NSF EHR CORE Research (ECR) Program and CSU Grantees Webcast

Moderated by:

Dr. Frank A. Gomez
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https://www2.calstate.edu/impact-of-the-csu/research/stem-net

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The California State University
OFFICE OF THE CHANCELLOR

NSF EHR Core Research (ECR) Program and CSU Grantees Webcast

Speakers

Earnestine Easter, National Science Foundation
NSF EHR Core Research (ECR) Program

Philip Vieira, Cal State Dominguez Hills
Supporting Student Success through a Combination of High Impact Educational Practices and Asset-Based Training

Dustin Thoman, San Diego State University
Diversity Interventions in the Classroom: From Resistance to Action

Melo-Jean Yap, San Diego State University
San Diego State University, Influential Networks for Women of Color in STEM Community College Pathways

P. Wesley Schultz , Cal State San Marcos
Becoming a Scientist: Identity Balance Among Underrepresented Students in STEM

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STEM Education Research: Opportunities for Innovation and Transformation

Earnestine Easter
Program Director
Division of Graduate Education

National Science Foundation

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Presentation Outline

- Overview of STEM Education Research Investments
- STEM Education Research Infrastructure
- Funding Opportunities
- Fundamental Research Guidelines
- Attributes of Competitive Proposals
- NSF Merit Review Criteria
- Helpful Resources

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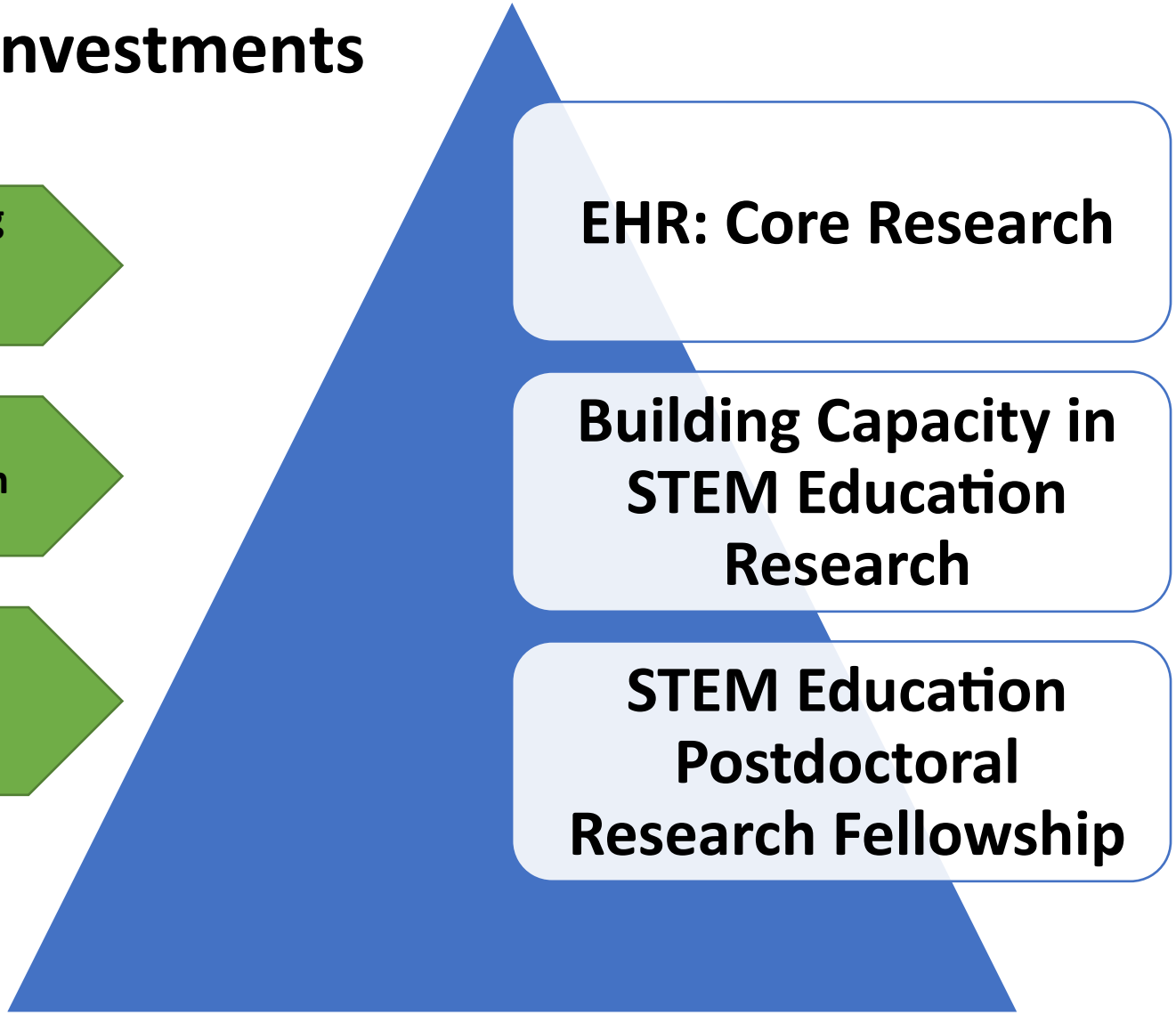
STEM Education Research Investments

- STEM Learning and Learning Environments
- Broadening Participation in STEM Fields
- STEM Workforce Development



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STEM Education Research Infrastructure

PROGRAMS	INSTITUTES	RESOURCE HUBS
• STEM Ed PRF • ECR: BCSER • ECR	• Design • Methods • Practices	• Data Resource • Resource Coordination

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STEM Postdoctoral Research Fellowships (STEM ED PRF) *NSF 22-531* *Next Deadline TBD*

Goal: To enhance the research knowledge, skills, and practices of recent doctorates in STEM, STEM Education, Education, and related disciplines to advance their preparation to engage in fundamental and applied research in STEM education that advances knowledge within the field.

Program Tracks:

Individual Postdoctoral Fellowships
$300,000 for 24 months

Institutional Cohort Postdoctoral Fellowships
$1,250,000 for single institutions for 36 months
$2,500,000 for collaboratives 36 months

https://beta.nsf.gov/funding/opportunities/science-technology-engineering-and-mathematics-education-

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ECR: Building Capacity in STEM Education Research (ECR: BCSER) *NSF 22-548*

Goal: To build investigators' capacity to conduct high-quality STEM education research and broaden the pool of researchers who can advance knowledge in STEM learning and learning environments, broadening participation in STEM fields, and STEM workforce development.

Program Tracks

- Individual Investigator Development (new and experienced)
- Institutes for Methods and Practices in STEM Education Research

Next Deadline: February 24, 2023

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EHR Core Research (ECR) NSF 21- 588

Goal: To support fundamental research (curiosity-driven basic research and use-inspired basic research) that contributes to the general explanatory knowledge that underlies STEM education.

Proposal Types

- Pilot Studies
- Level I, II, or III Projects
- Synthesis Proposals

Next Deadline: October 6, 2022

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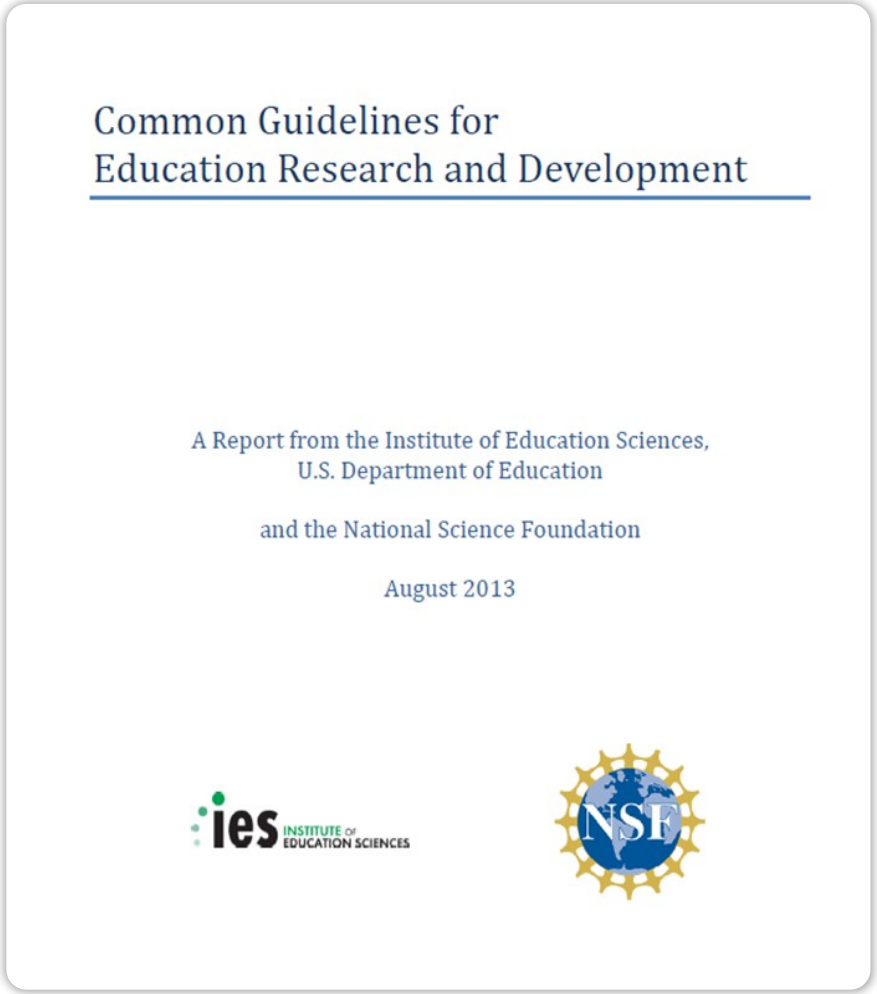
Common Guidelines (NSF 13-126)



https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf13126

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Fundamental Research

- Is grounded in theoretical or empirical frameworks that inform research questions;
- Identifies and explores important new constructs in STEM learning/learning environments, broadening participation in STEM fields, or STEM workforce development;
- Extends understanding of current constructs;
- Increases understanding of relationships among the constructs under investigation;
- Extends research or evaluation methodologies for advancing the evidence base to support improved policy or practice

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Attributes of Competitive STEM Education Research Proposals

- Create and study **new** models and innovations in STEM teaching and learning, broadening participation, and workforce development.
- Be **grounded** in current literature (conceptually and theoretically.
- Incorporate current research designs, methodologies, and conceptual frameworks.
- Inform STEM education policy and practices.

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Attributes of Competitive STEM Education Research Proposals

- Demonstrate a coherent linkage among the conceptual framework, research design, and research outcomes.
- Demonstrate how the project will result in rigorous, cumulative, reproducible, and usable findings to merit peer review and publication.
- As appropriate, describe mechanisms to facilitate the translation of research findings into practice for use by practitioners, other researchers and policymakers.

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Merit Review

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Merit Review Criteria

All NSF proposals are evaluated through two merit review criteria:

- **Intellectual Merit** – the potential to advance the knowledge
- **Broader Impacts** – the potential to benefit society and contribute to the achievements of specific, desired societal outcomes

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Merit Review Elements

The following **five elements** are considered in the review of both intellectual merit **and** broader impacts.

1. What is the potential for the proposed activity to
   a) **Advance knowledge** and understanding within its own field or across different fields (Intellectual Merit); and
   b) **Benefit society** or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or **potentially transformative** concepts?

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Merit Review Elements, cont.

3. Is the plan for carrying out the proposed activities **well-reasoned**, well-organized, and based on a sound rationale? Does the plan incorporate a **mechanism to assess success**?
4. How **well qualified** is the individual, team, or organization to conduct the potential activities?
5. Are there **adequate resources** available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

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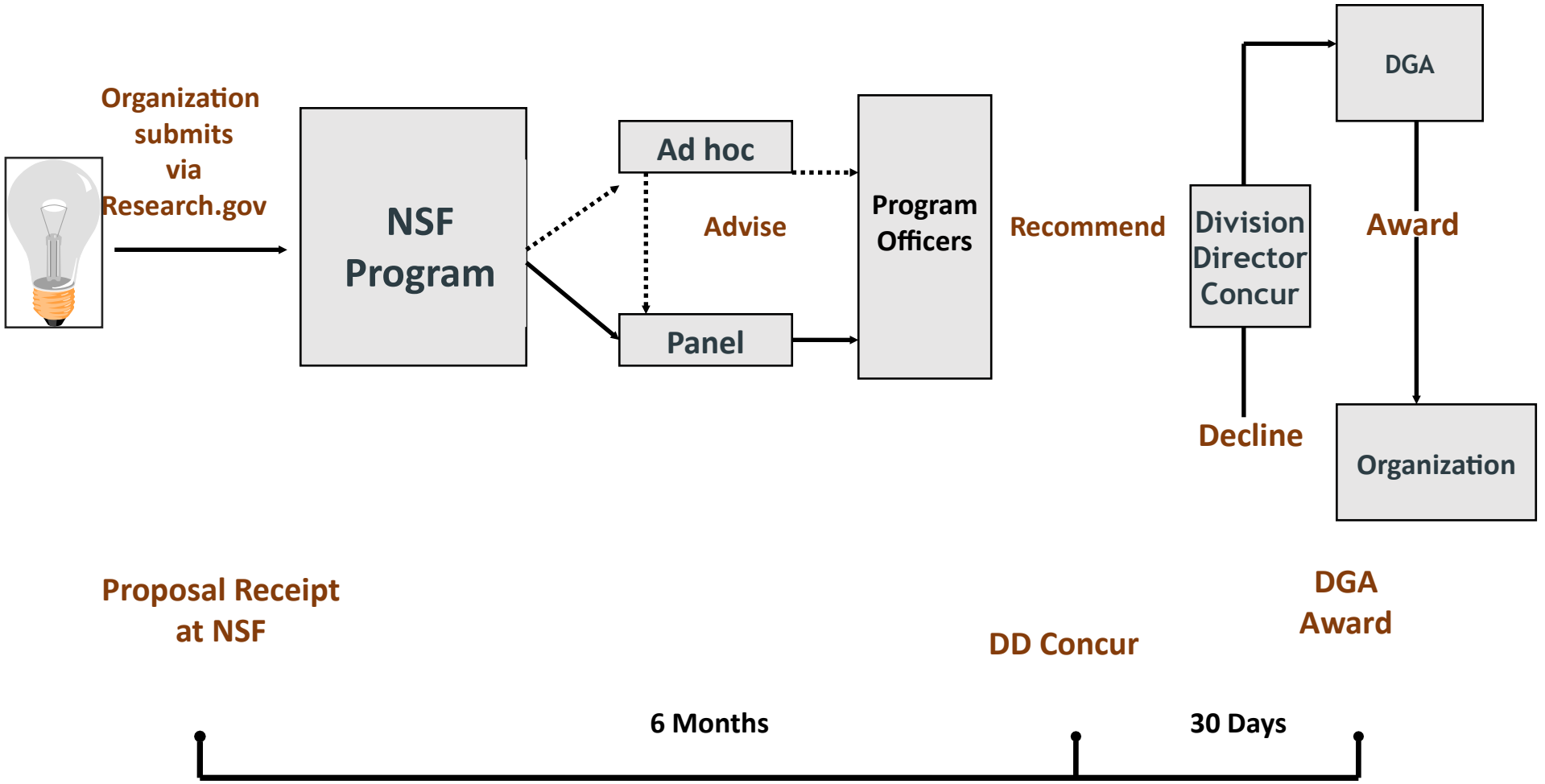
Proposal Review Process and Timeline



Helpful Resources

- Science, Technology, Engineering and Mathematics (STEM) Education Postdoctoral Research Fellowships (STEM Ed PRF) (nsf22531) | NSF - National Science Foundation
- EHR Core Research: Building Capacity in STEM Education Research | Beta site for NSF - National Science Foundation
- EHR Core Research (ECR:Core) | Beta site for NSF - National Science Foundation
- Merit Review | NSF - National Science Foundation
- PAPPG (NSF 22-1) dated October 4, 2021

Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Philip A. Vieira (PI)– CSU Dominguez Hills

Collaborators: Alexander Camarillo (Teaching Assistant)

Philip A. Vieira, Associate Professor

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Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Project Overview

- Broadening Capacity in STEM Education Research (BCSER): "*supports activities that enable researchers to expand their areas of expertise and acquire the requisite knowledge and skills to conduct rigorous research in STEM education*"
- Persistence and retention of STEM majors nationally does not meet the demand for STEM workforce
- URM students are more likely to leave STEM majors compared with their white counterparts
- CSUDH an ideal testbed to support URM student success in STEM: most diverse CSU, with highest percentage of students that are first generation, URM, Pell Grant recipients.

Table 1. Undergraduate student demographic data from Fall 2018	
Demographic	%
Hispanic	64%
African American	11%
Asian American	8%
White	7%
Pacific Islander	1%
American Indian	1%
Two or more	3%
Unknown/ decline to state	3%
Nonresident alien	5%
Pell Eligible	64%
First generation	56%
First in family to earn a degree	80%
Females	60%

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Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Activities

- Project implemented in a Fall 2021 First Year Seminar (FYS) course entitled *Sex, Drugs, Rock-n-Roll: The Neuroscience of Hedonism*
- Sample size=17 students
- Control groups: Fall 2020 FYS course (offered online only); Fall 2021 FYS course with similar sample size/demographics
- Pre/post design with survey data, facilitation logs, interviews, and supplemental data (IR, course materials, PTEs)

Fall 2021 Student Demographics	
Latinx/Hispanic	86%
Black/African American	7%
Other ethnicity/nationality	7%
Male	43%
Female	57%
First generation	71%

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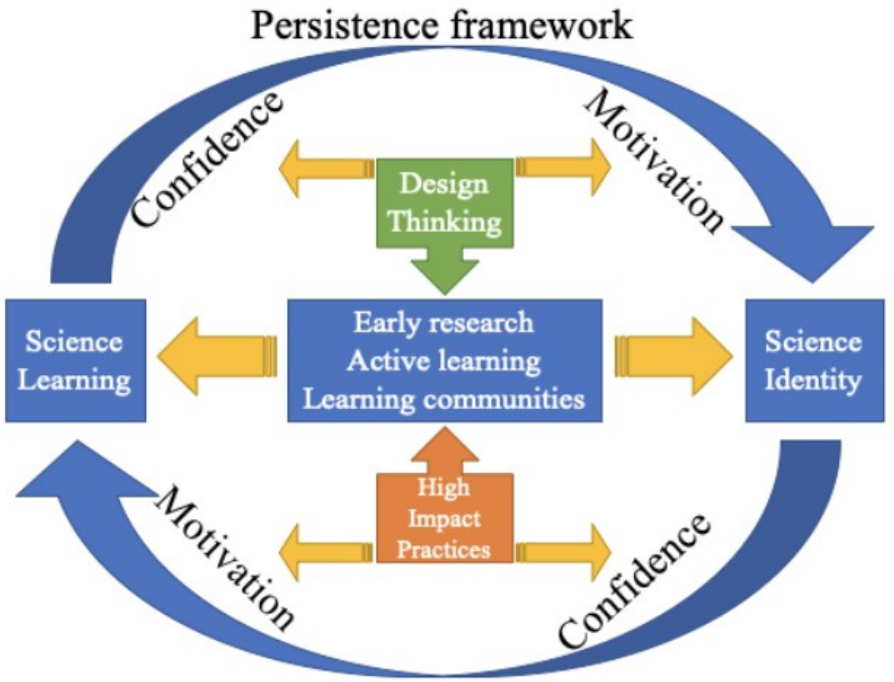
Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Activities

- Combined High Impact Educational Practices (HIPs) with Design Thinking (DT) and asset-based (Strengths) training in a First Year Seminar
  - HIPs: research experiences, collaborative projects, writing intensive assignments
  - DT: creative problem solving following an engineering-based framework that includes ideation, prototyping, testing, refining strategies to solve the problem. Activities included aspirational resume, Strength's coaching, career exploration, Odyssey Plan, Informational Interviews



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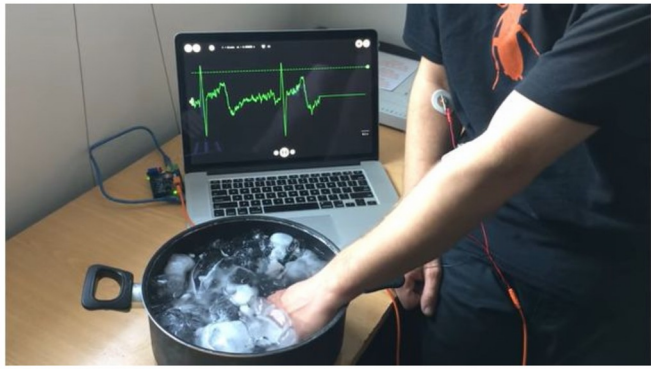
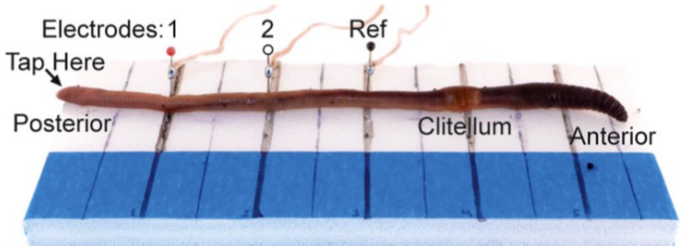
Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Activities

- CUREs: low-cost neuroscience research/education tools (Backyard Brains)
  - Sympathetic nervous system activation
  - Electroencephalography (EEG)
  - Neuronal conduction in earthworm model
- Student group projects:
  - Does ethanol affect conduction velocity?
  - What affect does phone usage have on brain activity?
  - How does body temperature affect muscle activity?
  - How does body temperature affect brain activity?
  - How does anemia affect the sympathetic nervous system?





Images from Backyard Brains, Inc.

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Activities

- Strength's training: asset-based approach to problem solving and goal achievement

CliftonStrengths®

	Executing									Influencing								Relationship Building									Strategic Thinking							
	Achiever	Arranger	Belief	Consistency	Deliberative	Discipline	Focus	Responsibility	Restorative	Activator	Command	Communication	Competition	Maximizer	Self-Assurance	Significance	Woo	Adaptability	Connectedness	Developer	Empathy	Harmony	Includer	Individualization	Positivity	Relator	Analytical	Context	Futuristic	Ideation	Input	Intellection	Learner	Strategic
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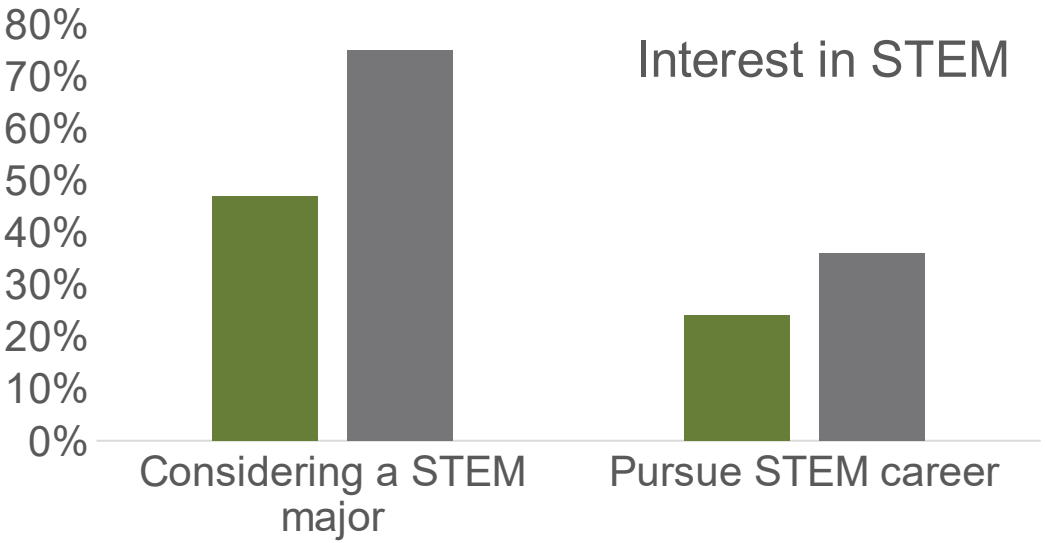
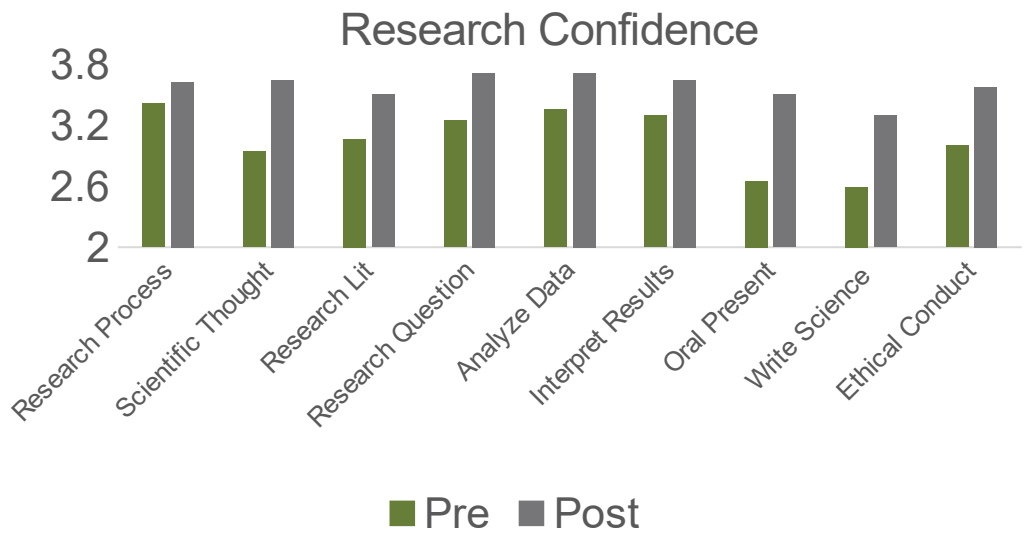
Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Results

- **Increased interest in STEM major/career**:
  - 28% increase in students pursuing STEM major
  - 12% increase in student interest in STEM careers
- **Increased confidence in research**:
  - research process/literature/scientific thought
  - generate a research question
  - analyze data/interpret results
  - ethical conduct in research
  - write scientifically/give an oral presentation related to research
- **Science identity maintained:** However, there was an increase in students that Strongly Agree with:
  - "I have a strong sense of belonging to the community of scientists"
  - "I have come to think of myself as a 'scientist"
  - "The daily work of a scientist is appealing to me"

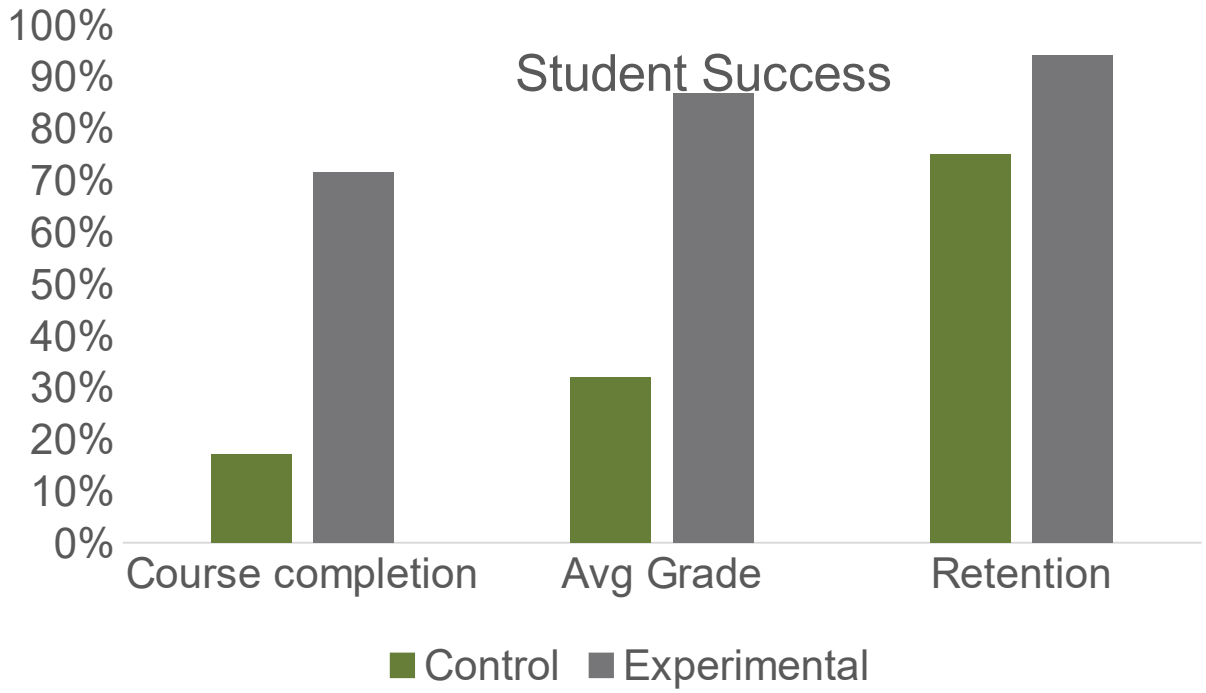




Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Results

- **Increased Student Success**:
  - 54% increase in course completion
  - 55% increase in average course grade
  - 19% increase enrollment in subsequent semester
- **Classroom Community:**
  - connected to other students in the course
  - encouraged to ask questions/know how to get help
  - given ample opportunities to learn
  - increased attendance in the course
- **Student Well-Being:**
  - personally invested in school/belonging/respected at school
  - understood academic support and emotional support
  - familiarity and use of healthy coping strategies to deal with stress



Lessons Learned

- Pandemic challenges
  - Absenteeism
  - Confusion regarding restrictions
  - general anxiety/lack of motivation
- Not enough time to cover all elements in depth
- Integrate more scaffolding to ensure timely progress and completion
- Intentional integration of individual course elements to be complimentary
- Include more control groups to provide complete data

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Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Next Steps/Long-Term Plans

- Continue collecting institutional research data on cohort (to measure persistence/retention in STEM)
- Implement lessons to next offering of the course (Fall 2022)
- Share results with broader STEM education research community
- Expand approach to other courses targeting first year and transfer students
- Broaden institutional STEM education research

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Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Summary

- Positive experience for students, teaching assistant, and instructor
- Pilot combinatorial strategy to improve STEM student success
- Foundation for future research opportunities in STEM education

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Supporting Student Success Through a Combination of High Impact Educational Practices and Asset-Based Training

Questions?

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Diversity Interventions in the Classroom: From Resistance to Action

Dr. Dustin Thoman, San Diego State University

Collaborators:
Dr. Felisha Herrera Villarreal, SDSU
Dr. Melo Jean Yap, SDSU
Dr. Jessi Smith, University of Colorado, Colorado Springs

Dustin Thoman, Associate Professor

San Diego State University, Department of Psychology

dthoman@sdsu.edu

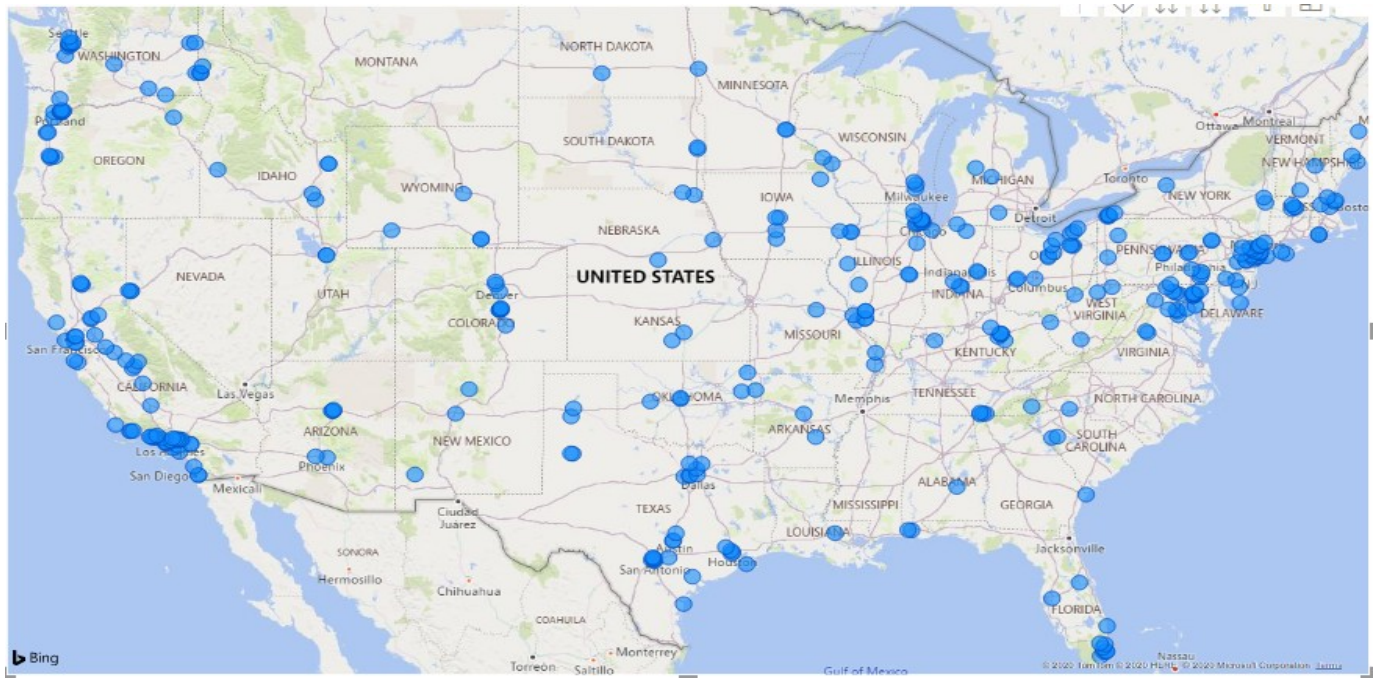
Project Overview

- **Defining the Problem**
  - Researchers have created many evidence-based interventions that improve equity in STEM classrooms
  - But moving interventions to scale in college classrooms is slow
  - Can we improve implementation science by taking the perspective of decision makers (faculty)?
- **"There's nothing so practical as a good theory"**
  - Thomas & Plaut (2008) Diversity resistance in the workplace
  - Latane & Darley (1978) Bystander helping model
- **Decision making inputs: Deciding when to "help"**

1. Notice that underrepresentation is a problem
2. Interpret underrepresentation as needing immediate action
3. Assume responsibility
4. Know how to help

Activities

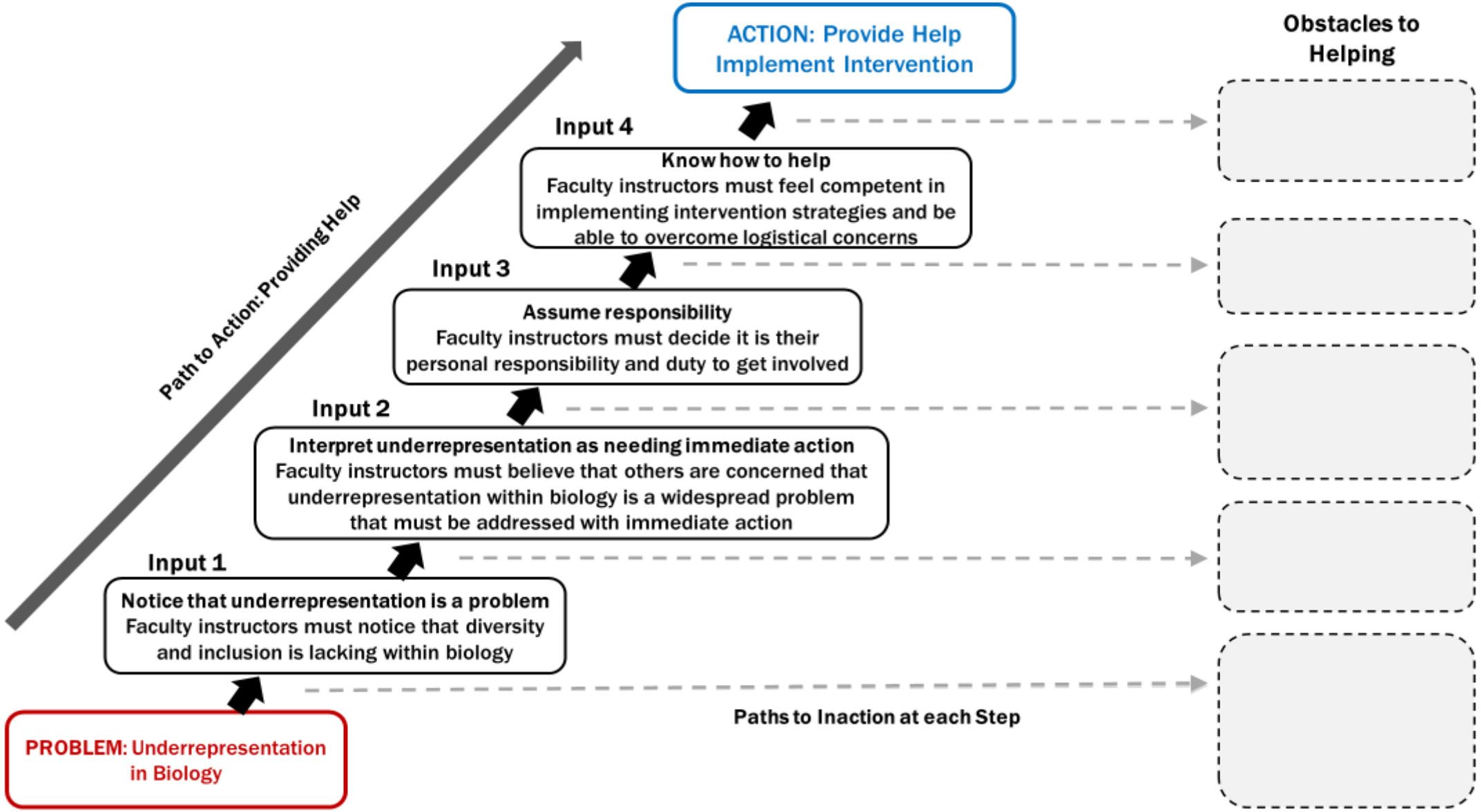
- Recruited a nationally representative sample of biology instructors
  - N = 40 in depth interviews and survey
  - N = 604 surveys after learning about the Utility Value Intervention (UVI)



SAN DIEGO STATE UNIVERSITY

Results

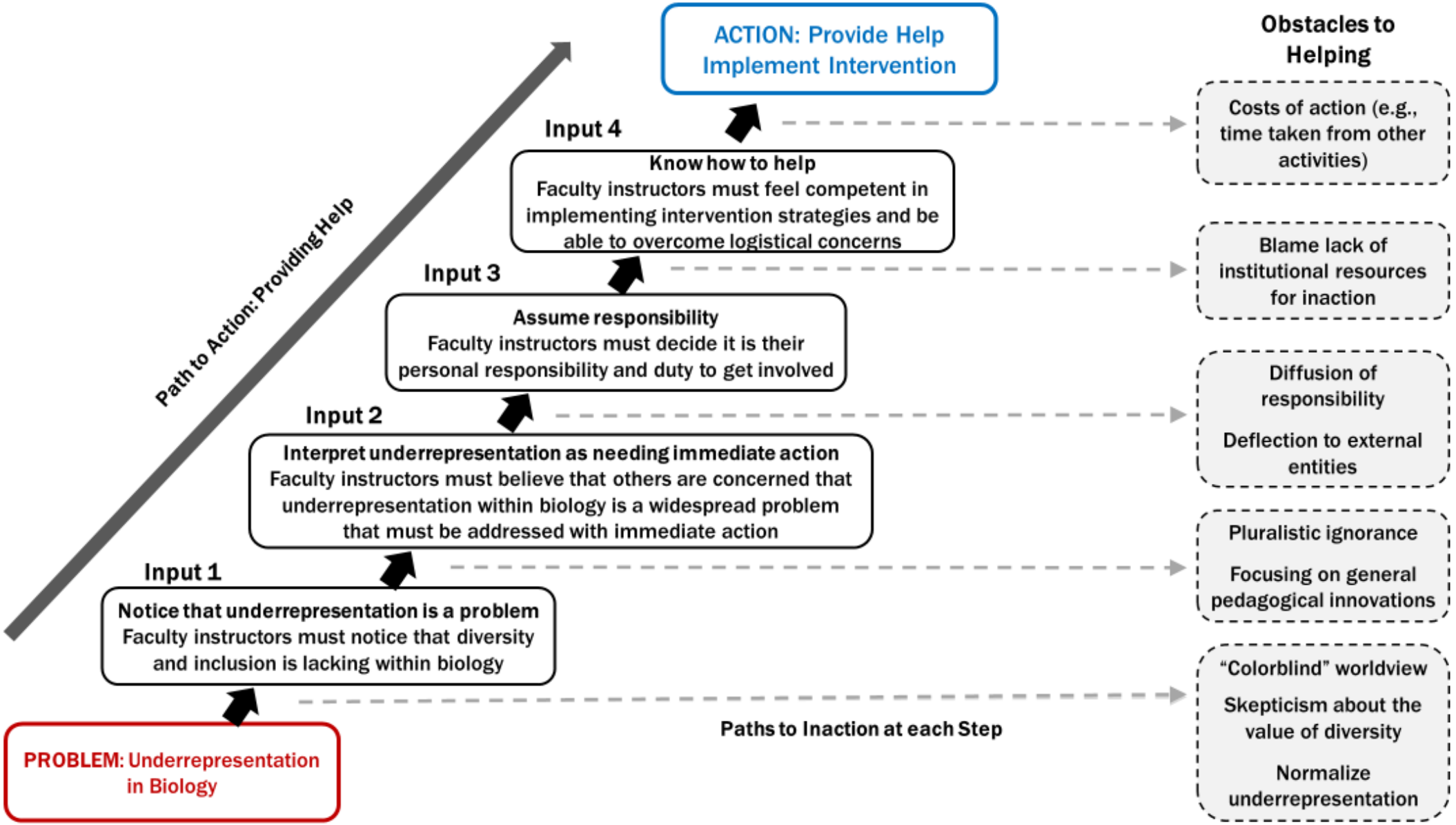
Diversity Interventions in the Classroom: From Resistance to Action



SAN DIEGO STATE UNIVERSITY

Results

Diversity Interventions in the Classroom: From Resistance to Action



Lessons Learned

- Faculty are gatekeepers for the implementation of classroom interventions that have been shown to reduce equity gaps
  - Getting information on interventions into their hands is not enough
  - We must understand their social psychological perspectives and systematically study decision making and behavior change

- When designing implementation supports (e.g., policies) we must consider building value and reducing implementation costs/barriers as equally important but separate goals

Thoman et al. (2021). CBE Life Science Education 20: ar52.

Next Steps/Long-Term Plans

- **Advancing Knowledge: Implementation Science**
  - Model refinement & testing
  - How do broader beliefs influence specific implementation decisions?

- **Broader Impacts: Advocating for evidence-based strategies**
  - Working with professional societies
  - Sharing our strategies

Summary

- NSF EHR Core Research supports theory driven and use inspired research across the STEM education system
  - Most research is student-focused
  - We must study other perspectives within the system, including gatekeepers of the system
  - Proposals must clarify how the work will advance knowledge in the field (not just solve a practical problem)

Questions?

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Follow us @ DustinThoman

Influential Networks for Women of Color STEM Community College Pathways

Melo-Jean Yap, Ph.D – San Diego State University

Collaborators: Dr. Felisha Herrera Villarreal (Research and Equity Scholarship Institute on Student Trajectories in Education @ SDSU)

NSF DUE-1937777

Melo-Jean Yap, Principal Investigator

SDSU, Department of Postsecondary Education

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Community College (CC)

The Potential

- "Critical access point in the STEM pipeline for BIPOC" (Herrera et al., 2018)
- 48% of UC STEM bachelor's degree holders are CC transfers
- ¼ of all Chicanx doctorate degree holders attended CC

The Challenge

Lack of enhancing equity & diversity in community college Biology Education Research (Schinske et al., 2017)

Project Overview

MIXED METHODS RESEARCH

Visualize:

- *pathways* of first-generation women of color STEM majors in community colleges
- how community *networks influence* how they navigate & negotiate their paths in higher education

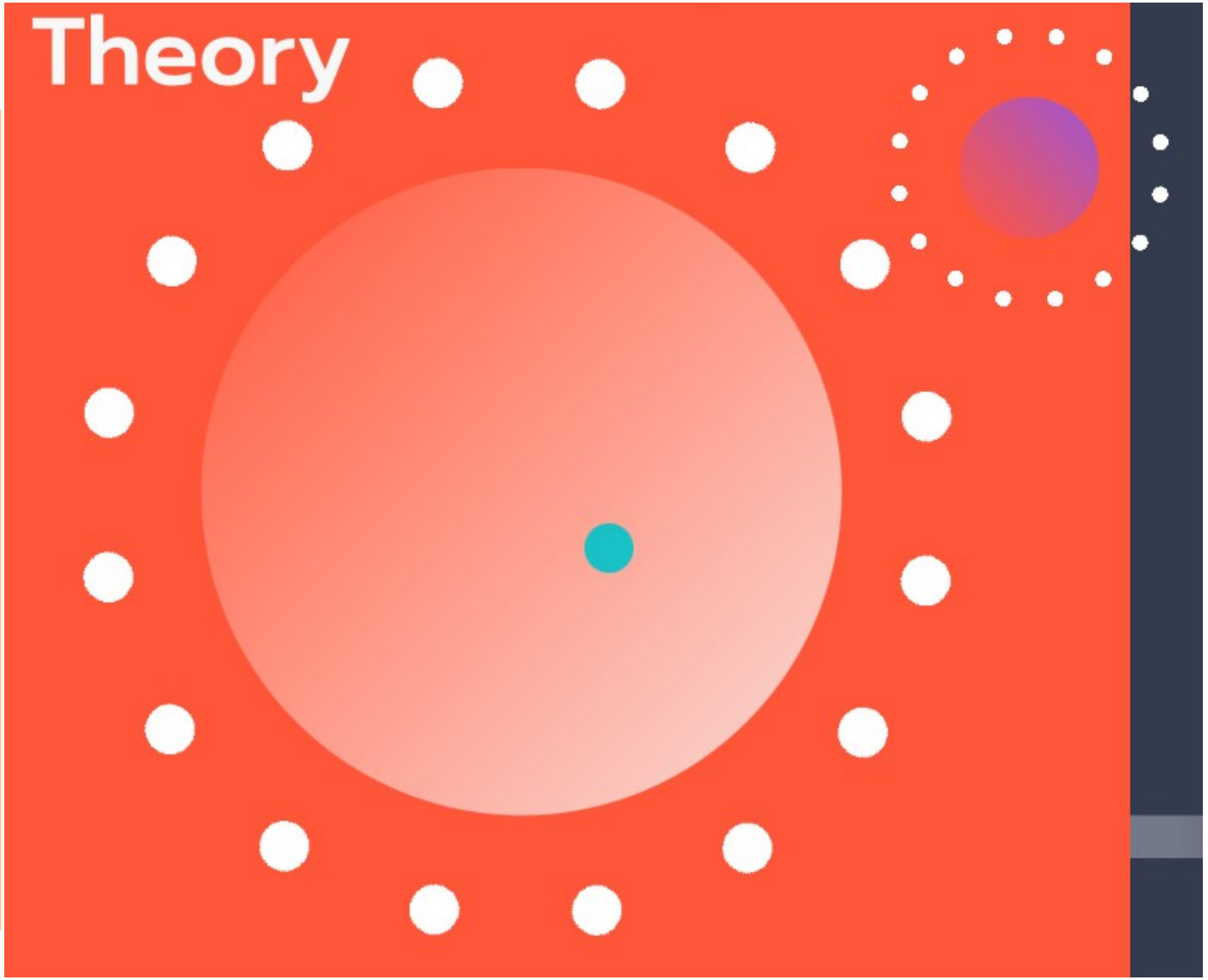
PROFESSIONAL DEVELOPMENT (PD)

Train an early-career investigator with an interdisciplinary background in Education, Biology, and Black Studies (now Africana Studies) from CSU system & UCLA

Theoretical Framework

STANDPOINT THEORY

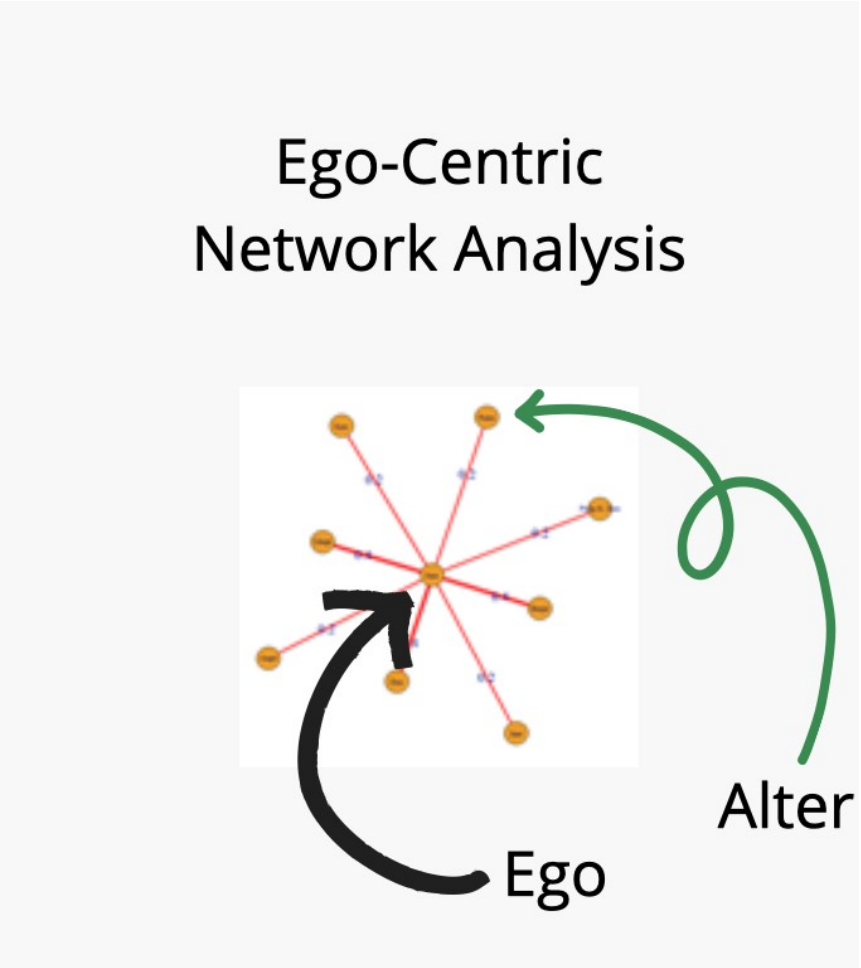
- Recognizes the power of the oppressed & their potential in using their knowledge for liberation
- Turn struggle into an epistemological advantage (a form of self-agency) for observing & analyzing the world at large



Social Network Analysis

Location & Knowledge Production

- SNA = tool for exploring how concept of (marginal) location may influence an individual's standpoint, and hence, knowledge production
- Location Matters! Potential site for diffusion of ideas & influence



Activities

QUANTITATIVE:

i. Identify student mobility patterns & institutional contexts

ii. Identify influential networks that impact women of color STEM majors in the community college

QUALITATIVE:

i. Obtain localized knowledge about the influences to the scientific thinking and navigational capital of participants

ii. Contextualize the influential networks

PD:

i. Analytical training in quant (R, NVivo, & Python) & qual

ii. Disseminate findings

iii. Networking

iv. Mentoring

Longitudinal Data

BPS & IPEDS datasets

Identified students who:

- started at a community college in 2011
- women of color
- STEM major at any point
- transferred at least once

n = 180 students

Institutions

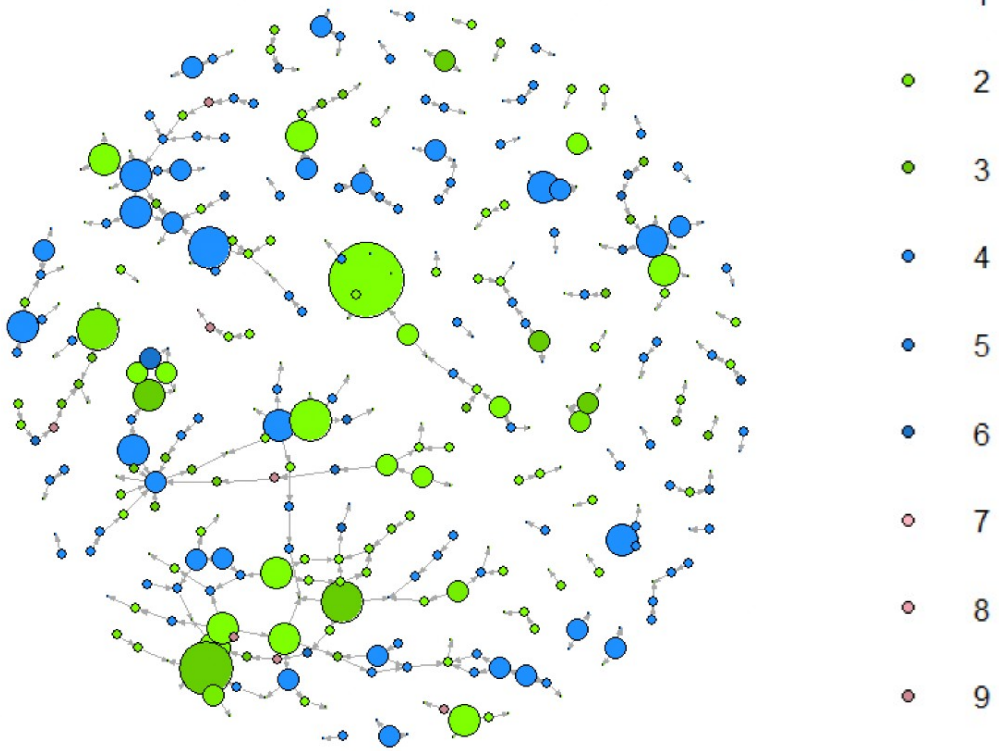
335 number of transfers = edges

324 unique institutions

Low network density of 0.0023, which indicates a lack of connectivity between the 372 institutions with 324 unique edges or transfer pathway

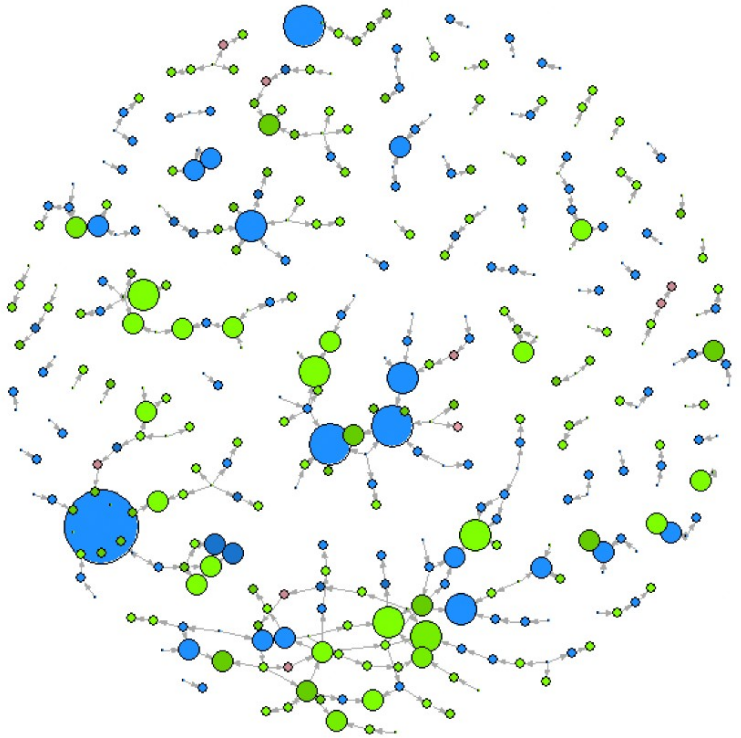
Results: Schools 2011-2017

Sending



Biggest nodes are green (4-years) which shows that many WOC STEM majors are leaving four-year institutions after transferring there

Receiving



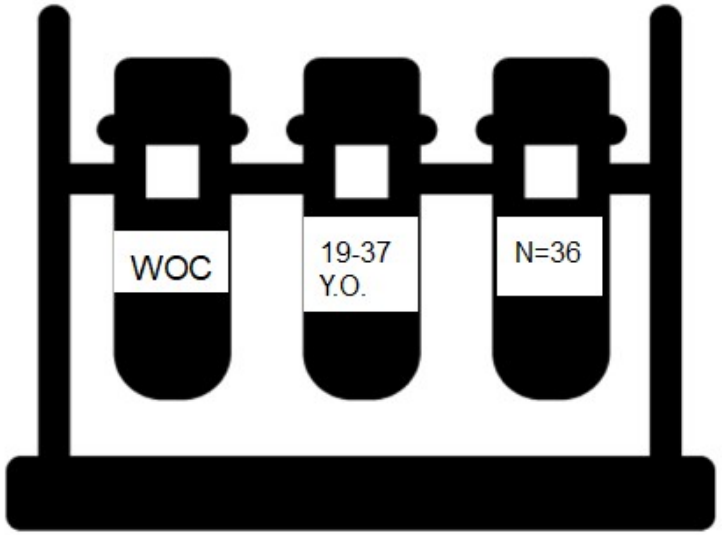
Biggest nodes are blue which means WOC STEM majors transfer to 2-years. There are some big 4-year nodes too (green), but it shows that many do lateral transfers

One-Site Focus

Social Network data

i. Who influences the scientific thinking & navigational capital of participants?

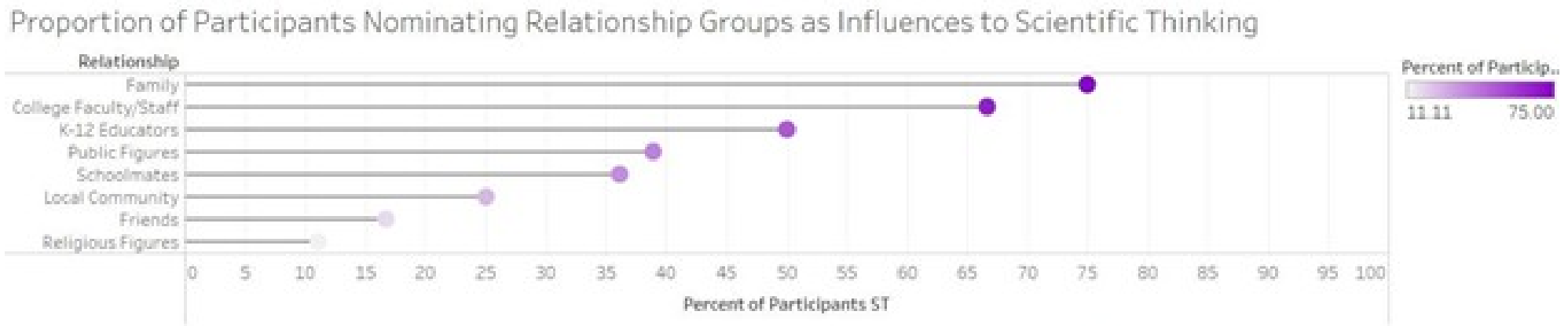
ii. How do nominees influence the participants?

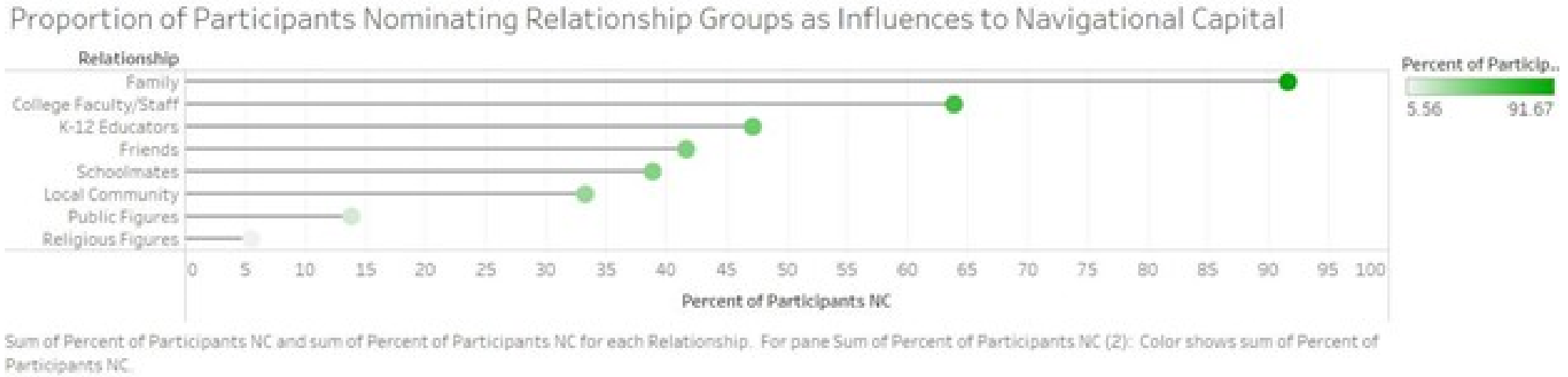


Race/Ethnicity of Participants: Latina = 19, Black/African American = 6, Asian Pacific Islander = 6, and Mixed = 5.

STEM Majors: Biology = 15, Chemistry/Biochemistry = 9, Engineering = 6, Physics/Astronomy = 2, Nutritional Science = 3, and Computer Science = 1.

Results: Family Matters

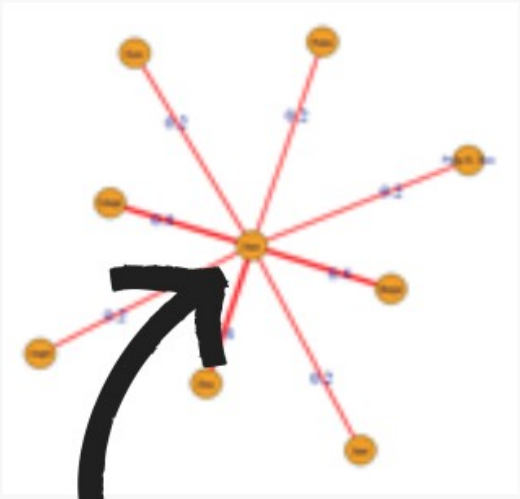




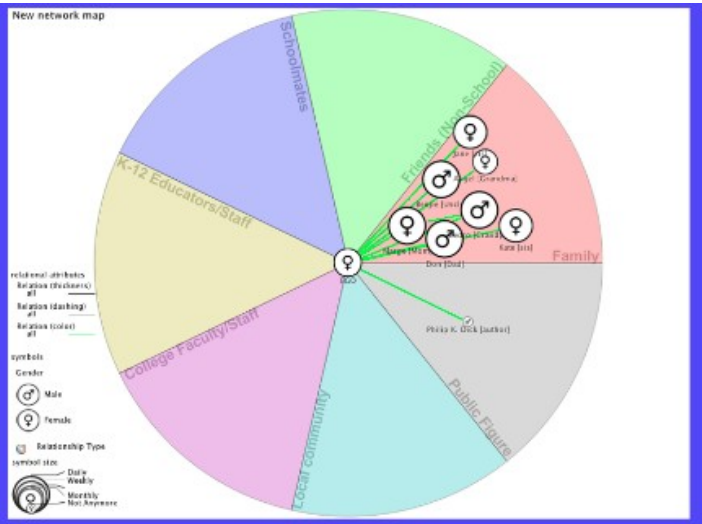
Results

ST Snapshot: Callisto

26, Latina, Physics major



Callisto

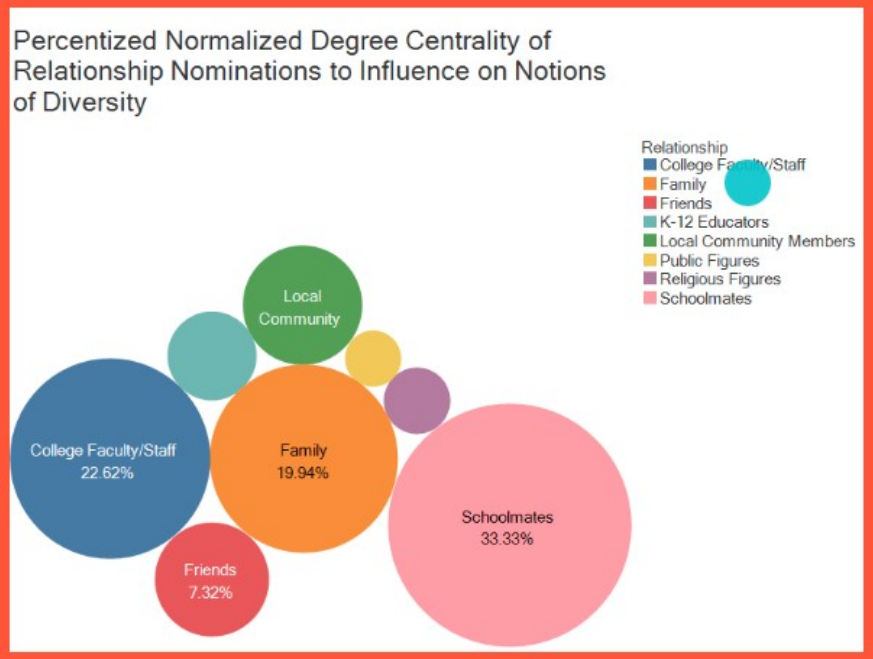


Mother "always told [her] to question things" which "[gave her] the scientific aspect" of observing things in detail.

Father & uncle "always encouraging [her] to look at 'the big picture'"

Results

Navigational Capital: Notions of Diversity



Schoolmates are the most impactful group on notions of diversity of ideas and people in the STEM fields

Rikki [24, Black, Civil Engineering major] nominated schoolmates who tutor her at the campus STEM center a few times a week.

Medusa [24, Multicultural, Biochemistry major] & Aurora [23, Latina, Neuroscience major] both nominated schoolmates who lead their campus' STEM club that caters and promotes diversity and inclusion of students of color in the STEM fields.

Lessons Learned

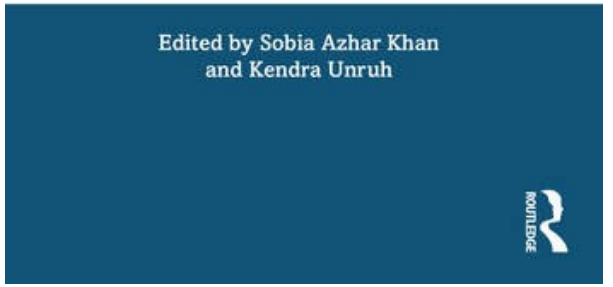
Centering the standpoint of women of color STEM majors is an asset-based and anti-deficit way of honoring them and their lived experiences as full human beings.

This acknowledgement of their humanity as full human beings has the potential to induce self-joy and profound motivation to contribute to innovation in the STEM fields.

The holistic frameworks used by this study also acknowledge their communities and can help broaden participation of those historically excluded individuals, groups, and communities in the STEM fields.

Next Steps/Long-Term Plans

- Disseminate findings & collaborate with CC researchers & practitioners (GitHub resource page for codes)
- Open to exploring institutional pathways analyses further
- Continue working with CC students in STEM pathways



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Summary

- The impact of this work on STEM education is using multiple sources of data to provide a macro, meso, and micro perspective of women of color STEM majors in the community college.
- From looking at longitudinal data of this population's educational transfer pathways to analyzing their personal networks and the impacts of these networks on the way they think as scientists and navigate community college, this study has carried out a comprehensive approach to look at broad and contextual patterns of this historically excluded group not just in the STEM fields but in the education literature in general.
- The lack of formalized pathways for this group also can inform educational policymakers and institutional leaders the value of establishing and strengthening such connections to solidify this pathway.

Questions?

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Github:
https://github.com/1melomelo/Women-of-Color-STEM-influential-networks

Becoming a Scientist: Identity Balance Among Underrepresented Students in STEM

Wesley Schultz – California State University San Marcos

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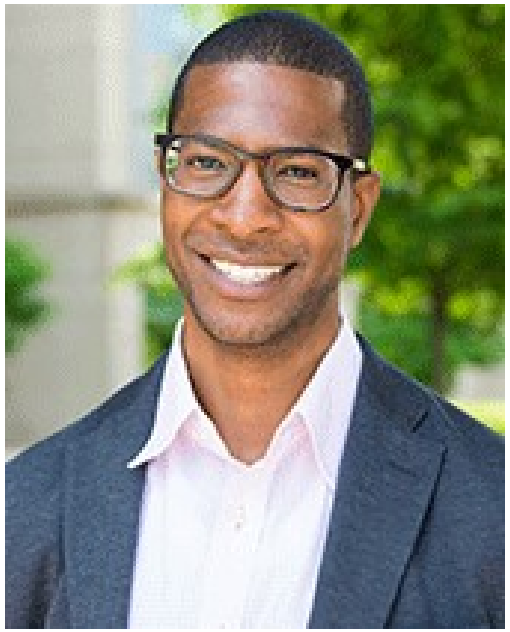

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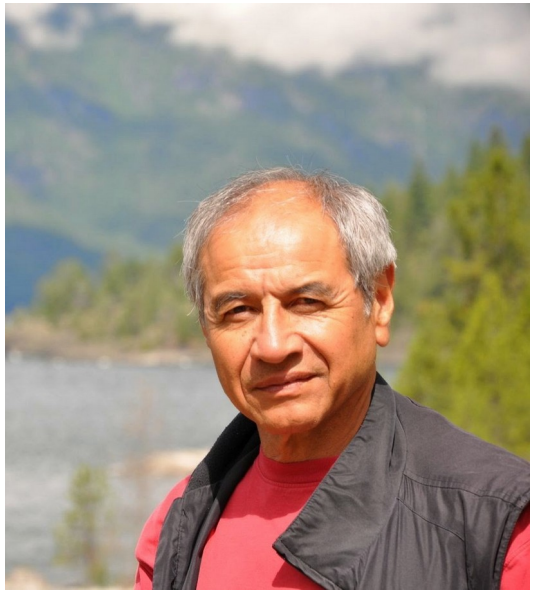


Dr. Victor Rocha
Professor (Emeritus), Founding Director, Office of Training, Research, and Education in the Sciences (OTRES)

Dr. Katherine Kantardjieff
Provost and Vice President for Academic Affairs, CSUMB

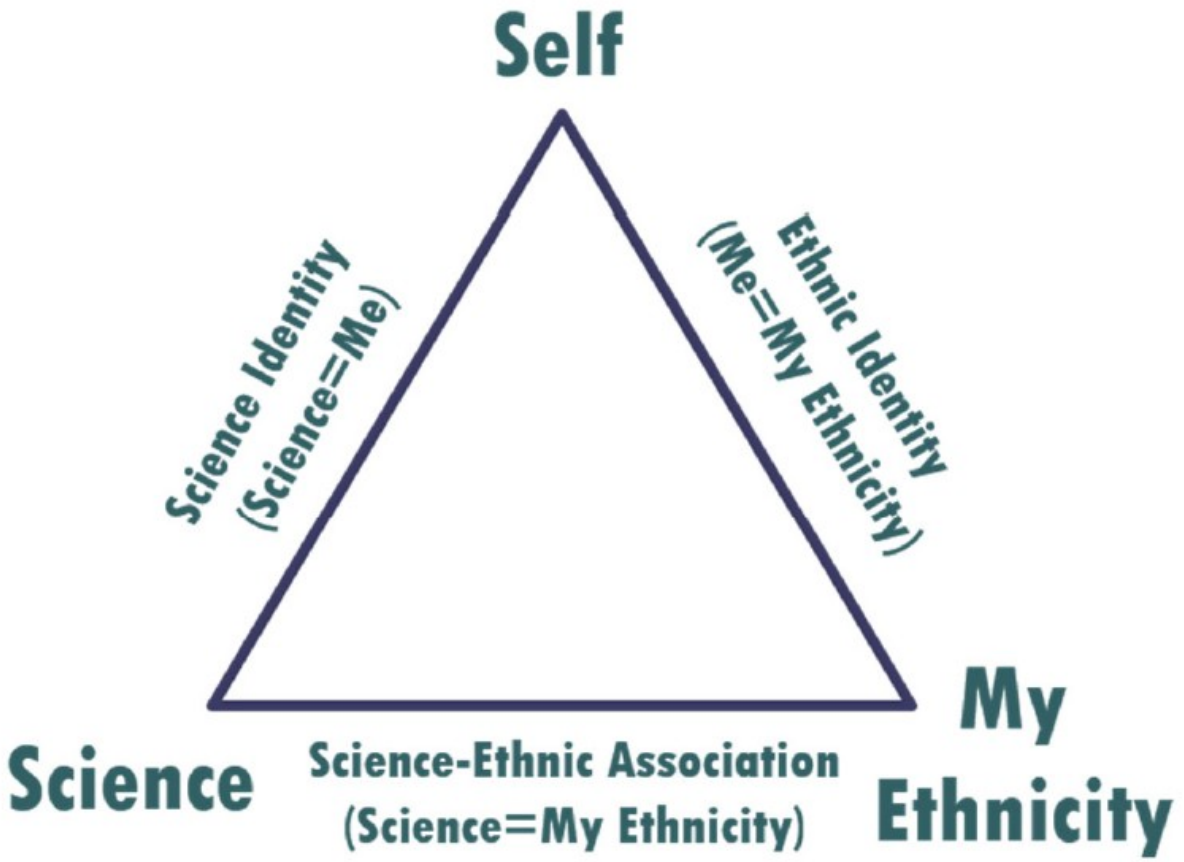
NSF Award

- Research team has long history of collaboration
- 12-years of NIH R01 funding to study the role of “identity” in success and persistence of underrepresented students in biomedical science (only included data on underrepresented students)
- Large-scale expansion submitted to NSF (scored well, but no funding)
- 2-year NSF EAGER award (2016-2018) to study “identity balance” among Hispanic/LatinX and White students.
- Full NSF proposal funded in 2019

Broader Impacts

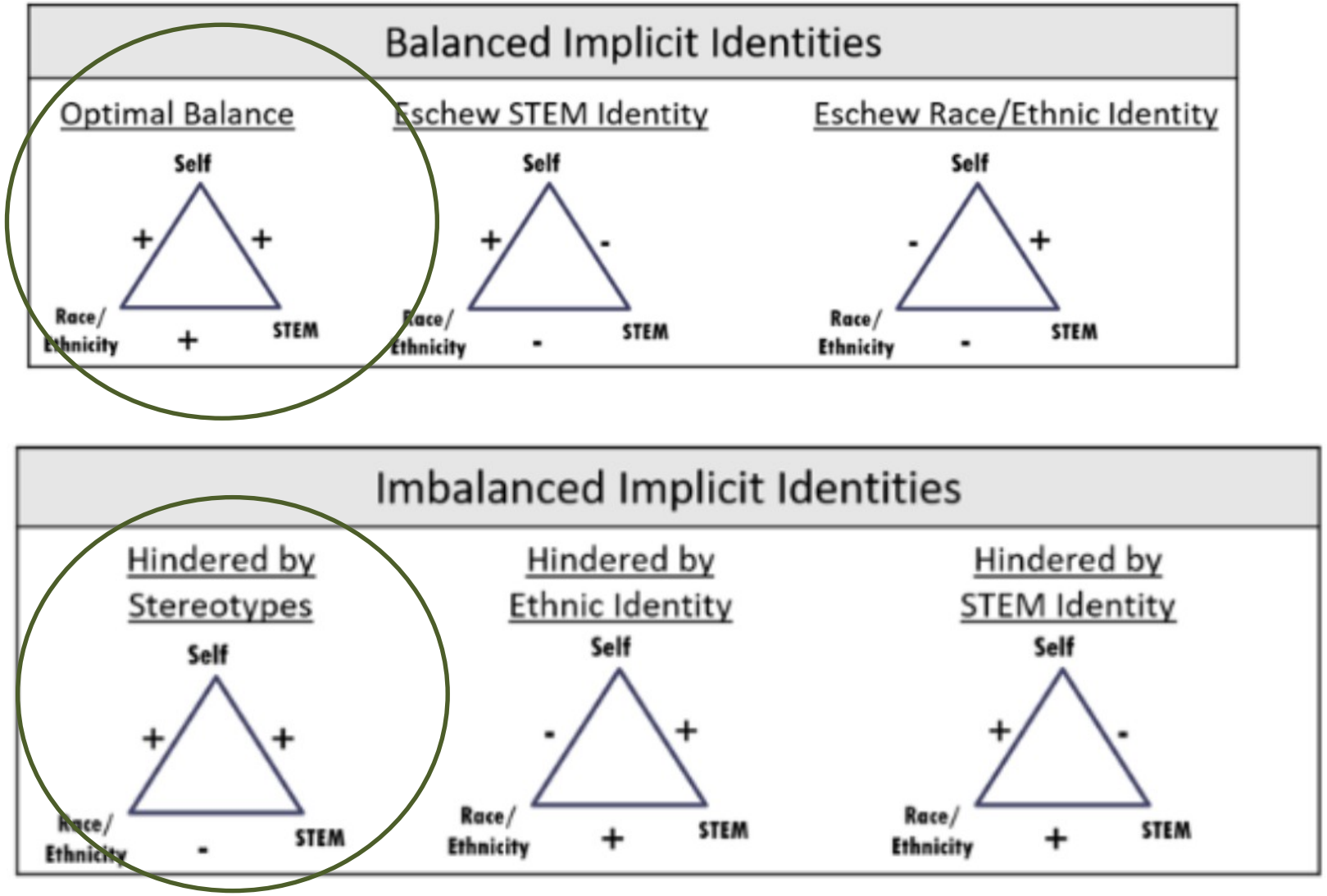
- On guidance from Program Officer, split advisors into two Boards: Scientific Advisory, Broader Impacts Advisory
- Proposed broader impacts
  - Dissemination through the CSU (CRO)
  - Academic publications and conferences
  - Involving URM students in the research process

Theoretical Foundations



California State University SAN MARCOS

Theoretical Foundations



Research Objectives

- Objective: understand how underrepresented students negotiate and resolve stereotypically incompatible identities across time and how this relates to STEM participation and success.

Figure 4: Model of implicit identity balance to support a strong STEM identity and STEM persistence and performance

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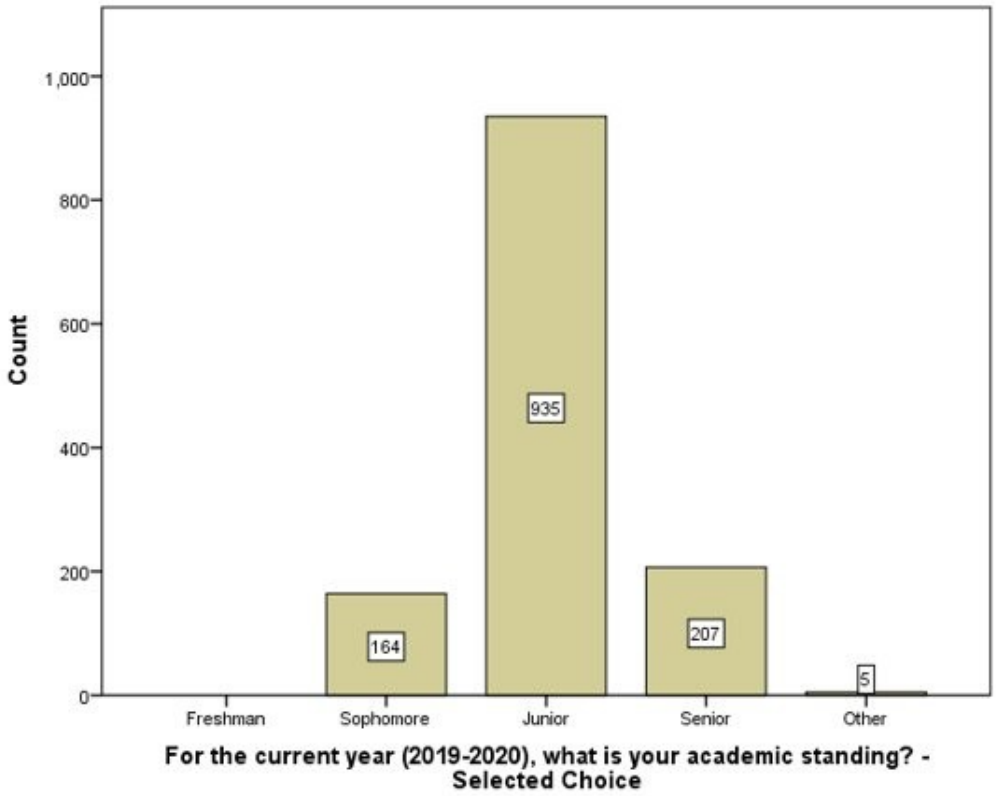
Becoming a Scientist: Identity Balance Among Underrepresented Students in STEM

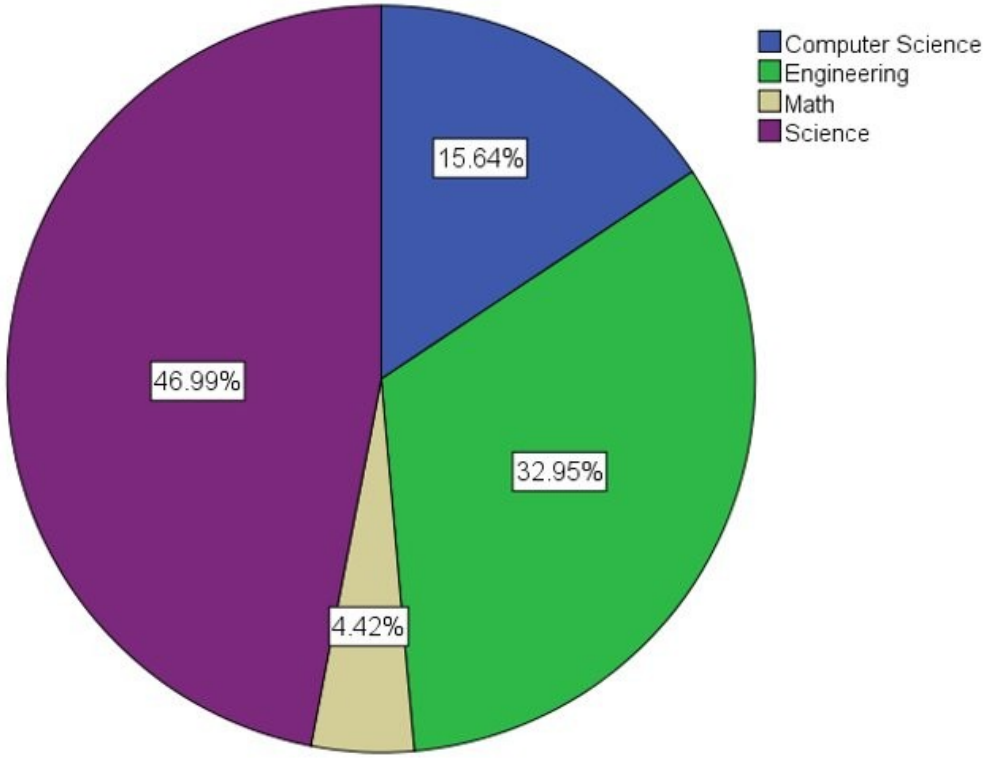
Research Plan

- Launched in Fall, 2019
- Recruited 1410 undergraduate STEM students
- 12 CSU campuses
- 56% Hispanic/LatinX
- Longitudinal design to track across five
  years (two waves of data per year)

12 CSU Campuses
Cal Poly Pomona
Cal Poly San Luis Obispo
California State University Bakersfield
California State University Chico
California State University Fresno
California State University Fullerton
California State University Long Beach
California State University Northridge
California State University Sacramento
California State University San Marcos
San Francisco State University
San Jose State University

Longitudinal Panel





Summary

- CSU provides a wonderful testbed for theoretical and applied work focused on issues of underrepresentation
- NSF is an excellent source of funding to support ambitious studies
- Important to balance science and broader impacts
- Think big

Questions?

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Next Steps/Closing Remarks

Dr. Frank A. Gomez
Executive Director, STEM-NET
Office of the Chancellor

https://www2.calstate.edu/impact-of-the-csu/research/stem-net

Frank A. Gomez *CSU Office of the Chancellor* *fgomez@calstate.edu*

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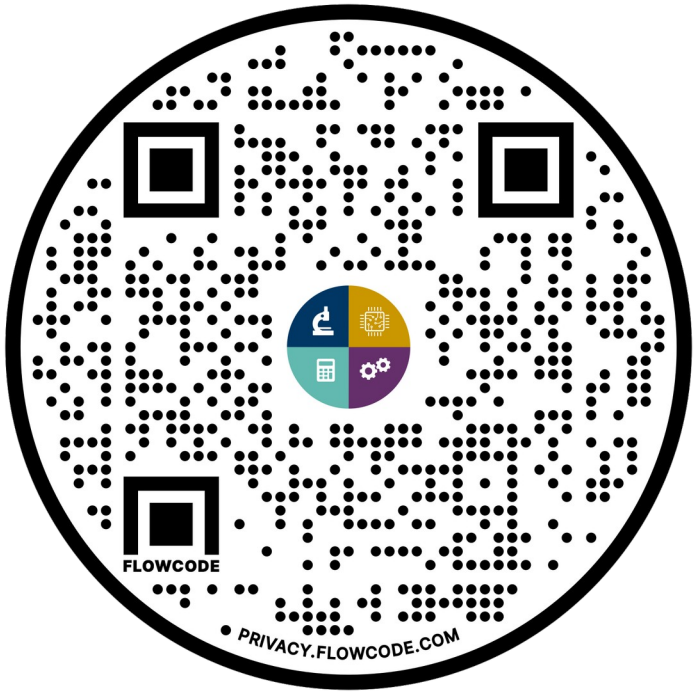
STEM-NET Feedback

Webcast Feedback Survey

Please take a few moments to tell us about your webcast experience.

Use the QR Scan Code to download it



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STEM-NET Upcoming Events

STEM-NET June Webcast

Topic: STEM Program Assessment and Evaluation
Date: Wednesday, June 29, 2022
Time: 10am- 11:15am

Register Here

Virtual Research Café 10.0

Date: Wednesday, June 15th, 2022
Time:11am-12pm

Register Here

Join our CSU STEM-NET Community listserv

csustemnet@lists.calstate.edu

Begin a Conversation with Colleagues and Join our Private CSU STEM-NET Facebook Group

https://www.facebook.com/groups/2629611737269292

THANK YOU FOR JOINING US TODAY!
For more information about STEM-NET visit our website:

Frank A. Gomez *CSU Office of the Chancellor* *fgomez@calstate.edu*