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Understanding why programs work:

Cultivating psycho-social stability and integration

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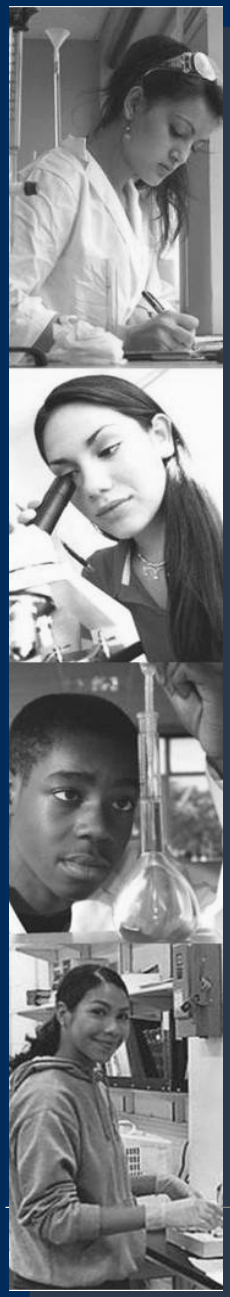
Medical Institute

…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

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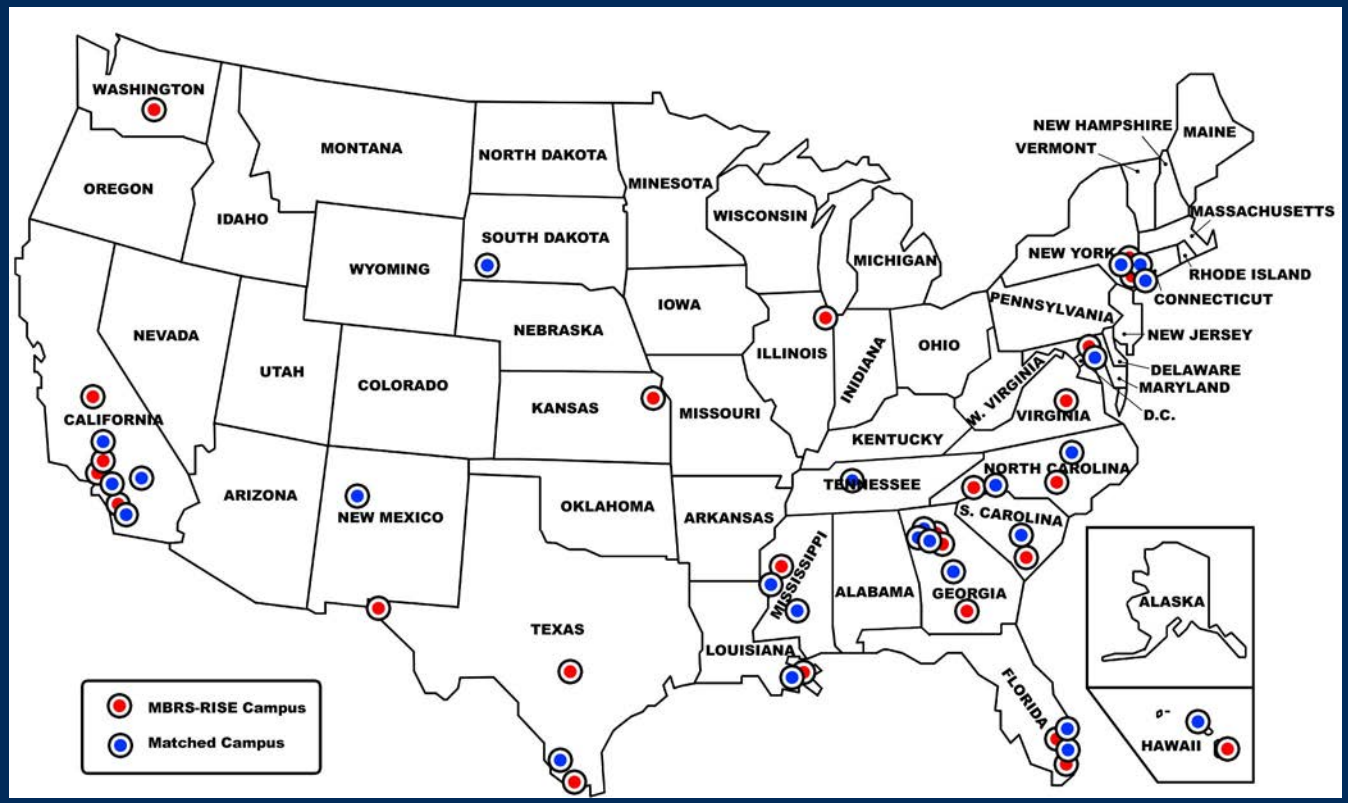
Overview: The Science Study



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

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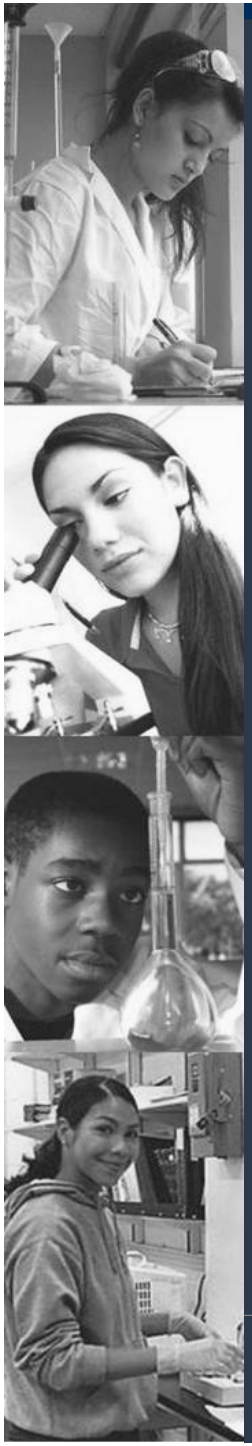

Longitudinal Panel

- 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

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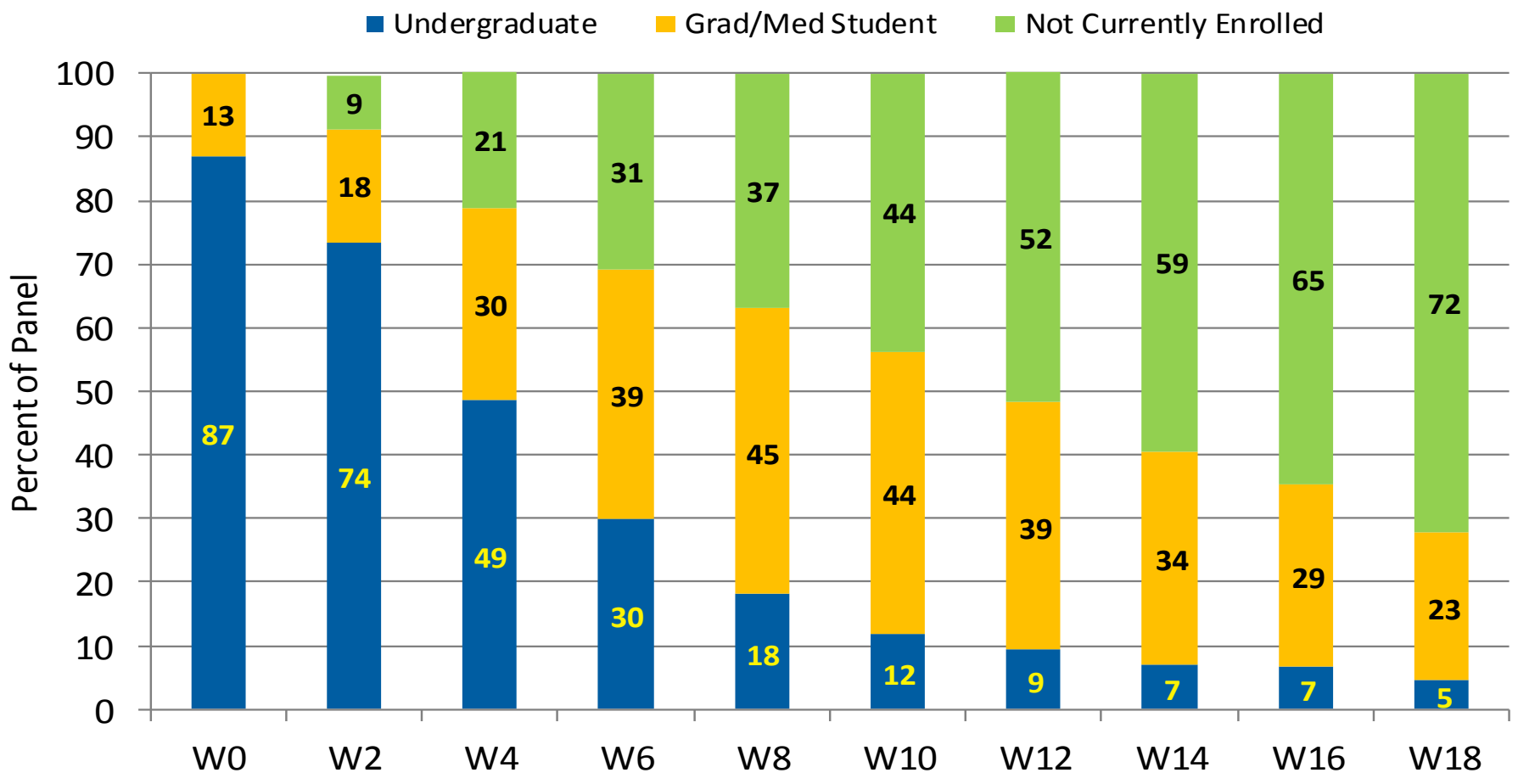
RETENTION: Tailored Panel Management

- 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

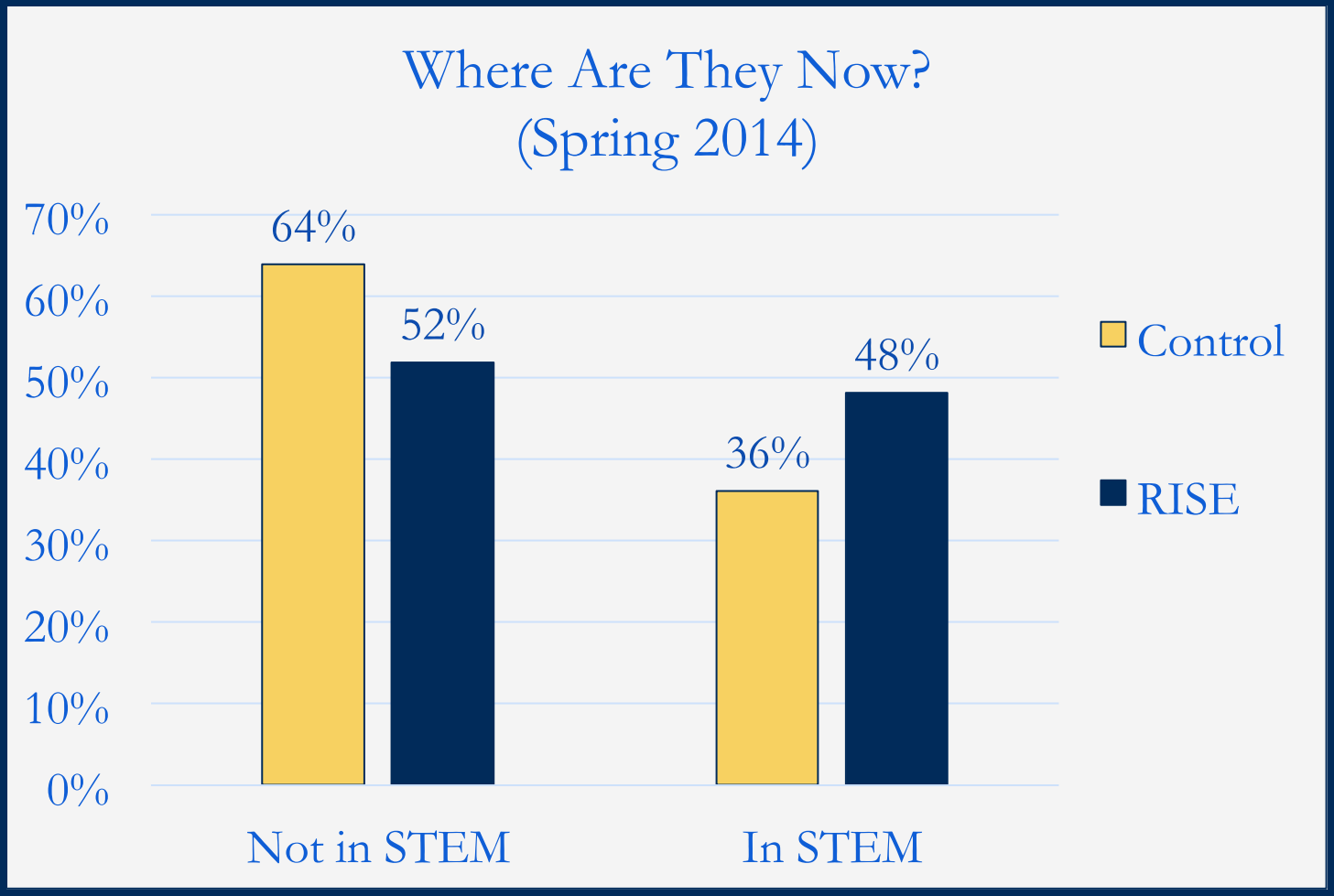
Protocol summarized in Estrada, Woodcock & Schultz, 2014

Panel: Educational Progress



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



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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.

+ Scientific self-efficacy

+ Scientific identity

+ Internalization of scientific values

Integration (persistence)

Estrada et al., 2011

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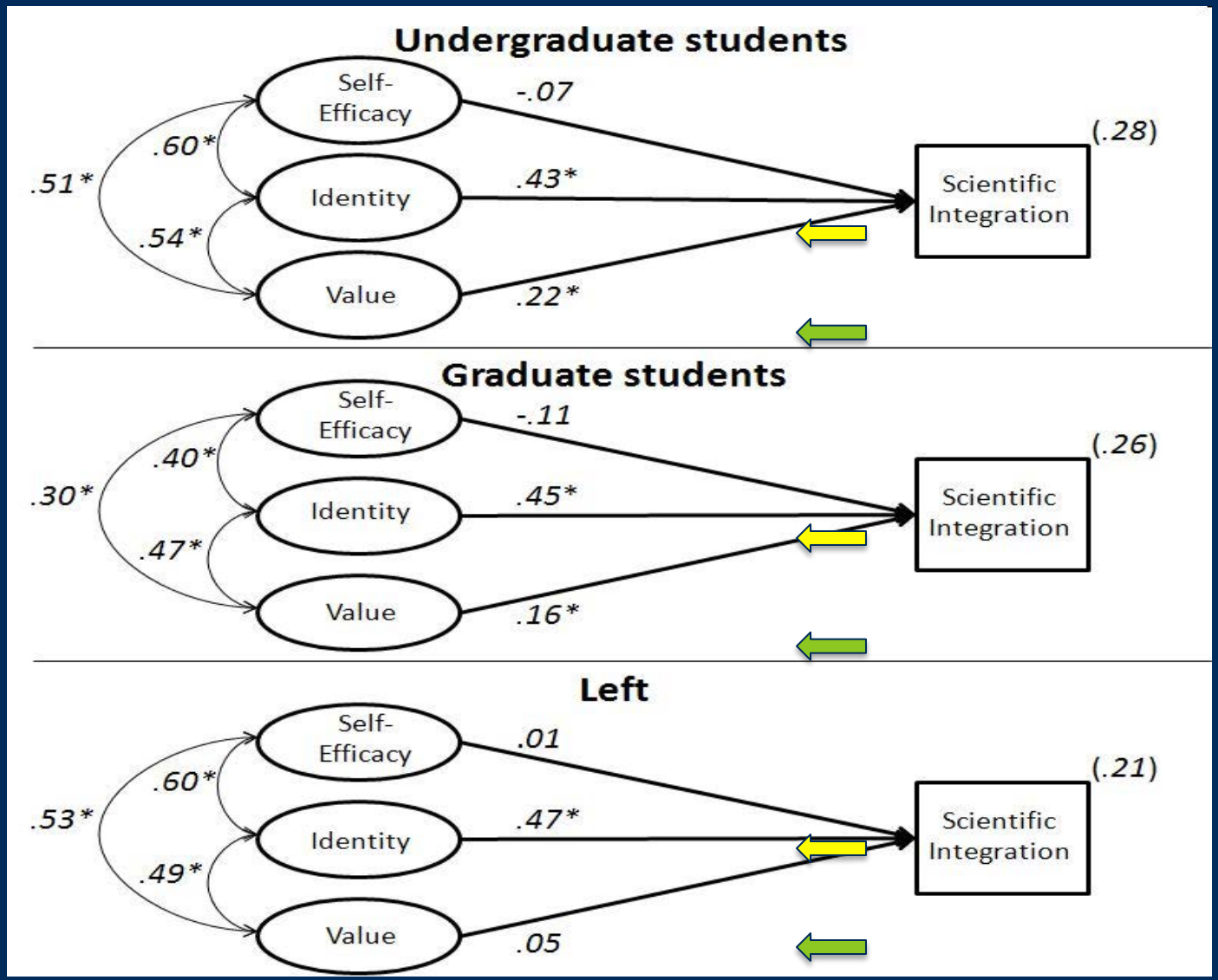
Tripartite Integration Model of Social Influence (TIMSI)



Estrada et al. (2011)

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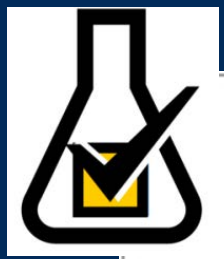
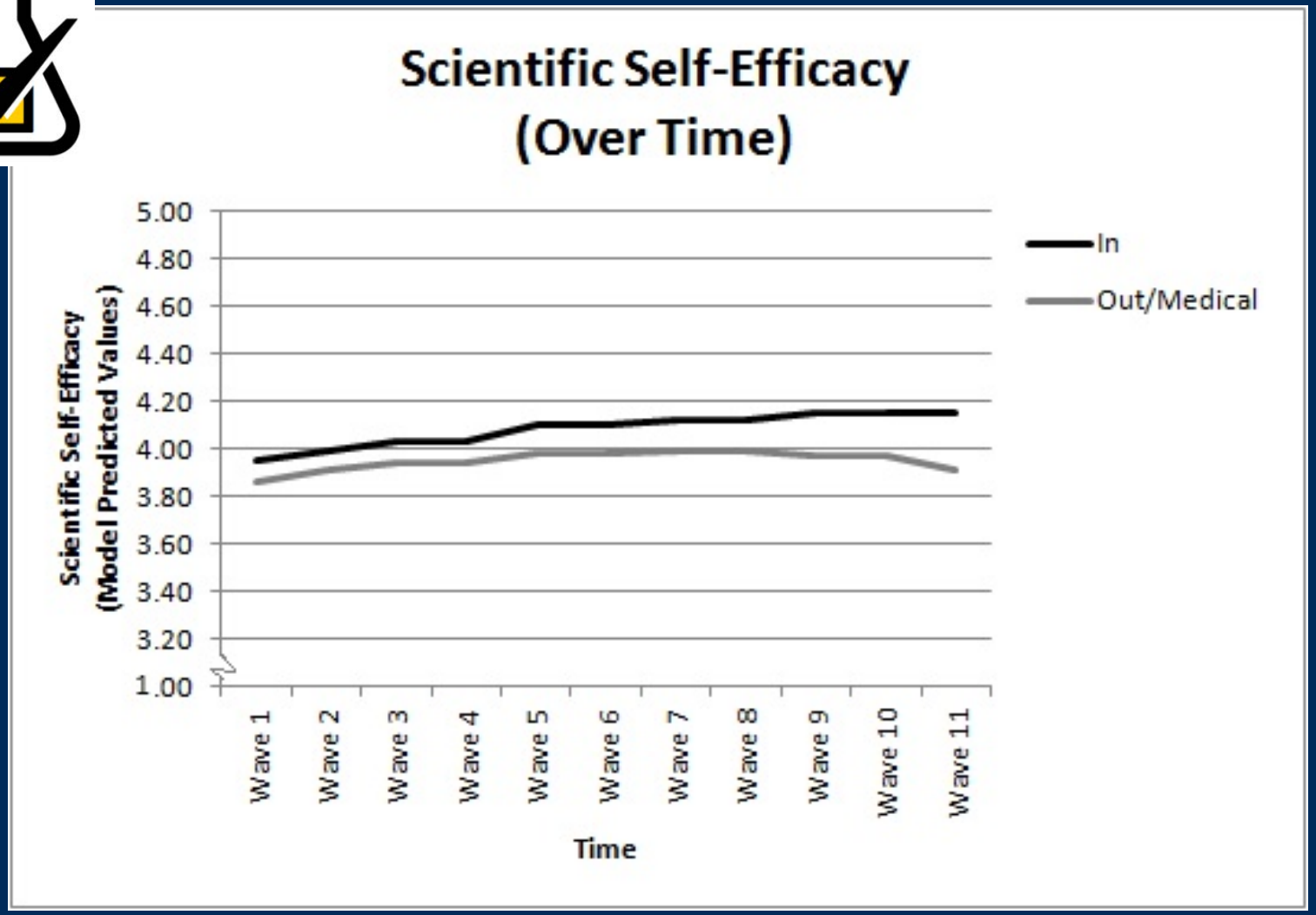
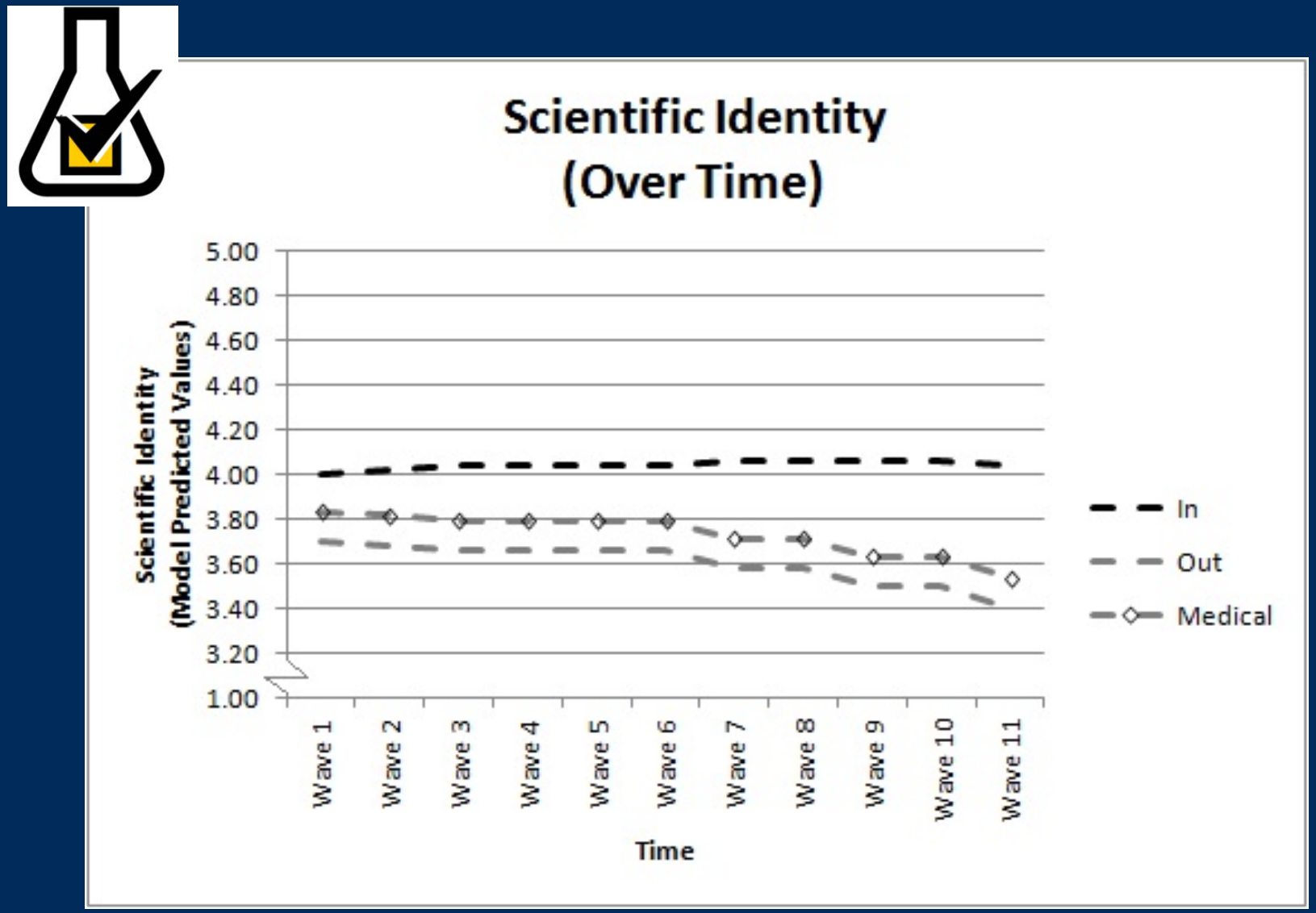
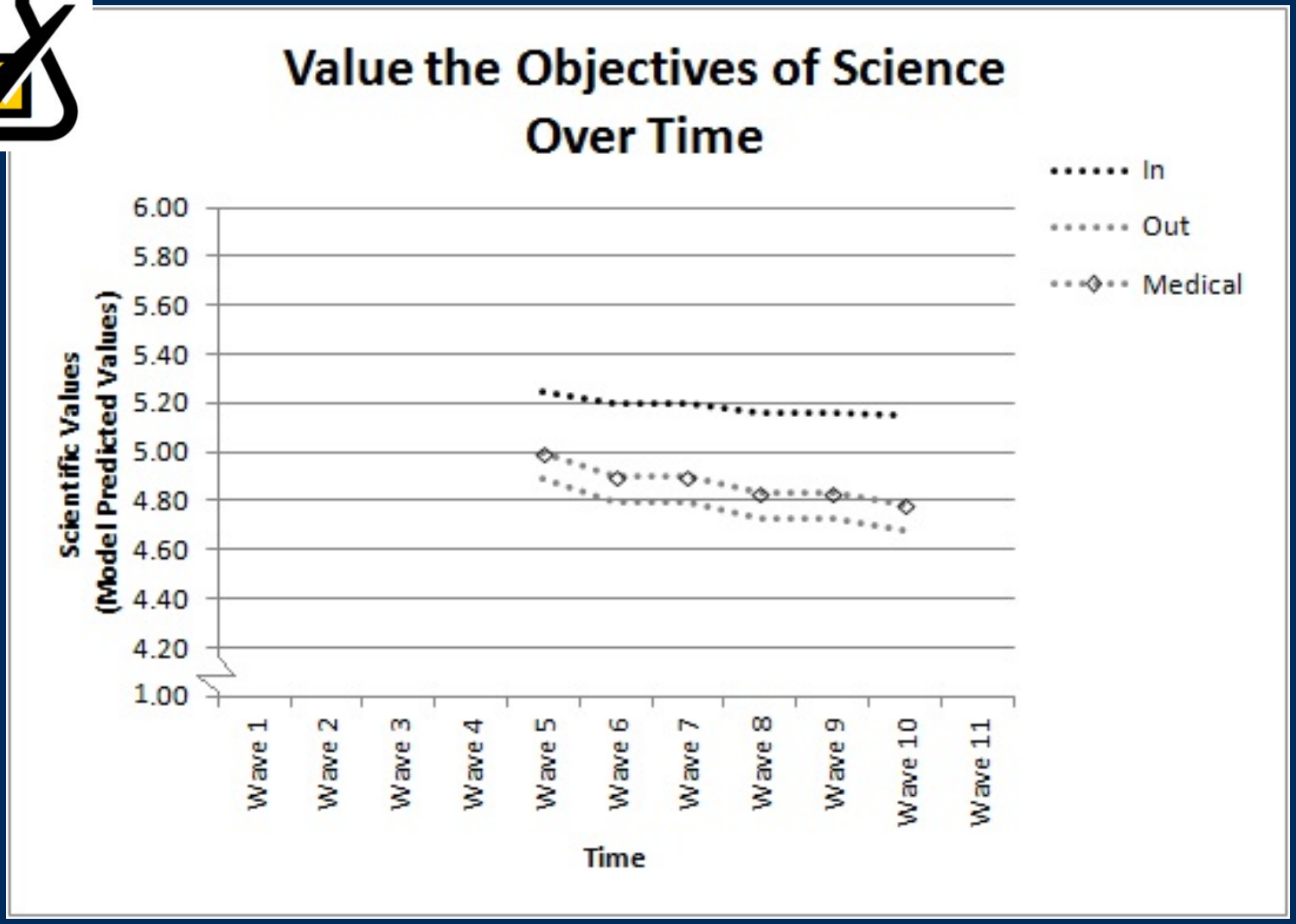



Scientific Self-Efficacy
(Over Time)
Scientific Self-Efficacy
(Model Predicted Values)
5.00
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
1.00
Wave 1
Wave 2
Wave 3
Wave 4
Wave 5
Wave 6
Wave 7
Wave 8
Wave 9
Wave 10
Wave 11
Time
In
Out/Medical


Scientific Identity
(Over Time)
Scientific Identity
(Model Predicted Values)
5.00
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
1.00
Wave 1
Wave 2
Wave 3
Wave 4
Wave 5
Wave 6
Wave 7
Wave 8
Wave 9
Wave 10
Wave 11
Time
In
Out
Medical


Value the Objectives of Science Over Time
In
Out
Medical
Scientific Values (Model Predicted Values)
6.00
5.80
5.60
5.40
5.20
5.00
4.80
4.60
4.40
4.20
1.00
Wave 1
Wave 2
Wave 3
Wave 4
Wave 5
Wave 6
Wave 7
Wave 8
Wave 9
Wave 10
Wave 11
Time

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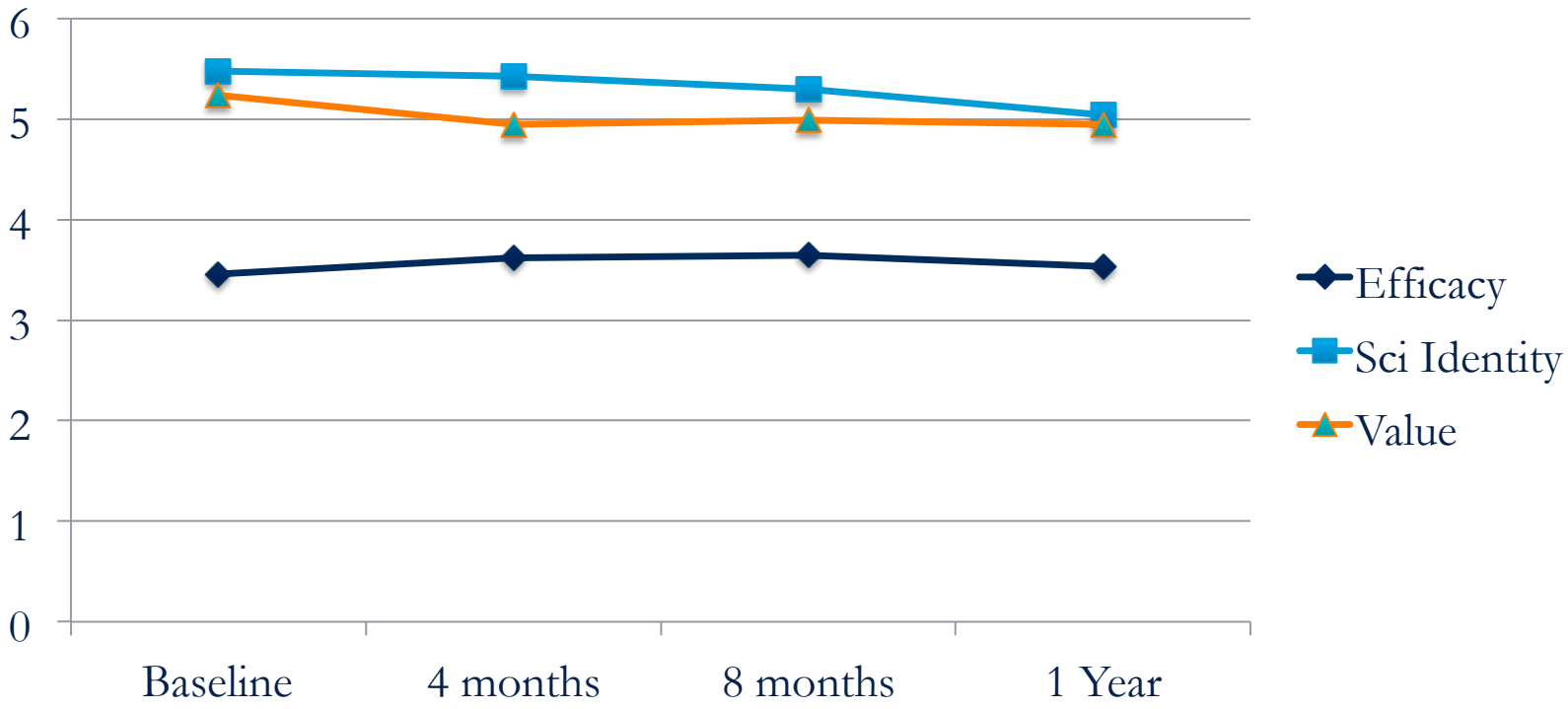
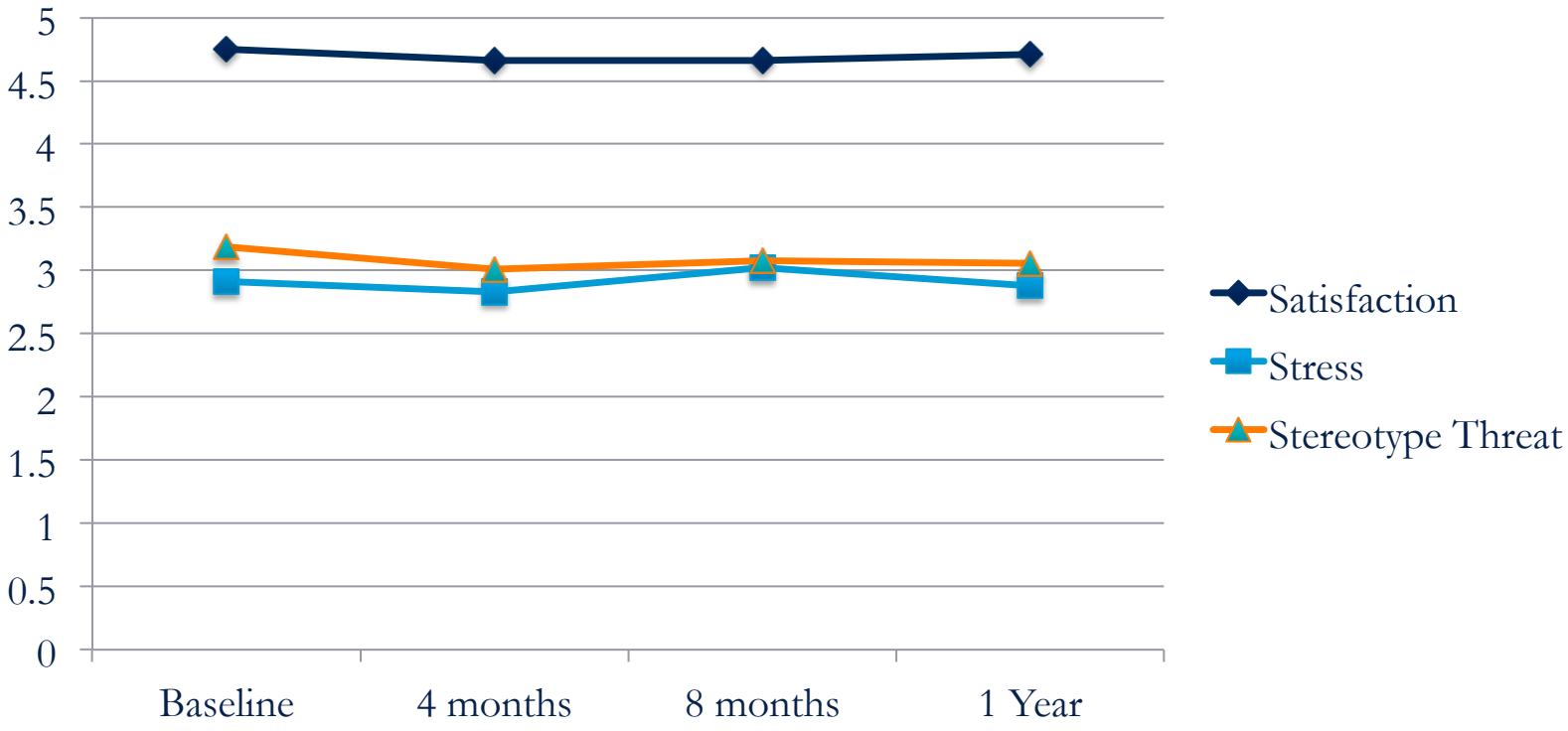
Biology Scholars
Integration into Science Community



No significant declines for BSP students.

Biology Scholars:
Well-being, Satisfaction, and Stress



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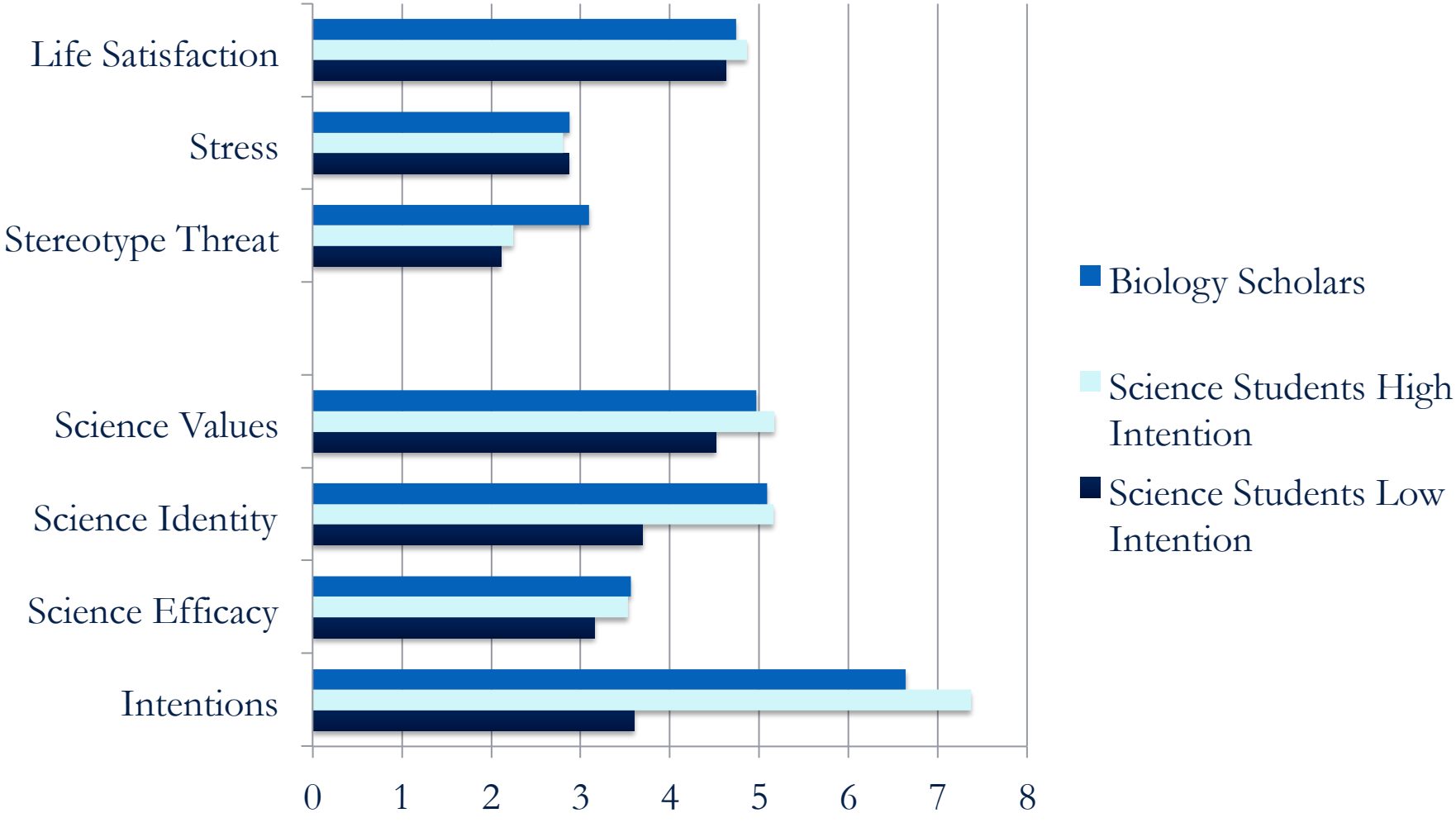
Psychosocial and Outcome Variable:
BSP compared with Bio1A/Chem 1A Students (Fall 2015)



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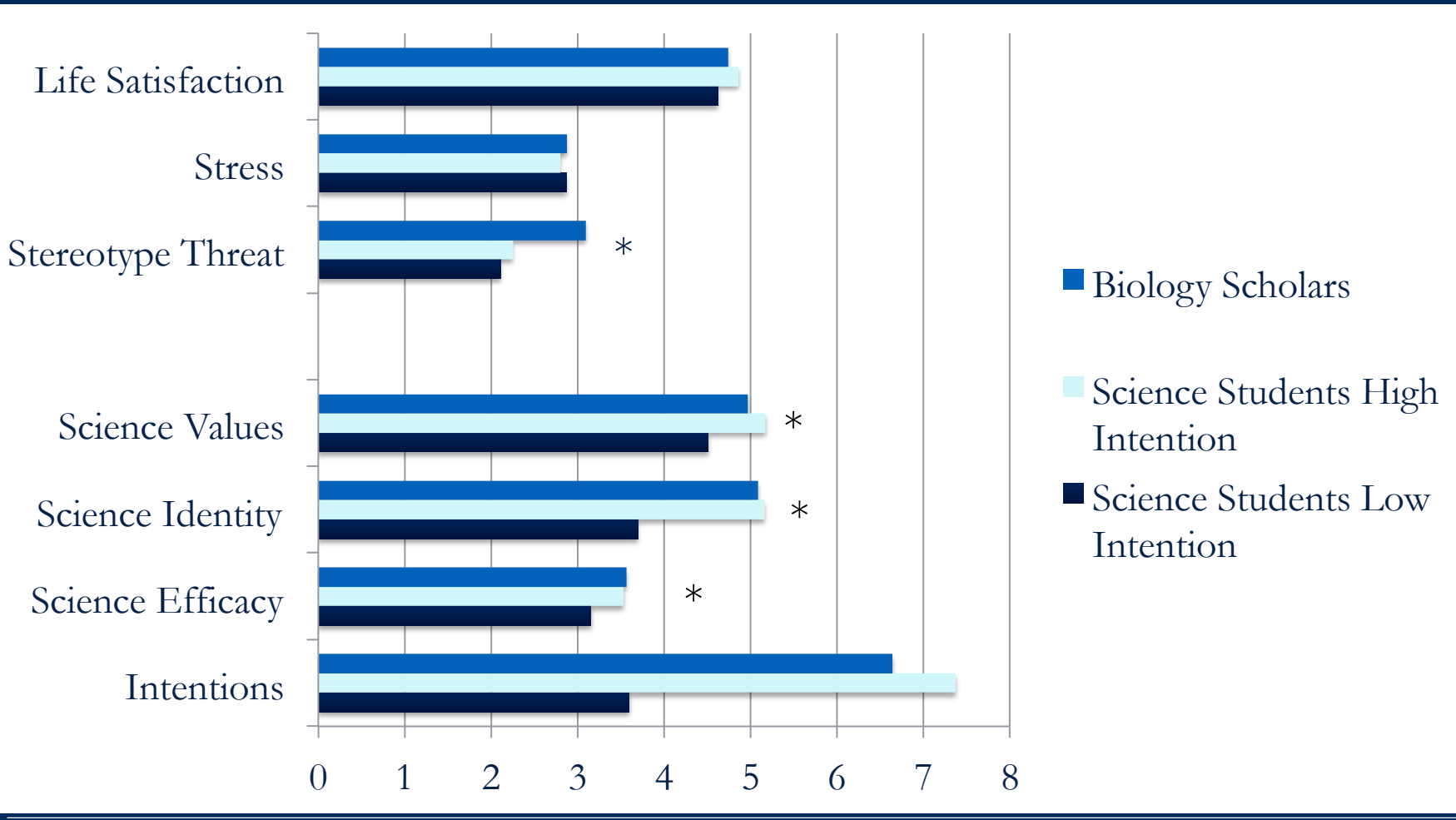

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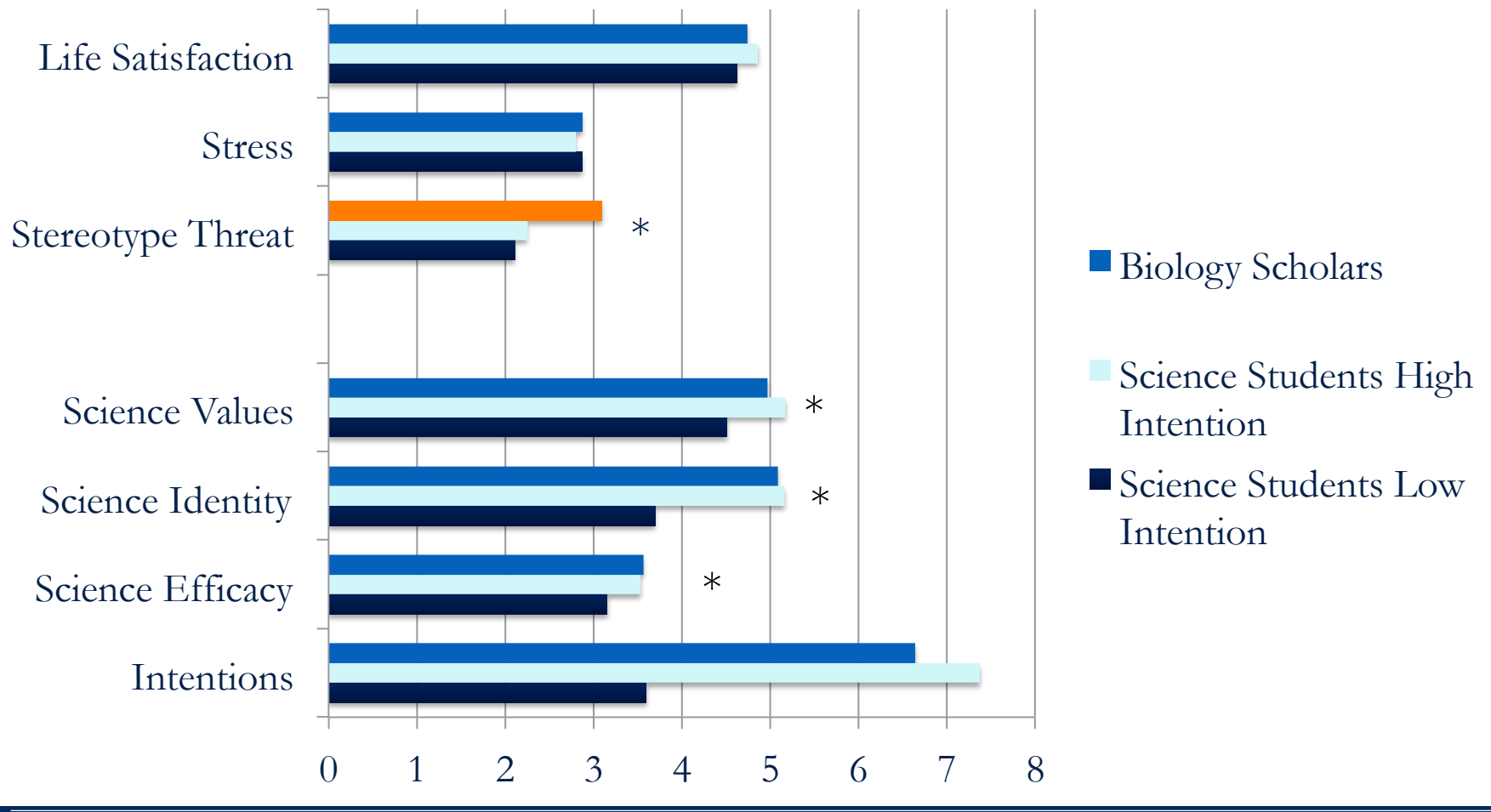

Example of Stereotype Threat Questions

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.

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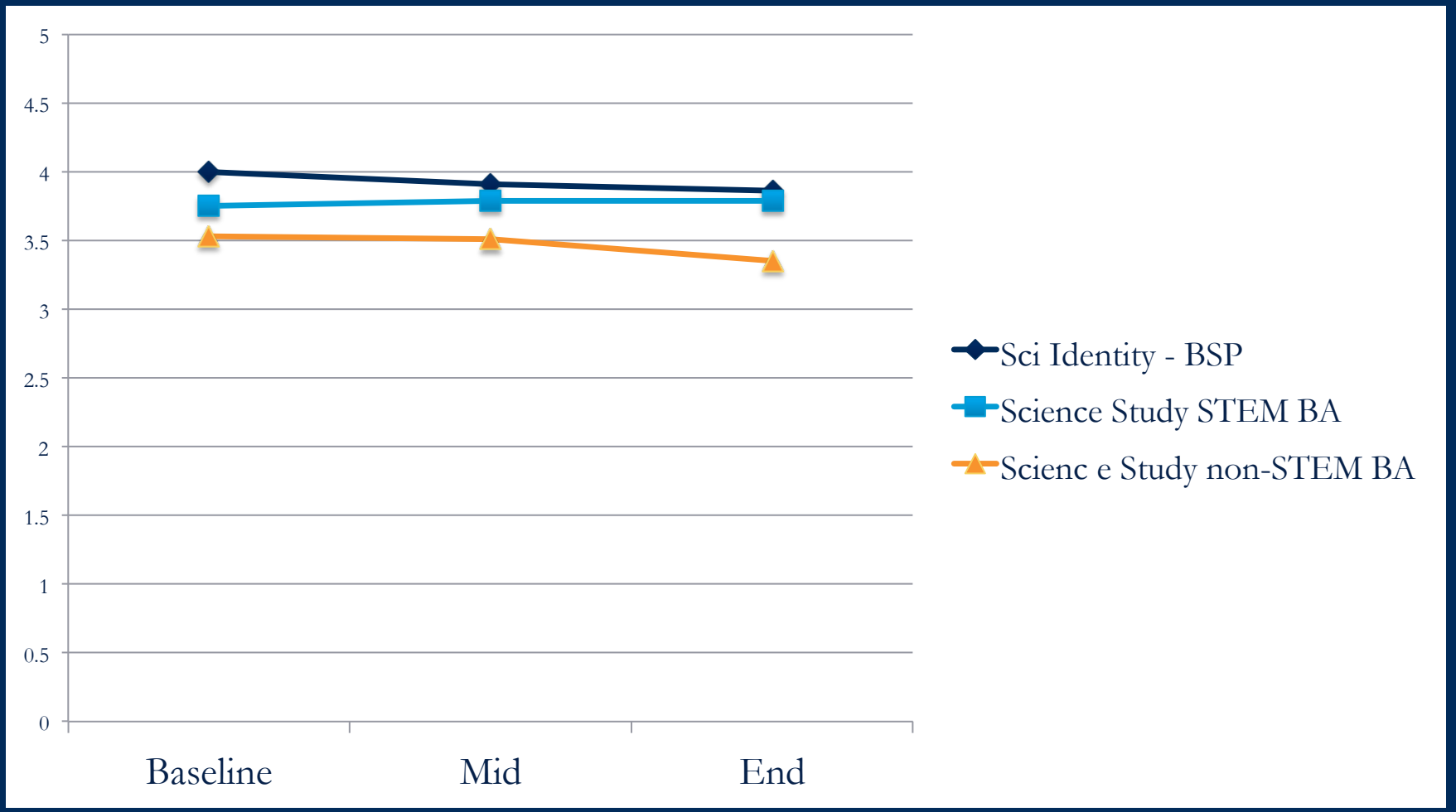
BSP Integration into Science Community

(compared with TheScienceStudy)



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Key Points

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

    Collect longitudinal data

    Prospective (as it happens)

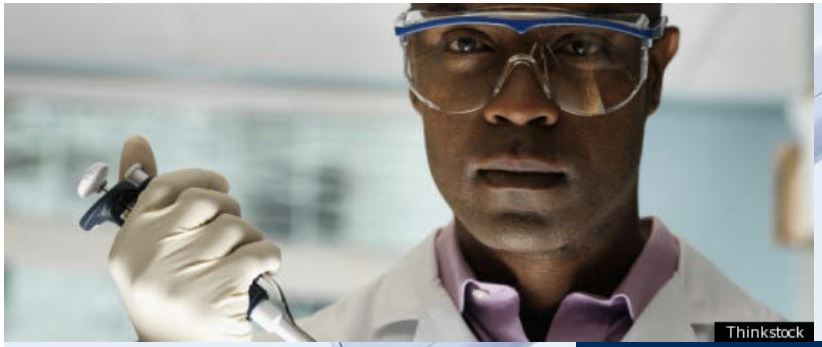
    Have comparison groups when feasible

    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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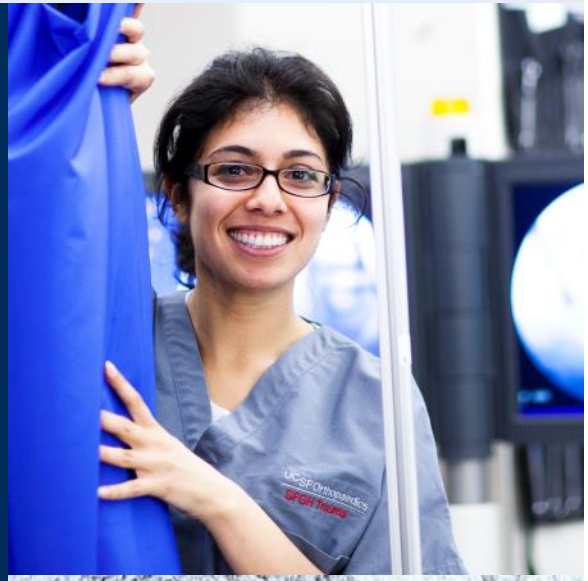

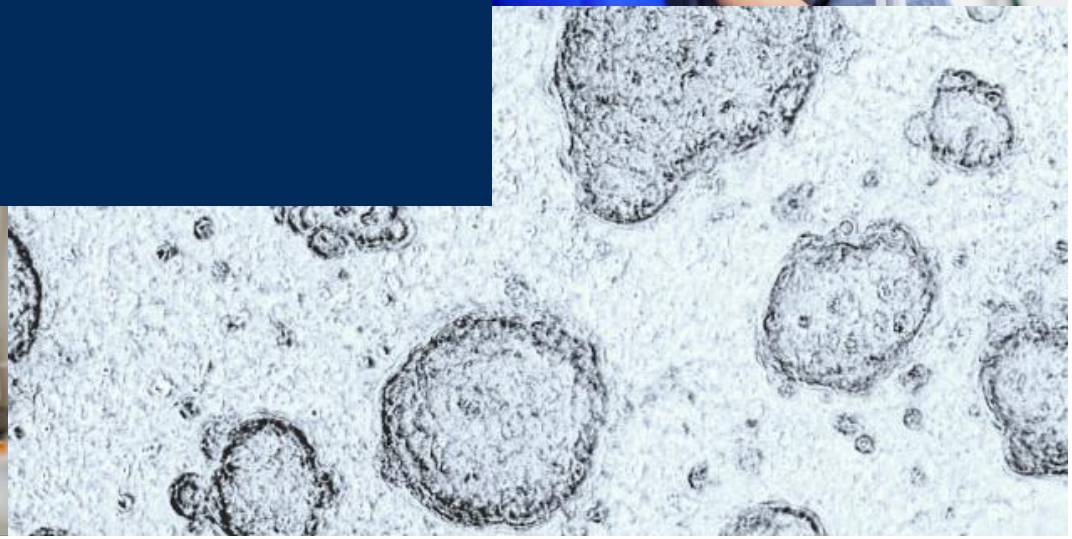

Example of Science Efficacy Questions

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).

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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).

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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).

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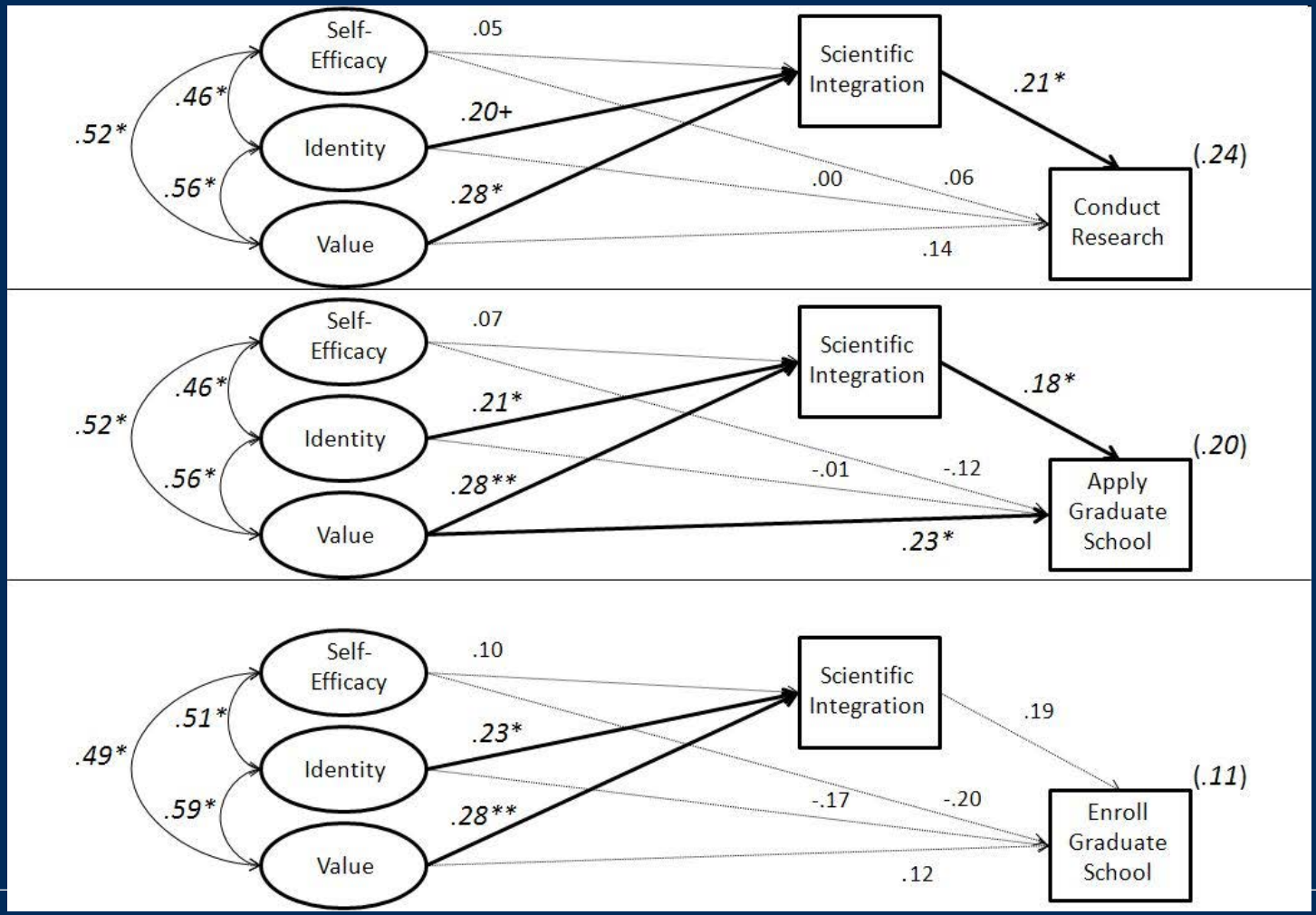
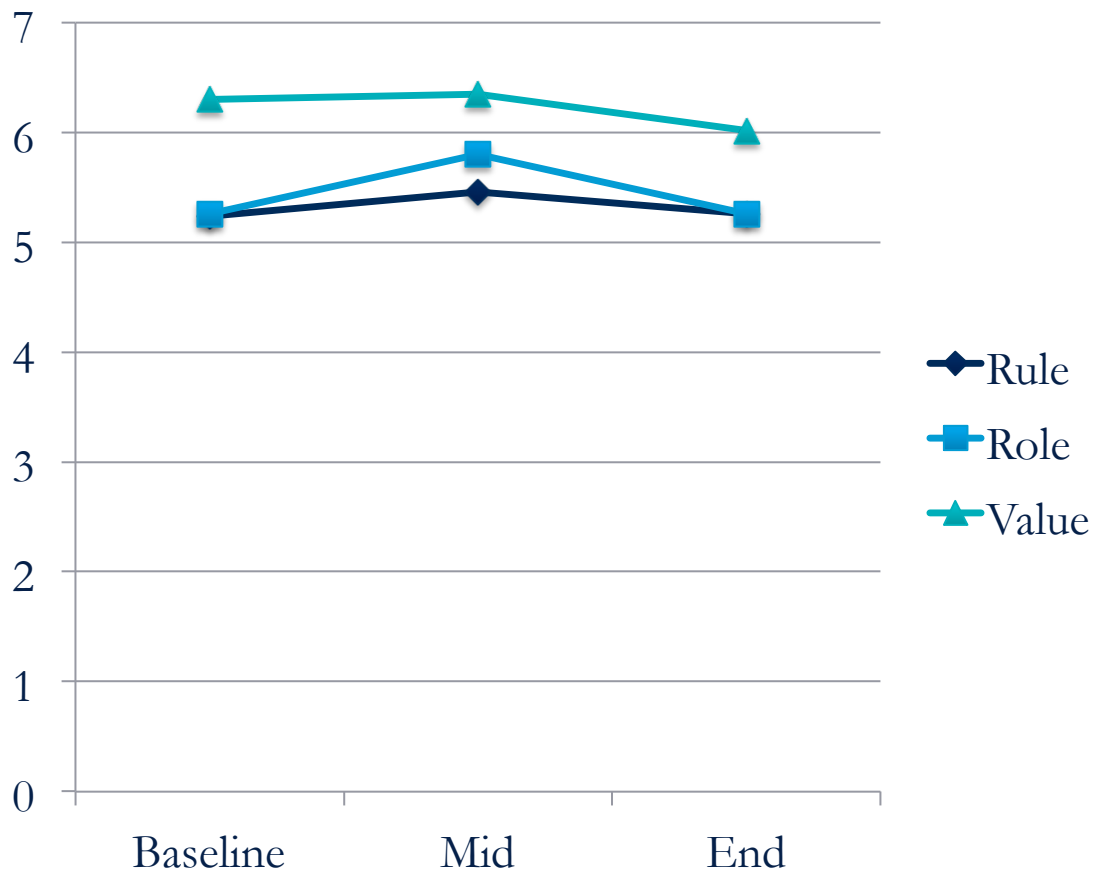
How does TIMSI relate to behavioral outcomes?



Integration into Academic Community



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