicky, minor adjustments can subvert the intent or get a null result

- No known examples of routine and regularized implementation of ST interventions yet

- Scaling of educational interventions is notoriously difficult

- Measuring, teasing out effects will be difficult in applied context

- *Yaeger and Walton, 2011.

…but proceed

- <u>Urgency:</u> STEM needs access to best of nation's intellectual resources; minority communities need access to STEM degrees for upward mobility, increasing social equality

- <u>Importance of social relationships to academic success:</u> Educational researchers are demonstrating the effects of social relationships embedded in academic contexts—such as apprenticeships, mentors, peer and near-peer learning communities—on UR students' achievement and retention.

- <u>Faculty & universities are ready</u>: many STEM faculty are concerned and will take up interventions if they are likely to work

- <u>Best hope:</u> Social-psychological interventions may be one of our best hopes (for now) to buffer against ST, and/or to facilitate more equitable access to current and new learning resources and opportunities.

UC Berkeley's Approach

1. In contrast to experimental interventions (where participants remain blind to the purposes & design of the study,) <u>implementation must be transparent.</u>

2. <u>Institutional effort requires science faculty who teach classes, administrators, psychologists to collaborate.</u> To convey a credible message, instructors must send a message they understand, and with which they agree. The social science research basis must be withstand STEM faculty scrutiny. And student engagement is key.

3. <u>Ramp up and go to scale. </u>) Builds onUC Berkeley's rich history and institutional infrastructure for equity and inclusion, especially in STEM.

4. Research-implementation-research (<u>Implement interventions in context of rigorous research.</u>

Progress to date

1. Develop community of scientists
 (I3-BSC, BSN, BSN-SP)

2. Deliver ST research to STEM faculty and UR STEM community
 ST research withstands STEM faculty scrutiny, galvanizes community

3. Mechanisms: Deep Dive into Mentoring, distribution of ST scholarship to faculty; public forums.

4. STEM faculty, deans lead with psychology faculty engagement, expertise, and guidance.

5. Faculty coalesce; faculty and dept chair initiate proposals, new approaches; new effort to craft approaches for gateway courses and other critical transitions is underway.

Minority, gender, UR status remain salient, viz.: enrollment gaps, performance gaps, academic/research career outcomes, representation in the STEM workforce.

Decades of investment and effort have not **yet** resolved these problems, nor is there a consistent pattern in a positive direction in all areas.

Research, Policy, Practice for Positive Impact: Praxis

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<u>Faculty ought to be compensated if this is a serious endeavour.</u> The University of California Academic Personnel Manual policy governing faculty appointment and advancement (APM 210) was amended effective July 2005 so that faculty contributions to diversity would receive recognition and reward in the academic personnel process. An excerpt from the policy states:

The University of California is committed to excellence and equity in every facet of its mission. **<u>Teaching, research, professional and public service contributions that promote diversity and equal opportunity are to be encouraged and given recognition in the evaluation of the candidate's qualifications.</u>** These contributions to diversity and equal opportunity can take a variety of forms including efforts to advance equitable access to education, public service that addresses the needs of California's diverse population, or research in a scholar's area of expertise that highlights inequalities. (APM 210-1-d)

Selected Resources

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