ENGENDERING SUCCESS IN STEM

Engendering Success and Allyship in STEM

Toni Schmader, Ph.D.
Head of Department, Psychology
University of British Columbia

SSHRC CRSH
Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

On the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people

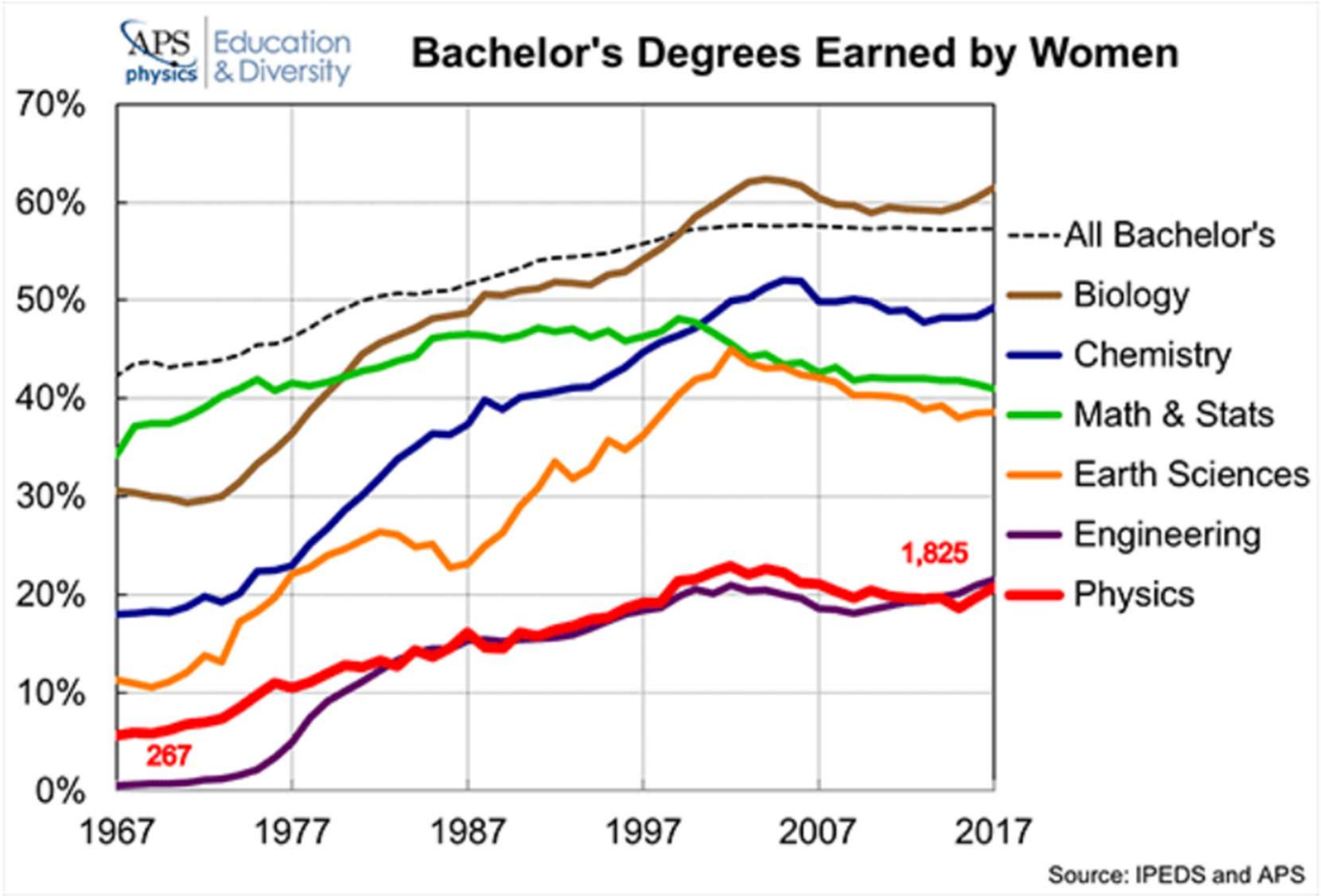
successinSTEM.ca

“Scientist”

“Biologist”

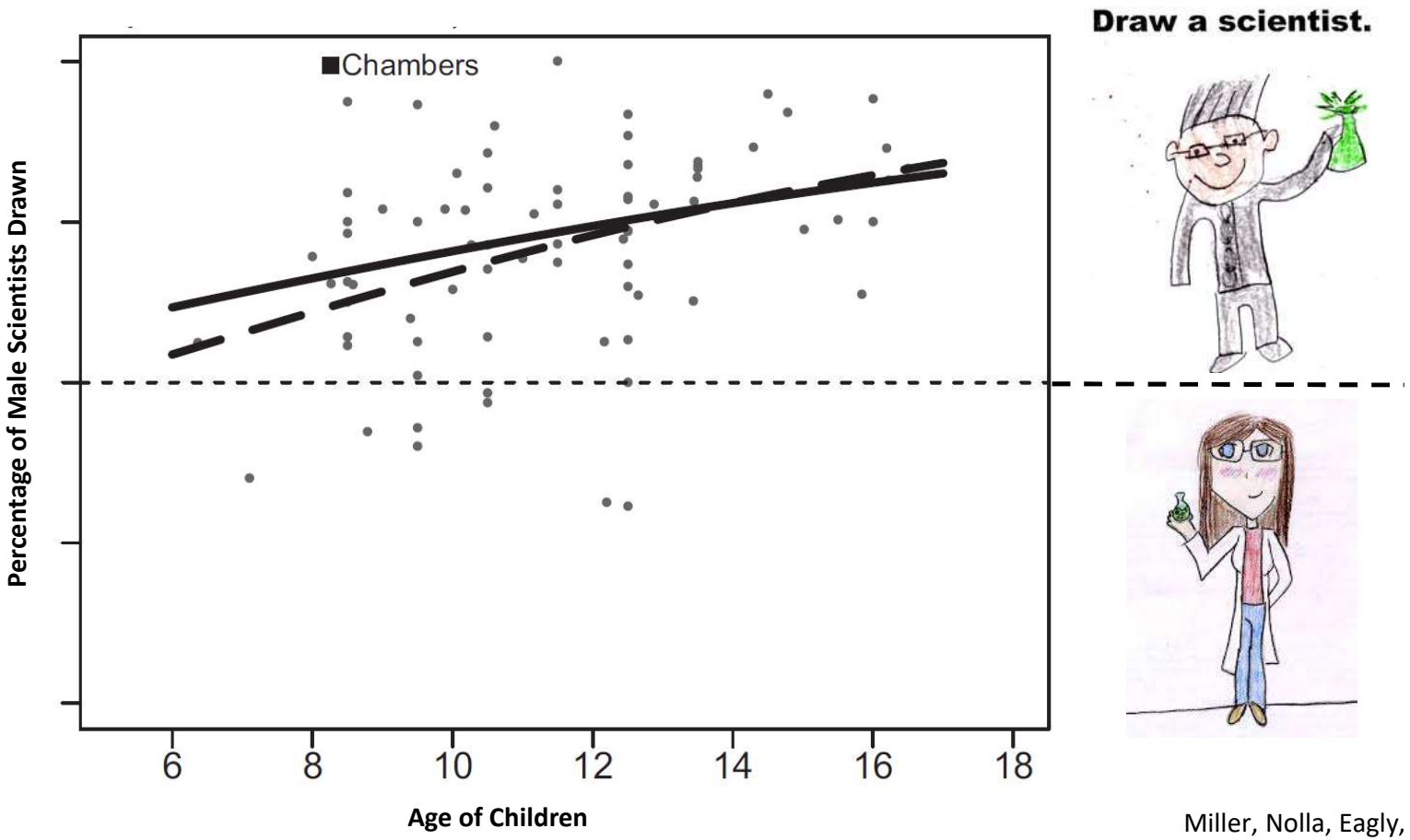
“Particle Physicist”

Images generated by AI (OpenArt)



Percentage of bachelors and doctoral degrees awarded to women in various STEM subjects in the USA.

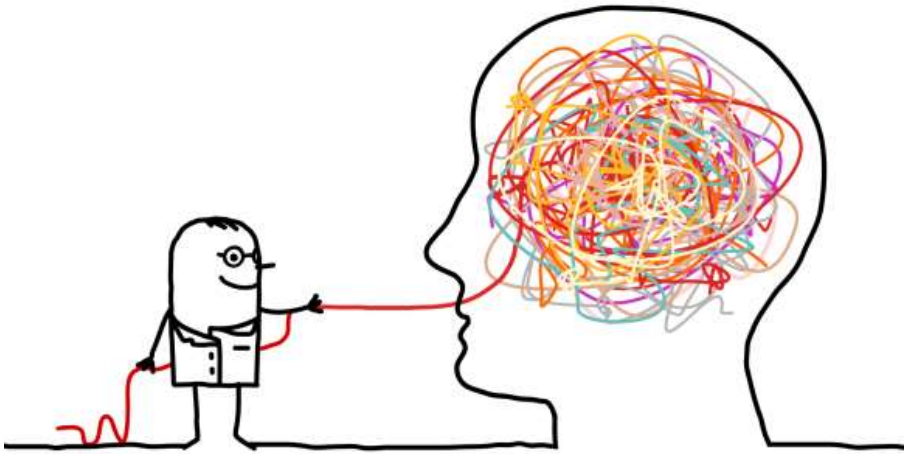
Science = Male Associations



Miller, Nolla, Eagly, & Uttal (2018)

Stereotypes as Implicit Associations in the Mind

- Implicit Associations are cognitive links between concepts that co-vary
- Distinct from explicit intentions or beliefs
- Implicit Association Test: validated on over 20 million participants

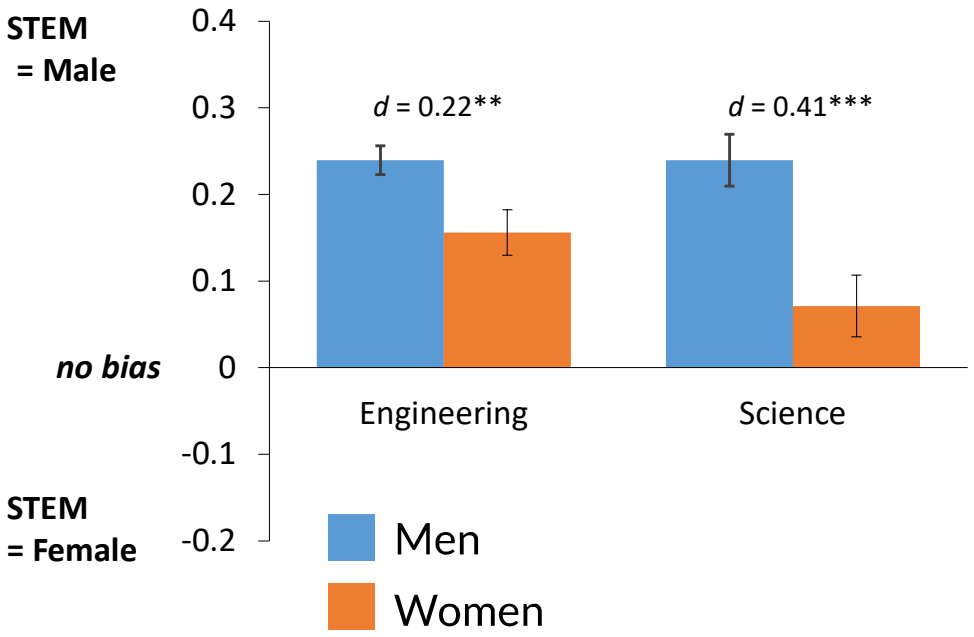


SCI-IAT ENG-IAT

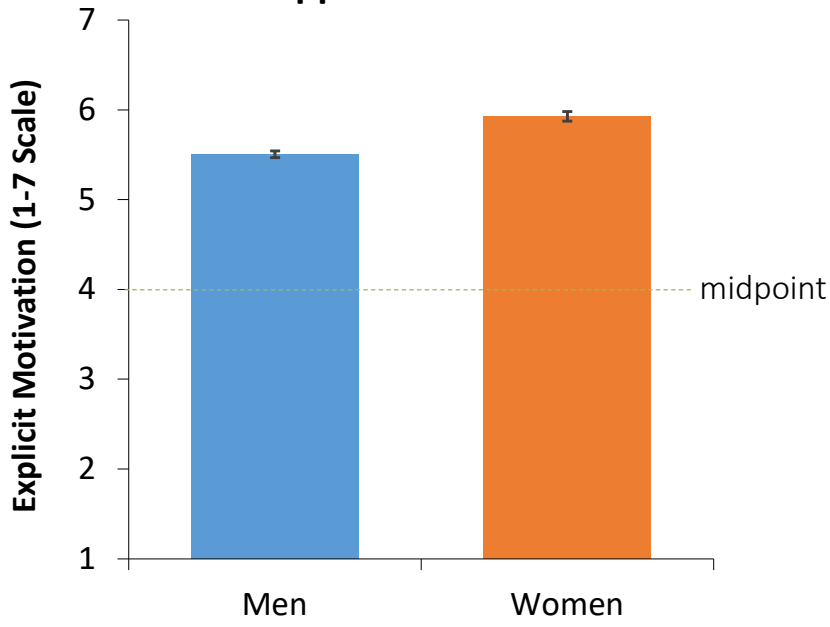
Greenwald, McGhee, & Schwartz, 1998; Kurdi et al., 2018

Implicit Associations ≠ Explicit Motivation

Both Men and Women have an Implicit "Think STEM, Think Male" Bias



But are Explicitly Motivated to Support Gender Inclusion



RISE Workplace Culture Survey, 2018

Stereotypes Create Barriers to Inclusion

ENGENDERING SUCCESS IN STEM

Project CLIMB

Dr. Andy Baron
Professor of Psychology
University of British Columbia

Dr. Jennifer Steele
Professor of Psychology
York University

Project PRISM

Dr. Steve Spencer
Professor of Psychology
Ohio State University

Dr. Steve Wright
Professor of Psychology
Simon Fraser University

Project SINC

Dr. Elizabeth Page-Gould
Professor of Psychology
University of Toronto

Dr. Sonia Kang
Professor of Organizational Behaviour and HR Management, University of Toronto Mississauga & University of Toronto's Rotman School of Management

Project RISE

Dr. Toni Schmader
Professor of Psychology
Director of Engendering Success in STEM
University of British Columbia

Dr. Hilary Bergsieker
Associate Professor of Psychology
University of Waterloo

ESS Team: STEM Experts

Dr. Elizabeth Croft
Vice President Academic and Provost
University of Victoria

Dr. Sheryl Staub-French
Professor of Civil Engineering
University of British Columbia

Dr. Mary Wells
Dean of Engineering
University of Waterloo

Dr. Lesley Shannon
Professor of Engineering
Simon Fraser University

Dr. Anne Condon
Professor of Computer Science
University of British Columbia

Dr. Carla Fehr
Associate Professor of Philosophy
University of Waterloo

Acknowledgements: ESS Partners and Funding

- Actua
- R.F. Binnie and Associates
- Bstro
- Canadian Institute of Mining Metallurgy and Petroleum
- City of New Westminster
- City of Port Moody
- City of Vancouver
- Cloud Army Network Inc.
- Dana Industries
- District of West Vancouver
- Eng-Cite
- Engineers Canada
- Engineering Change Lab
- Engineers and Geoscientists BC
- Engineering Science Quest
- The Institute for Gender and the Economy
- Geering Up
- McElhanney
- McMaster University Faculty of Engineering
- Insight Software (formerly Magnitude)
- Metro Vancouver
- Mining Industry Human Resources Council
- National Research Council
- NSERC Chairs for Women in Science and Engineering
- Ontario Network of Women in Engineering
- Science AL!VE
- Science World, Vancouver
- Society for Canadian Women in Science and Technology
- Simon Fraser University (Faculty of Arts and Social Sciences, Engineering Science, Psychology)
- Teck Resources Limited
- TRIUMF
- Canadian Commission for UNESCO
- University of British Columbia (Faculties of Applied Science, Arts, and Science, Department of Psychology, Vice-President of Research and Innovation)
- University of British Columbia Okanagan
- University of Toronto (Applied Science and Engineering, Psychology)
- University of Toronto Mississauga (Department of Management)
- University of Waterloo (Engineering, Psychology, Vice-President of Research and Innovation)
- Veolia Water Technologies Solutions
- WinSETT Centre

SSHRC CRSH
Social Sciences and Humanities Research Council
Conseil de recherches en sciences humaines

An Evidence-Based Approach to Gender Inclusion

Project CLIMB

How best to change implicit biases early in childhood

Project PRISM

Improving girls' feelings of fit with a STEM career

Project SINC

How to mitigate identity-threat in one's first job

Project RISE

Using allyship to create a more inclusive workplace culture

An Evidence-Based Approach to Gender Inclusion

Project
CLIMB

How best to change implicit biases early in childhood

When in development do children's gender stereotypes emerge?

Do children's gender stereotypes affect their beliefs and behavior?

Can we change children's gender stereotypes about STEM?

C
L
I
M
B

When do children's gender stereotypes emerge?

- **Explicit Beliefs**: Boys and girls ages 6-10 said they liked science, were good at science, and said that their own gender was better at science

- **Implicit Associations:** both boys and girls associated men more with science and women more with reading

- Such stereotypes are linked to girls' decreased interest in STEM fields (Master, 2021; Master et al., 2021)

Pun, Gonzalez, Steele, Block, & Baron, in prep

SCIENCE WORLD BRITISH COLUMBIA

C
L
I
M
B

SCIENCE WORLD
BRITISH COLUMBIA

Do gender stereotypes affect children's performance?

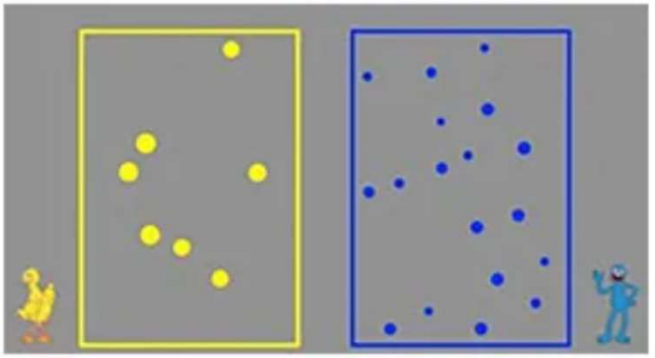
- In adults, reminders of gender stereotypes can impair math performance (Nguyen & Ryan, 2008; Schmader & Johns, 2003; Spencer et al., 2016)

- Mixed evidence in samples with children (Flore & Wicherts, 2015)

Does the effect depend on knowing the stereotype?

- Among 3-4 year olds,

  few held explicit gender stereotypes



- 3-4 year old girls with math=boy stereotypes performed worse when task was described as a math test (vs. eyesight test)

Gonzalez, Odic, Schmader, Block, & Baron, 2021

C
L
I
M
B

SCIENCE WORLD
BRITISH COLUMBIA

Can we change children's gender stereotypes about STEM?

- **Role models** change implicit stereotypes in adults & children

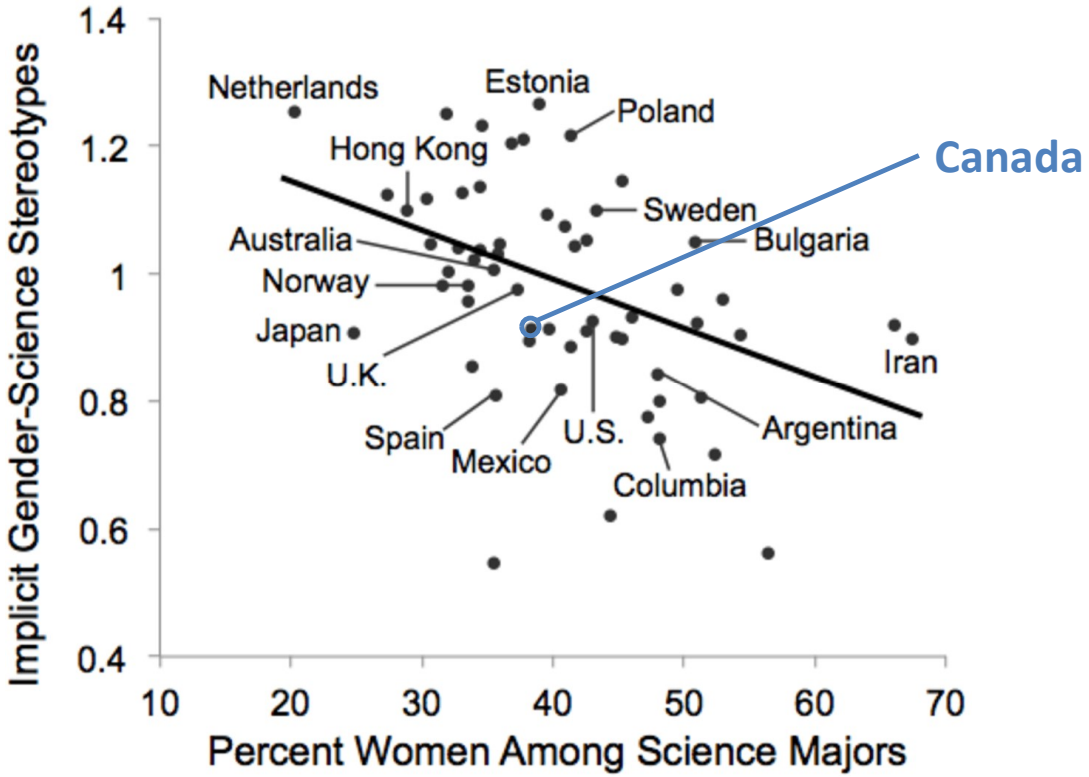
  (Dasgupta & Asgari, 2004; Gonzalez et al., 2017; Gonzalez et al., 2021; Kurdi et al., 2023; Lai et al. 2014; 2016)

- When boys and girls ages 7-10 were told stories about girls who were good at math, and boys who were good at reading…

  → reduced implicit stereotypes associating boys with math

Block, Gonzalez, Choi, Wong, Schmader, & Baron, 2022

Implicit Science = Male Associations Are Stronger in Countries with Fewer Women in Science

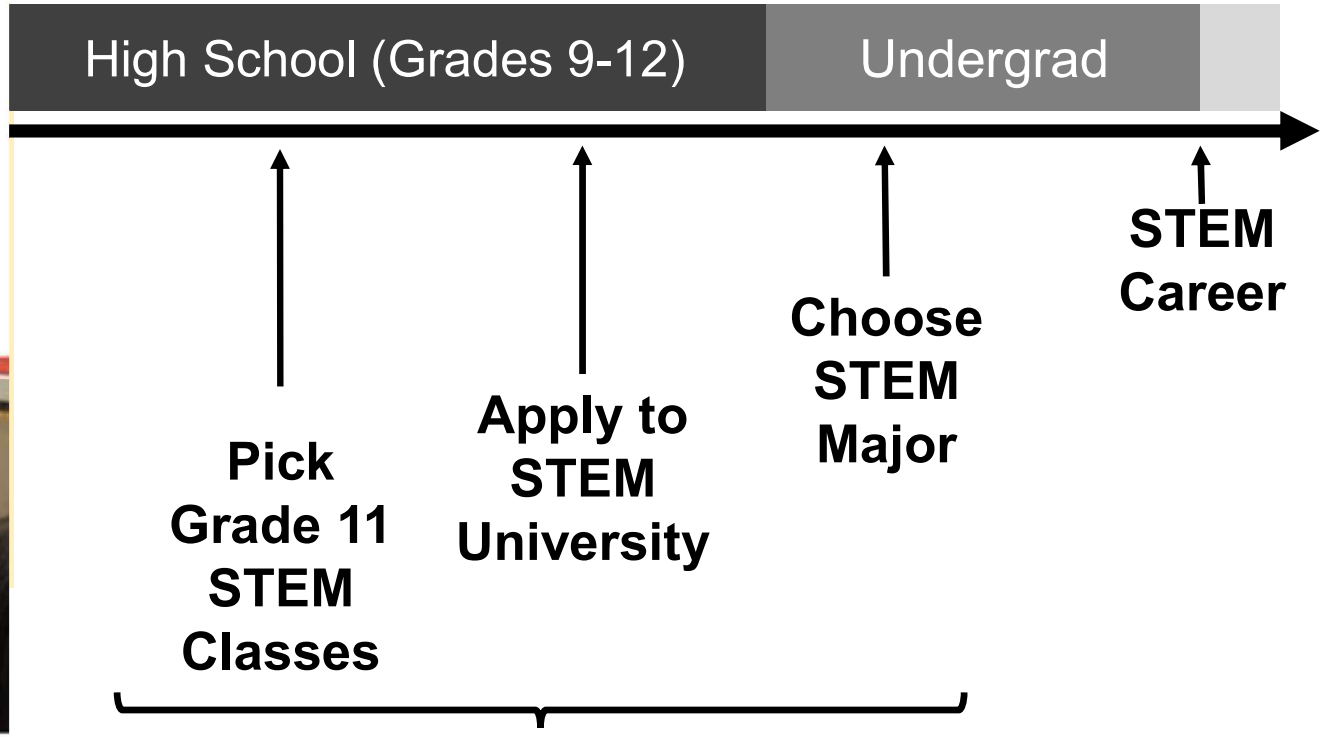


Miller, Eagly, & Linn, 2015

Project

PRISM

Improving girls' feelings of fit with a STEM career



Key participation bottlenecks for girls

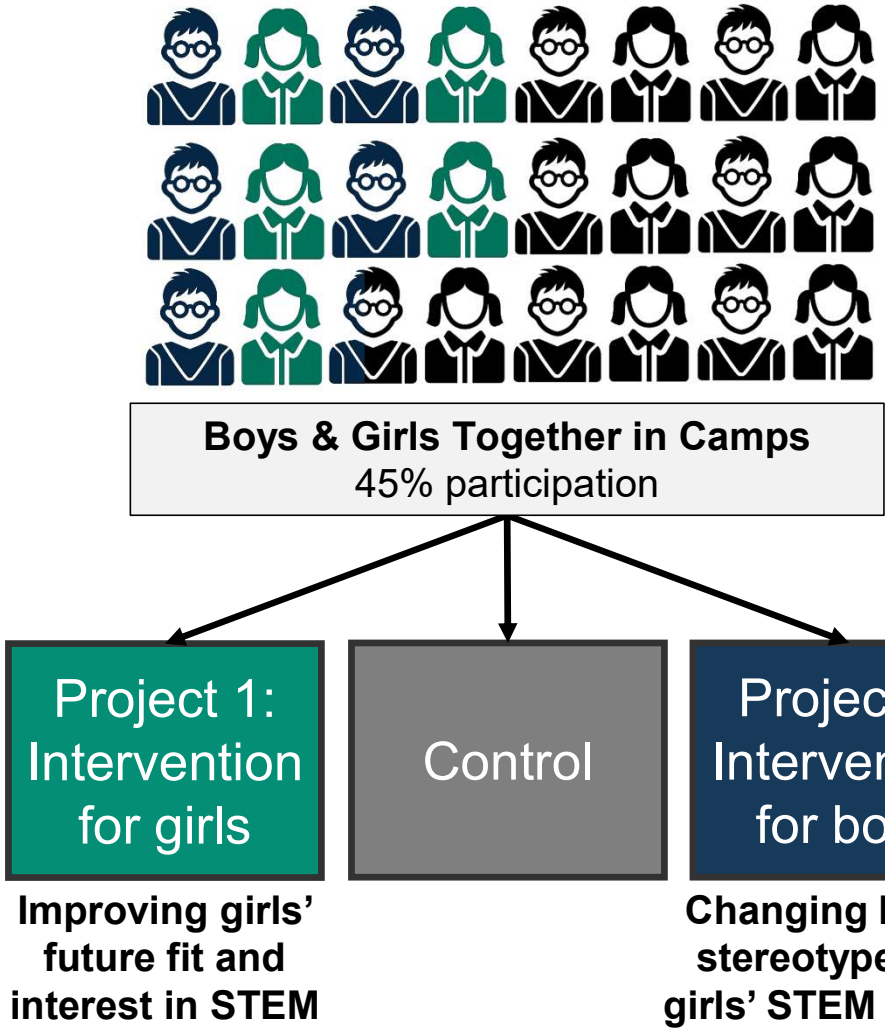
(Breda & Napp, 2019; Card & Payne, 2021; Eccles, 1983; Stoet & Geary, 2018; Wang & Degol, 2013)

PRISM Partnered with

actüa

STEM Camps

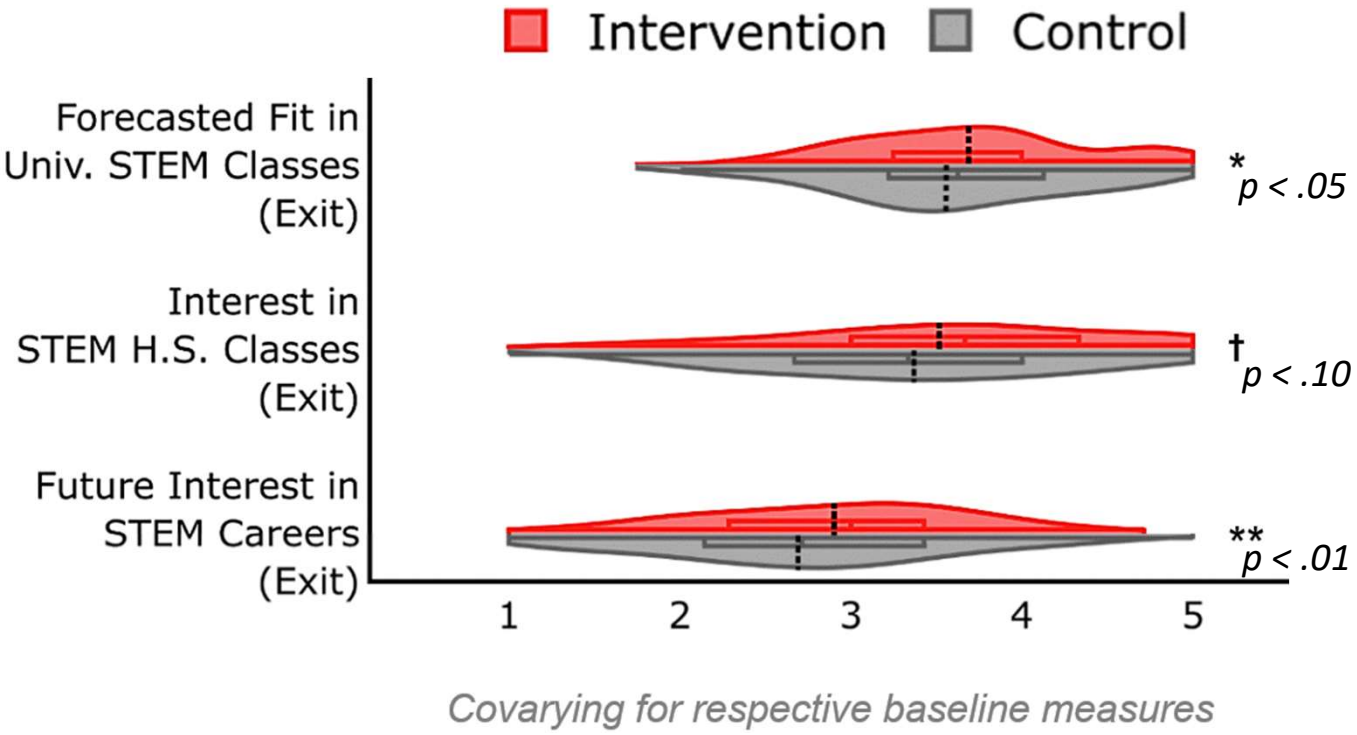
257 girls and 327 boys
11-13 years old



Project 1:

Intervention boosted girls' forecasted fit & interest in STEM classes & careers

Intervention:
A video of a highly successful woman engineer talking about her interest in STEM



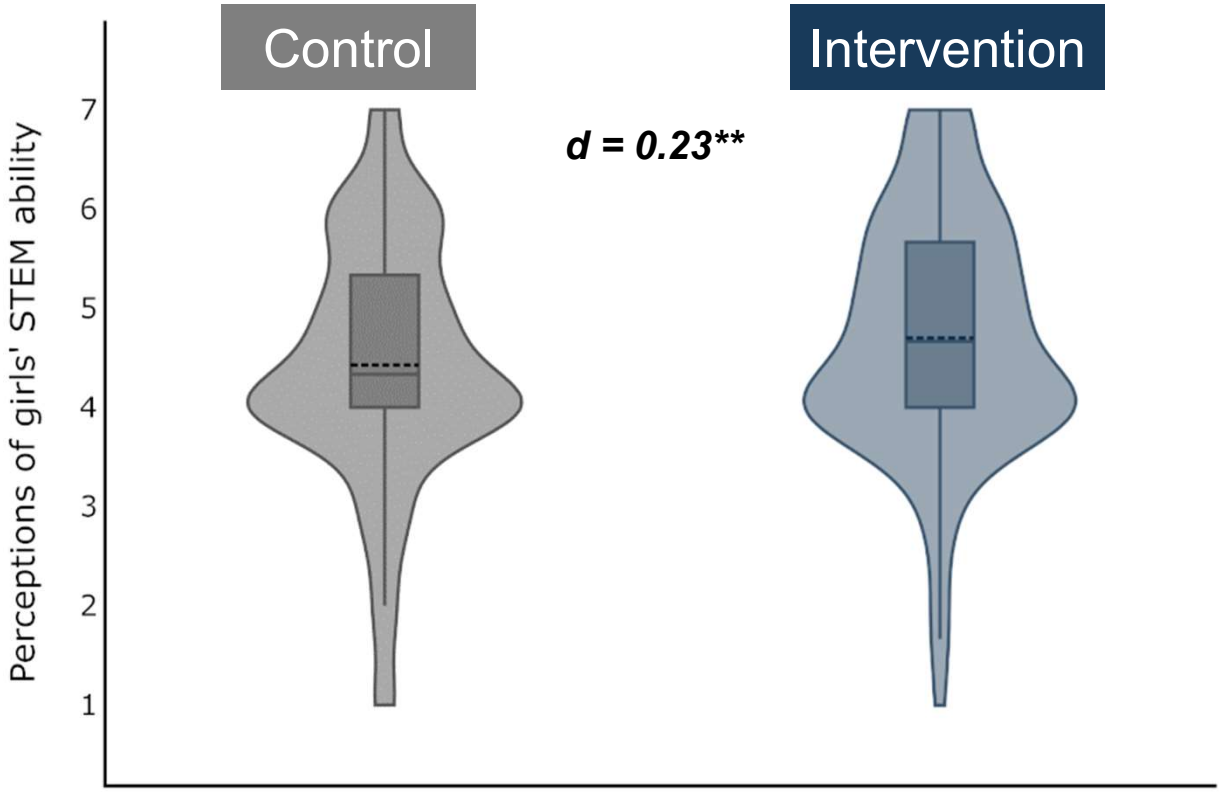
Covarying for respective baseline measures

Cyr et al., in prep.

Project 2:

Intervention improved boys' perceptions of girls' STEM ability

Intervention:
A video of a man talking about positive experiences working with highly successful women in STEM



Note. Effects somewhat stronger in younger boys

Cyr et al., 2024

An Evidence-Based Approach to Gender Inclusion

Project CLIMB

Project PRISM

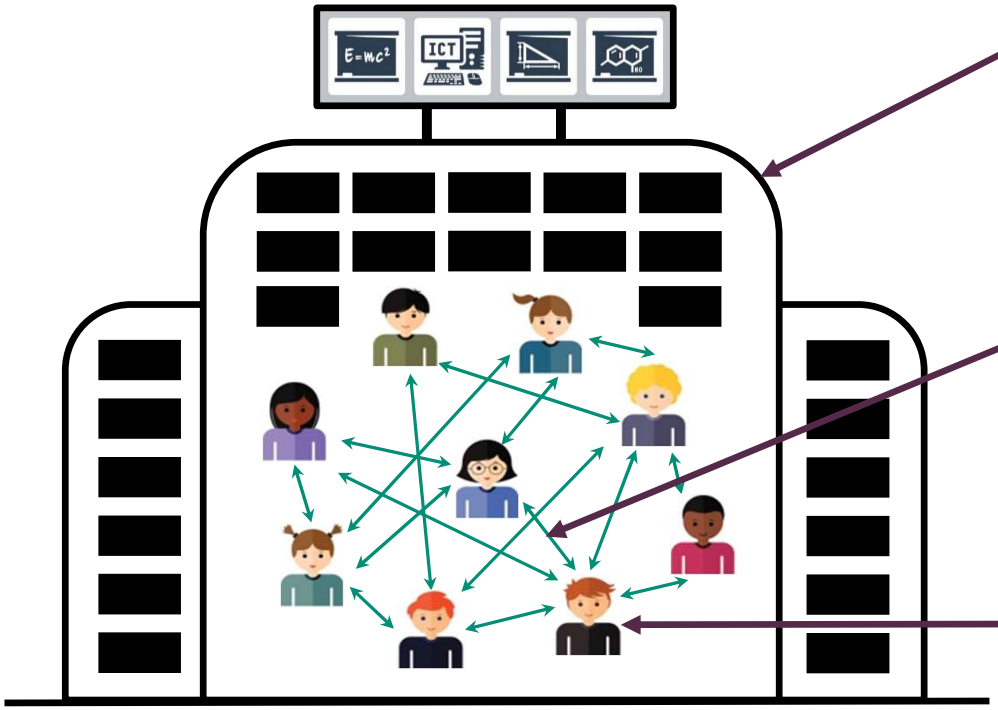
Project SINC

Project RISE




How to mitigate identity-threat in one's first job

Gender Gaps in Attrition: A Problem of Culture



Institutional:
Organizational policies and practices

(Choi & Rainey, 2013; Green & Kalev, 2009; Williams & Bauer, 1994)

Interpersonal:
Daily interactions between people

(Gaughan, Uzzi, & Yang, 2017; Hall, Schmader, Aday, & Croft, 2018)

Individual:
Implicit and explicit biases and beliefs

(Devine et al., 2017; Carnes et al., 2015; Forscher et al., 2017)

What Predicts Women's Daily Burnout?

Social Identity Threat: Concern with being evaluated on the basis of a devalued social group identity

Hall et al., 2019; 2015; Photo credit: Morsa Images

What Predicts Women's Daily Burnout?

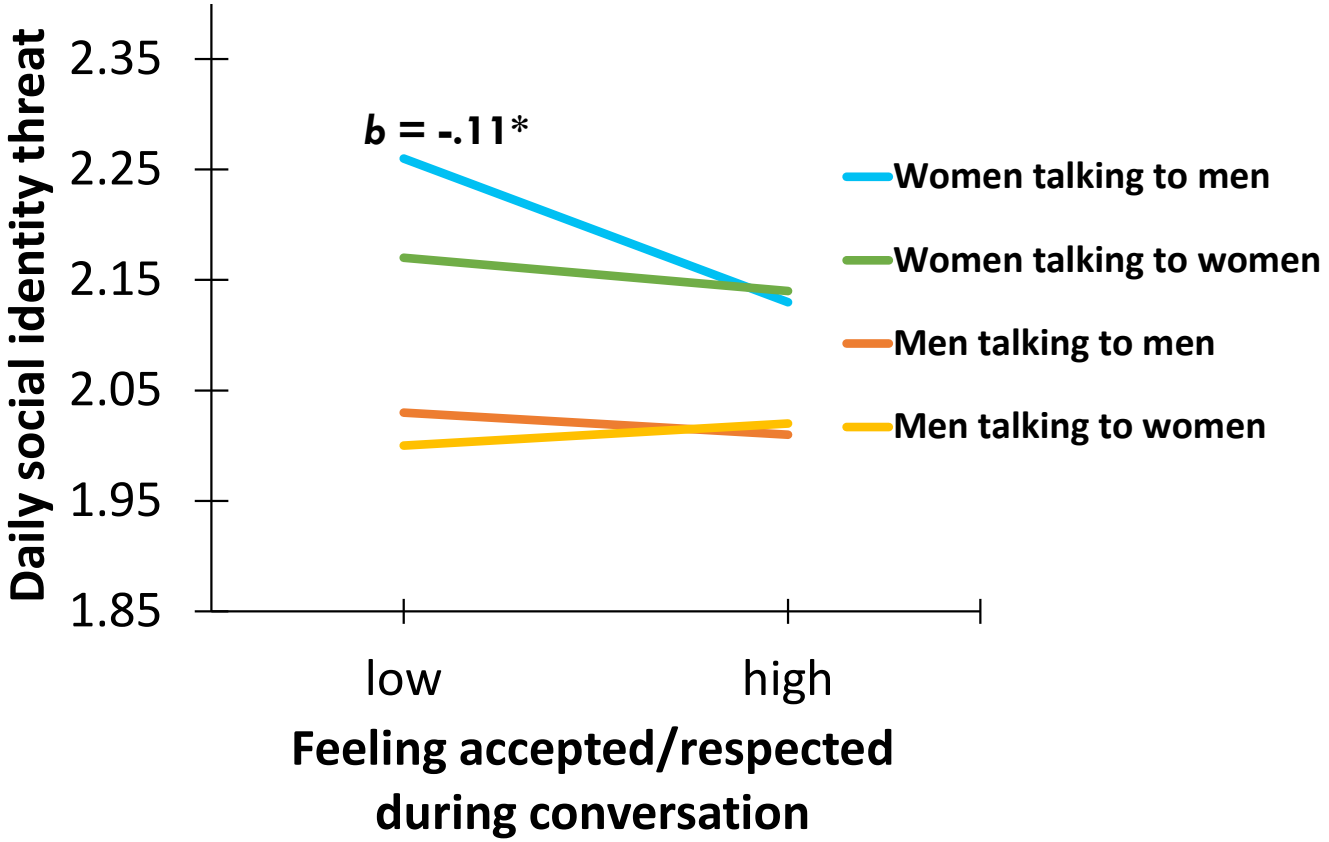
Sample:

144 women & 117 men, students in first STEM Internship

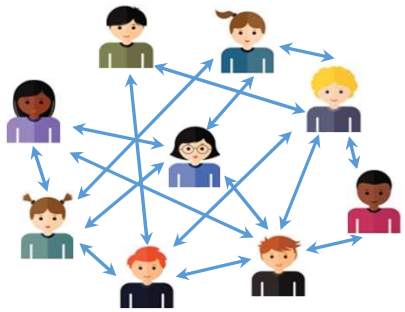
Recount and rate 3 most significant conversations each day
Daily experience of **acceptance, social identity threat,** and **mental burnout**
Performance measures of **working memory capacity**

Hall et al, in prep

Women Report Lower Social Identity Threat When they Feel Accepted by Male Colleagues



What Predicts Women's Daily Burnout?



Acceptance & Respect from Male Colleagues → Lower Social Identity Threat → Lower Burnout & Higher Working Memory Capacity

Hall et al, in prep

An Evidence-Based Approach to Gender Inclusion

Project CLIMB

Project PRISM

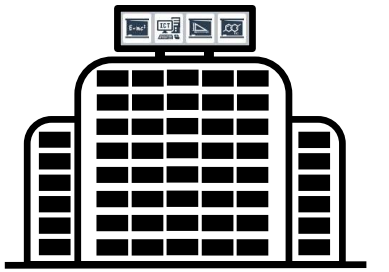
Project SINC

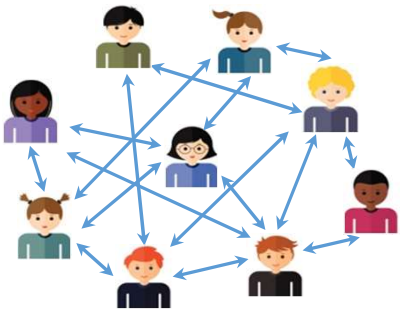
Project RISE




Using allyship to create a more inclusive workplace culture

Can Allyship Foster a Culture of Inclusion?





Gender-Inclusive Policies and Practices

+

Allyship from Male Colleagues

-

Individual Beliefs & Stereotypes (STEM = Male)

-

Social Identity Threat

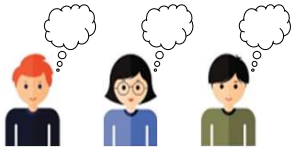
-

Inclusion, Burnout, and Organizational Commitment

(Hall, Schmader, & Croft, 2015; Hall, Schmader, Aday, Inness, & Croft, 2018; Hall, Schmader, Aday, & Croft, 2018)

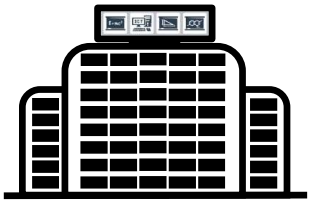
A Typology of Allyship Action

De Souza & Schmader (2024)



Intrapersonal

Interpersonal

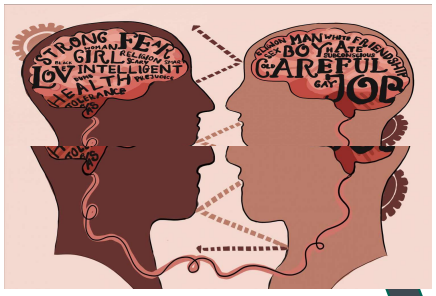


Institutional

Proactive	**Education and Intergroup Contact**	**Mentorship & Microinclusions**	**Inclusive Leadership**
Reactive	**Bias Awareness & Regulation**	**Confronting Others' Biases**	**Collective Action & Protest**

Project RISE
Realizing Identity Safe Environments

The Nature of Implicit Bias and its Effects



Environmental Cues To Fit and Inclusion

Social Identity Threat In Workplace Conversations

Barriers and Benefits Of Allyship Actions

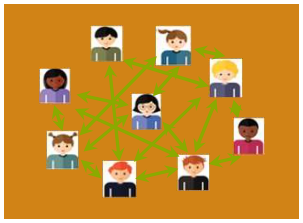
Can Evidence-Based Inclusion Training be Effective?

Can Inclusion Training Change Bias Beliefs and Boost Allyship Behaviour?

Sample: 297 women and men in STEM

Total: 13 workshops with 13-36 attendees each

Method: Randomly assigned to half-day workshop on:



Inclusive Innovation

Influential Leaders

Design Activity

Values Task

Learning Unit

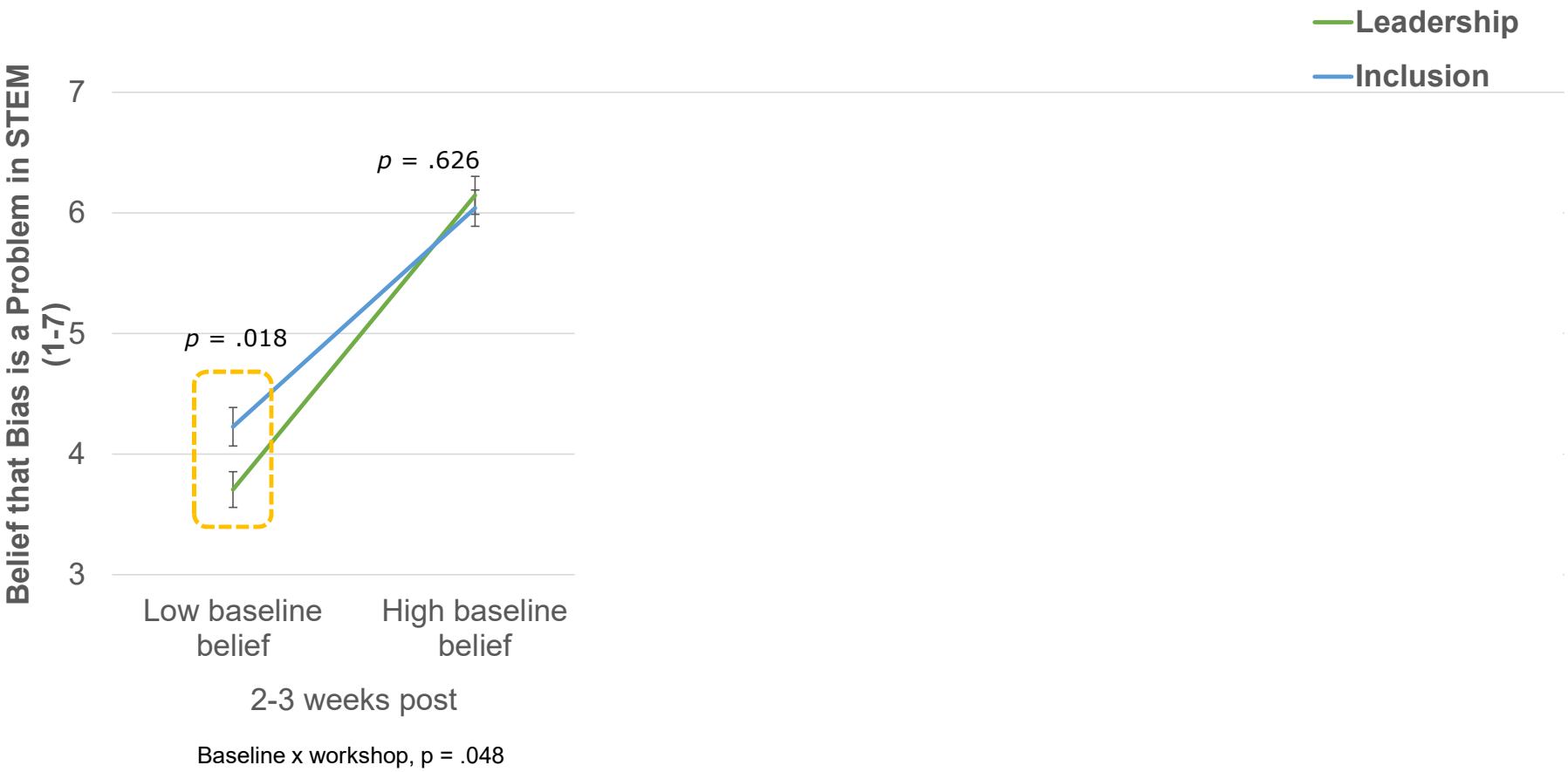
Dialogue Task

If-Then Action Plan

Bergsieker, Schmader et al., in prep

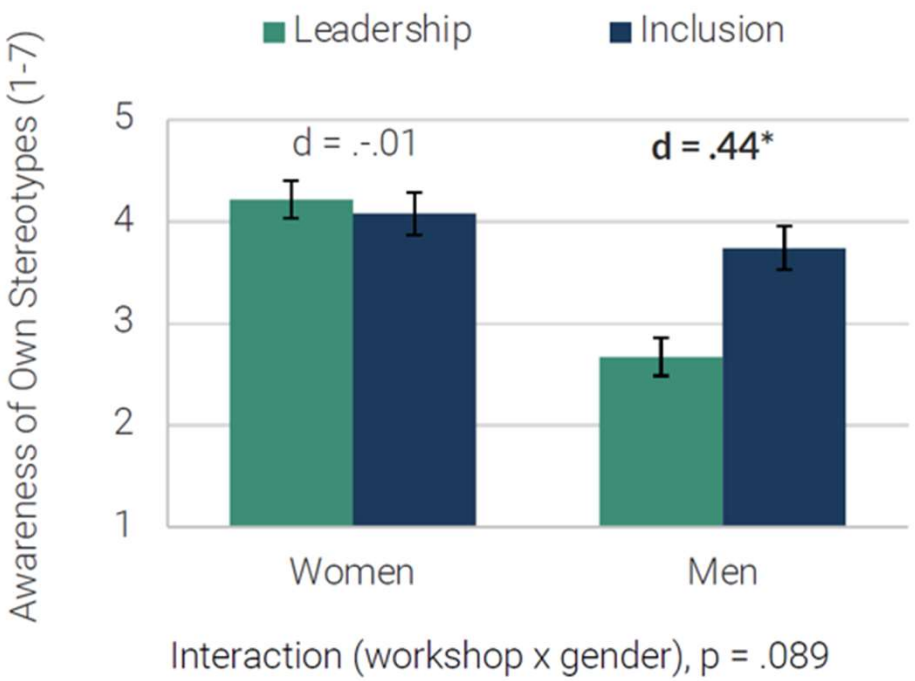
Change in the Belief that Bias is a Problem

No Evidence of Reactance: Effect is Larger for Skeptics



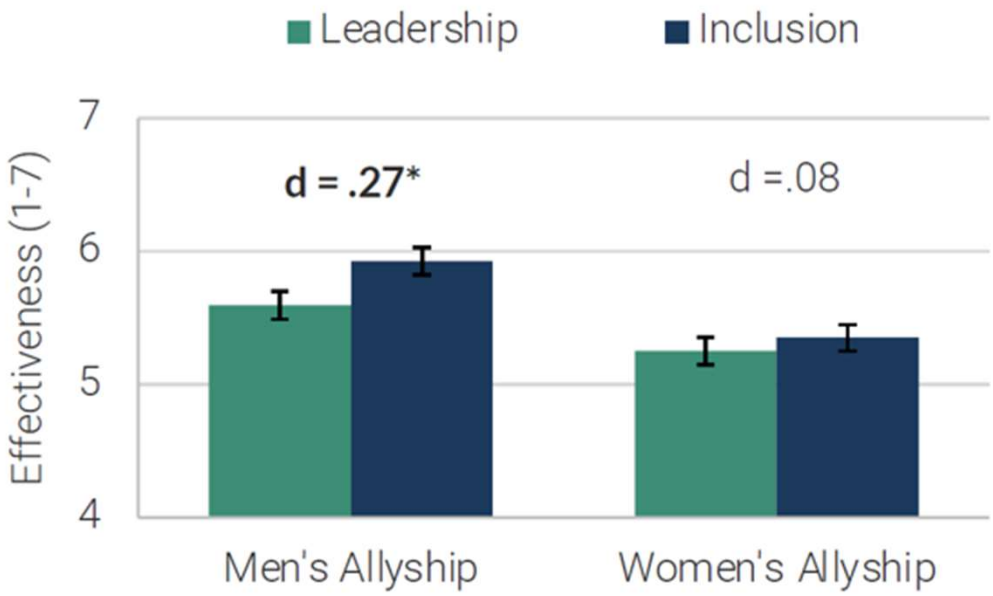
Baseline x workshop, p = .048

Inclusion Workshop Raises Men's Awareness of Own Stereotypes



Interaction (workshop x gender), p = .089

Inclusion Workshop Fosters Belief That Men's Allyship Works



Interaction (workshop x ally gender), p = .069

Initially Women Engage in More Supportive Allyship Action

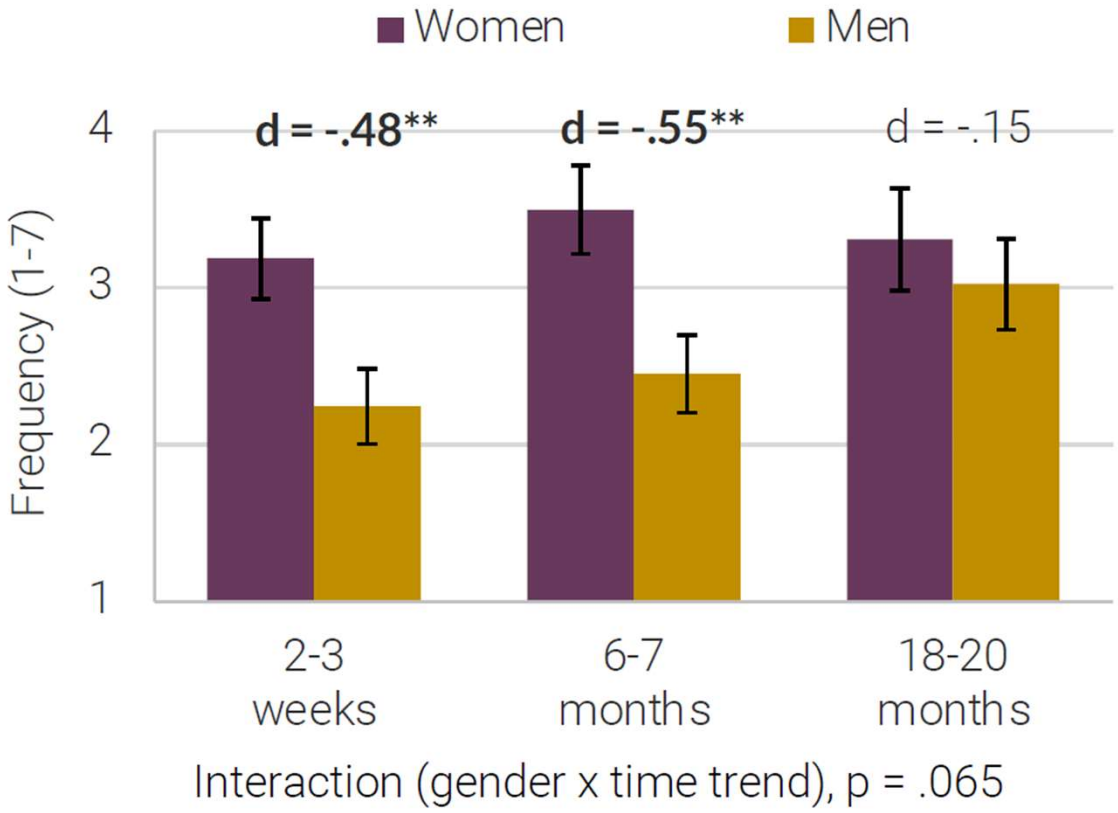
Completing An Allyship Action Plan In Inclusion

Step 5: Automate your Action Plan to be a Proactive Ally

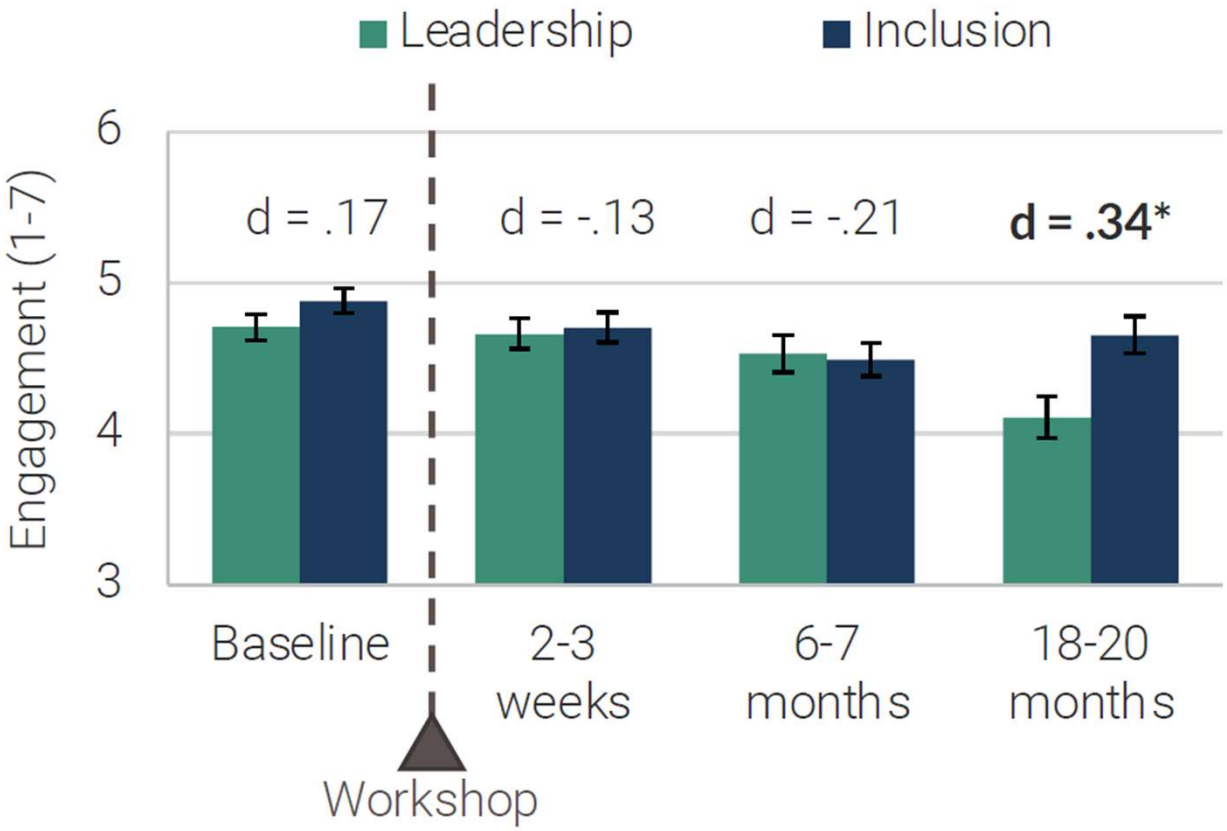
Commit to taking one of the actions above in the next 1-2 weeks.

IF: _____

THEN, I WILL: _____



18 Months Later:
Inclusion Workshop Buffers Feelings of Engagement & Fit



Engagement = less burnout, greater organizational commitment

Effects somewhat stronger for women

Project RISE
successinSTEM.ca

Inclusion training can boost skeptics' bias awareness

Training can boost allyship efficacy and motivation

How best to reduce barriers to allyship action?

Acknowledgements: Project RISE TEAM


Toni Schmader


Lucy De Souza


Tara Dennehy


Audrey Aday

THE UNIVERSITY OF BRITISH COLUMBIA


Hilary Bergsieker


Jessica Trickey


Grace Denney


Emily Cyr

UNIVERSITY OF WATERLOO


Will Hall
Brock U


Joyce He
UCLA


Susan Hollett


Erica Garcia

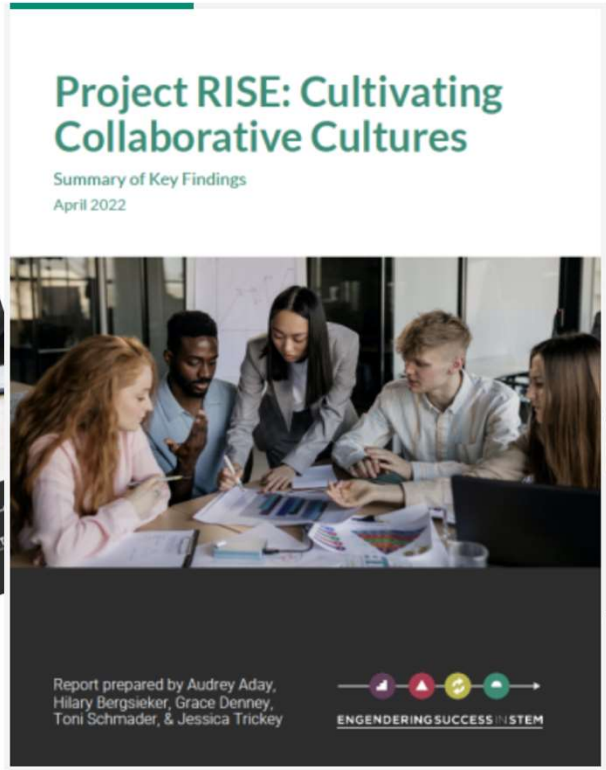

Cheryl Kristiansen


Helen Wilson

Winsett Centre

Project RISE

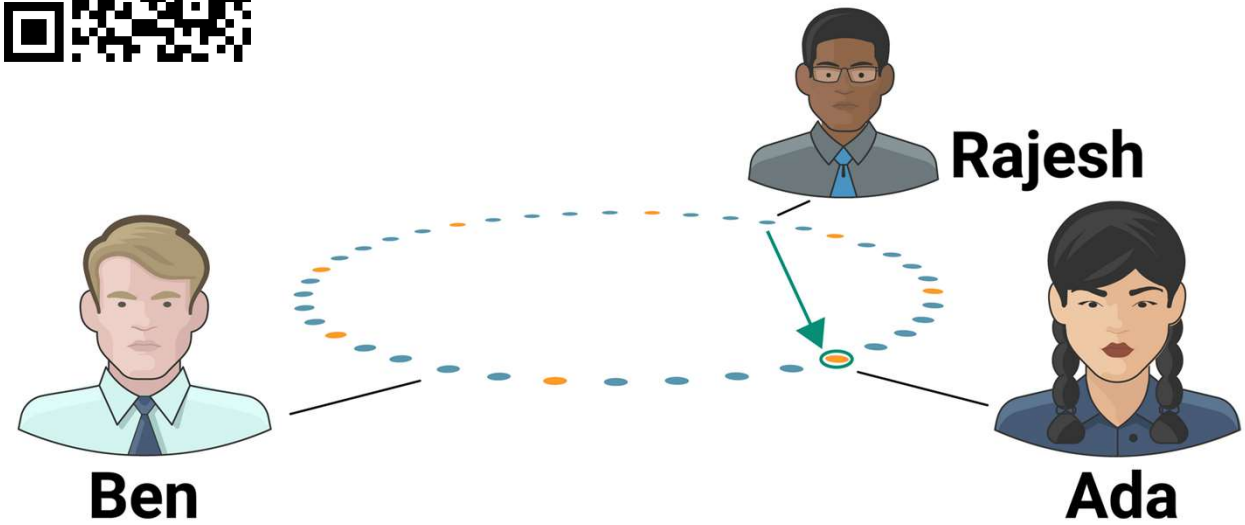
successinSTEM.ca

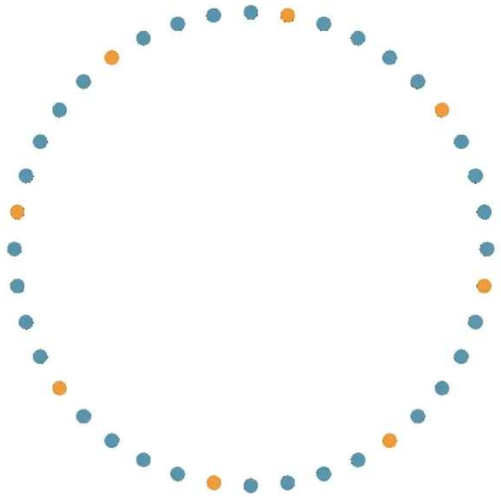


Project RISE

successinSTEM.ca

An Interactive Simulation of how Allyship can Foster Inclusion





"Hi all, We're excited to have Ada lead the next round of client talks. Here's the agenda..."

ENGENDERING SUCCESS IN STEM

Project CLIMB

***Role models** help to change gender stereotypes early in childhood*

Project PRISM

They also reduce boys' stereotypes and boost girls' fit in STEM

Project SINC

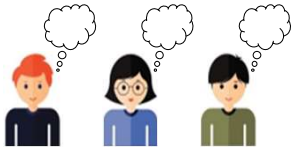
Men's allyship can mitigate women's identity-threat in STEM

Project RISE

Evidence-based training can increase bias awareness and motivate allyship actions

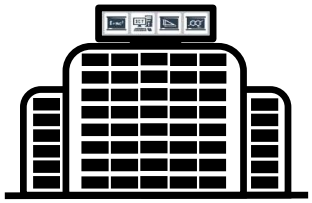
A Typology of Allyship Action

De Souza & Schmader (2024)



Intrapersonal

Interpersonal



Institutional

Proactive	**Education and Intergroup Contact**	**Mentorship & Microinclusions**	**Inclusive Leadership**
Reactive	**Bias Awareness & Regulation**	**Confronting Others' Biases**	**Collective Action & Protest**

Engendering Success in STEM | Booklet

6+ years of rigorous research and evidence-based strategies for promoting gender equality in STEM at all levels – from elementary and high school, to college and the workforce.

successinSTEM.ca

Acknowledgements: ESS Partners and Funding

- Actua
- R.F. Binnie and Associates
- Bstro
- Canadian Institute of Mining Metallurgy and Petroleum
- City of New Westminster
- City of Port Moody
- City of Vancouver
- Cloud Army Network Inc.
- Dana Industries
- District of West Vancouver
- Eng-Cite
- Engineers Canada
- Engineering Change Lab
- Engineers and Geoscientists BC
- Engineering Science Quest
- The Institute for Gender and the Economy
- Geering Up
- McElhanney
- McMaster University Faculty of Engineering
- Insight Software (formerly Magnitude)
- Metro Vancouver
- Mining Industry Human Resources Council
- National Research Council
- NSERC Chairs for Women in Science and Engineering
- Ontario Network of Women in Engineering
- Science AL!VE
- Science World, Vancouver
- Society for Canadian Women in Science and Technology
- Simon Fraser University (Faculty of Arts and Social Sciences, Engineering Science, Psychology)
- Teck Resources Limited
- TRIUMF
- Canadian Commission for UNESCO
- University of British Columbia (Faculties of Applied Science, Arts, and Science, Department of Psychology, Vice-President of Research and Innovation)
- University of British Columbia Okanagan
- University of Toronto (Applied Science and Engineering, Psychology)
- University of Toronto Mississauga (Department of Management)
- University of Waterloo (Engineering, Psychology, Vice-President of Research and Innovation)
- Veolia Water Technologies Solutions
- WinSETT Centre

SSHRC CRSH
Social Sciences and Humanities Research Council
Conseil de recherches en sciences humaines


THANK YOU!