Understanding why programs work:  
*Cultivating psycho-social stability and integration*

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...in diversity there is beauty and there is strength.

Maya Angelou
The Science Study

✧ Longitudinal study of underrepresented minority science students who had a strong interest in pursuing a biomedical research career
Overview: The Science Study

From 50 campuses nationwide, 25 of these had RISE programs in 2005 (when study began)
Overview: The Science Study

Matched control group

- For each R.I.S.E. or MARC student, we found a similar student who does not go through the program

- Matching variables: ethnicity, gender, major, GPA, intention to become a scientist, enrollment level (LD, UD, Grad)

- Secondary matching: age, parental education, community college transfer, English as first language
Survey Data Collection

✧ Data collected twice yearly from students through a secure web interface

✧ 10 years

www.TheScienceStudy.com
Longitudinal Panel

- 72% Female
- Ethnicity/Race:
  - 49% African American
  - 39% Hispanic/Latino(a)
  - 1% Native American
- Major (when began):
  - 63% Biological Sciences
  - 21% Natural Sciences
  - 12% Behavioral & Social Sciences
  - 4% Mathematics & Engineering
RETENTION: Tailored Panel Management

- **Response rates** at each wave range from 86% to 70% (71% in most recent, Spring 2015)
- Data augmented with degree attainment from the National Student Clearinghouse
- Remain in contact with 97% of panel

*Protocol summarized in Estrada, Woodcock & Schultz, 2014*
Note: The “not currently enrolled” category includes those who have graduated and those who have either permanently or temporarily left college before graduation.
Chance students is now in a STEM Career: RISE EFFECT

Where Are They Now? (Spring 2014)

Not in STEM

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>RISE</th>
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<tbody>
<tr>
<td>64%</td>
<td>52%</td>
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In STEM

<table>
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<tr>
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<th>Control</th>
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<tr>
<td>36%</td>
<td>48%</td>
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Building on Kelman’s social influence theory….

Who integrates into the scientific community?

**Tripartite Integration Model of Social Influence (TIMSI)**

- **Scientific self-efficacy**
  - I can do what scientists do

- **Scientific identity**
  - I am a scientist

- **Internalization of scientific values**
  - I agree with the values of the scientific community.

Integration (persistence)

Estrada et al., 2011
Tripartite Integration Model of Social Influence (TIMSI)

**Undergraduate students**
- Self-Efficacy
- Identity
- Value
- Scientific Integration

**Graduate students**
- Self-Efficacy
- Identity
- Value
- Scientific Integration

**Left**
- Self-Efficacy
- Identity
- Value
- Scientific Integration

Estrada et al. (2011)
Scientific Self-Efficacy (Over Time)

- In
- Out/Medical

Scientific Self-Efficacy (Model Predicted Values)

Time

Waves 1 to 11
Scientific Identity (Over Time)
Biology Scholars
Integration into Science Community

No significant declines for BSP students.
Biology Scholars: Well-being, Satisfaction, and Stress

No significant declines for BSP students.
Psychosocial and Outcome Variable:
*BSP compared with Bio1A/Chem 1A Students (Fall 2015)*

![Bar chart showing psychosocial and outcome variables for Biology Scholars and Science Students.](chart)

- **Life Satisfaction**
- **Stress**
- **Stereotype Threat**
- **Science Values**
- **Science Identity**
- **Science Efficacy**
- **Intentions**

- **Biology Scholars**
- **Science Students High Intention**
- **Science Students Low Intention**

Understanding why programs work
Psychosocial and Outcome Variable:
BSP compared with Bio1A/Chem 1A Students (Fall 2015)

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* indicates a significant difference.
Example of Stereotype Threat Questions

How often do you feel that because of your ethnicity...

- Some people believe that you have lower ability than other students.
- People assume that you are not good enough, even if you are similar to other students.
- If you do poorly on a test, people act like that is normal.
- Your intelligence is not fairly evaluated.
BSP Integration into Science Community
(compared with TheScienceStudy)

Baseline | Mid | End

Sci Identity - BSP
Science Study STEM BA
Science Study non-STEM BA
Key Points

1. There are ways to evaluate if programs are effective at increasing persistence

   - Collect longitudinal data
   - Prospective (as it happens)
   - Have comparison groups when feasible
   - Utilize institutional data to understand the impacts

2. There are ways to start to understand why programs work

   - Measure psychosocial variables -- such as science efficacy, identity and values -- that are related to persistence.
   - Looks at well-being, stereotype threat and stress as well.
THANK YOU

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Example of Science Efficacy Questions

Extent to which you are confident you can successfully complete the following tasks…

- Use scientific language and terminology.
- Figure out/analyze what data/observations mean.
- Use scientific literature and/or reports to guide research.
- Use technical science skills (use of tools, instruments, and/or techniques).

- Report research results in a written paper.

Estrada et al., 2011 modified from Chemers, et. al. (2010).
Example of Science Identity Questions

Level of agreement with each statement…

- In general, being a scientist is an important part of my self-image.
- I am a scientist.
- I have a strong sense of belonging to the community of scientists.
- Being a scientist is an important reflection of who I am.

Estrada et al., 2011 modified from Chemers, et. al. (2010).
Example of Science Value Questions

How much is this person like you?

- A person who thinks it is valuable to conduct research that builds the world's scientific knowledge.

- A person who believes writing up research results to be published in a leading scientific journal is a good use of time.

- A person who feels discovering something new in the sciences is thrilling.

- A person who thinks it is important work to identify truths using the scientific method.

- A person who thinks discussing new theories and ideas between scientists is important.

Estrada, et al. (2011).
How does TIMSI relate to behavioral outcomes?
Integration into Academic Community

- Significant linear trend in role.
- Rule and values are staying steady.