The TIDES Approach to Increasing Diversity and Equity in Computer Science

Dr. Kelly Mack[1] and Dr. Kate Winter[2]

[1] Association of American Colleges and Universities, USA

[2] Kate Winter Evaluation, USA

7th Gender Summit – Europe; 6-7 November 2015, Berlin

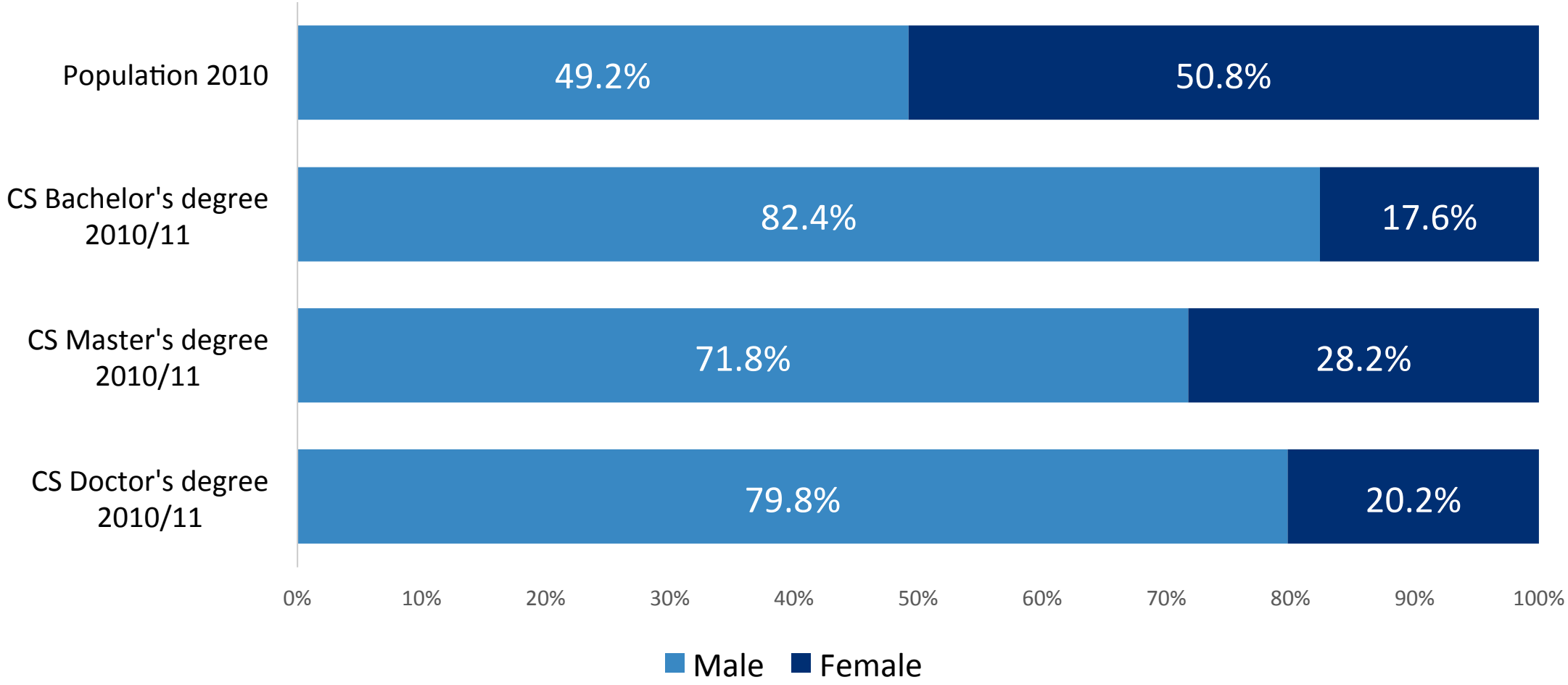
Presentation Overview

- US Context regarding:
  - Increasing demand for CS degree holders
  - Who gets CS degrees by gender and race/ethnicity
  - Student demographics
- Intro to TIDES
- Methods
- Preliminary results
- Next steps

Current and Growing Demand for CS Grads

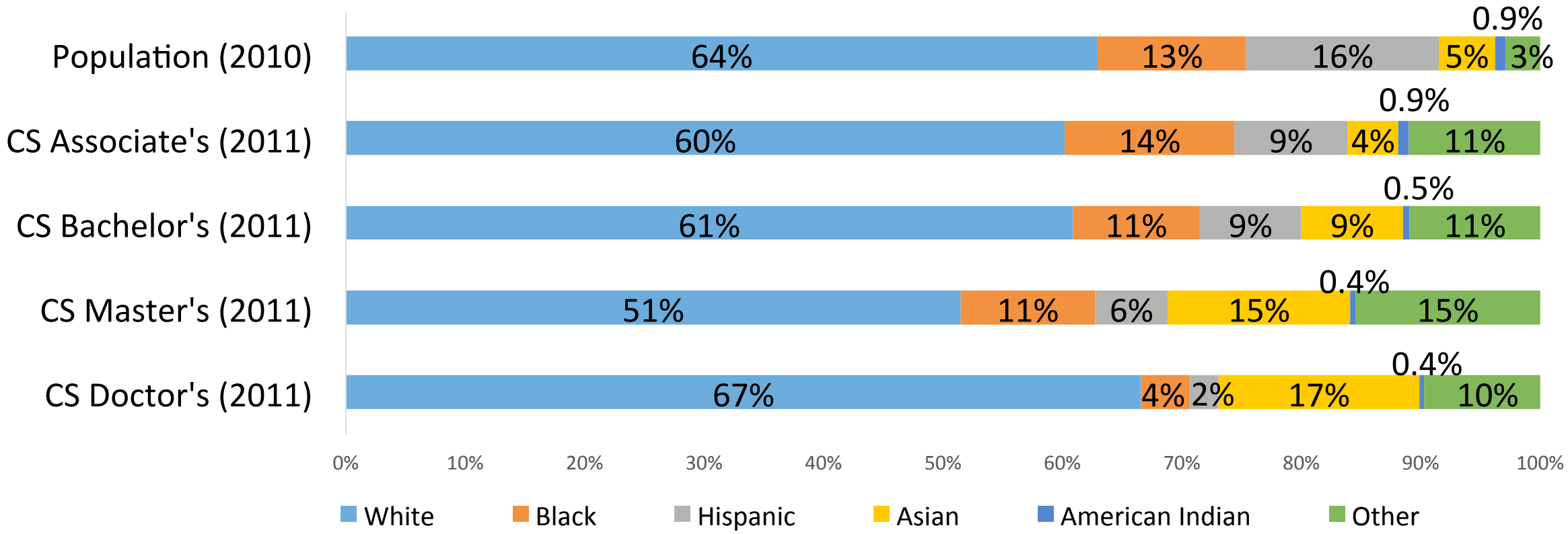
- In 2014, there were 238,158 postings for cybersecurity-related jobs nationally. Cybersecurity jobs account for 11% of all IT jobs.
- Cybersecurity postings have grown 91% from 2010-2014. This growth rate is more than faster than IT jobs generally.
- In the US, employers posted 49,493 jobs requesting a Certified Information Systems Security Professional (CISSP) in 2014, recruiting from a pool of only 65,362 CISSP holders nationwide.

US Computer Science Degrees by Sex



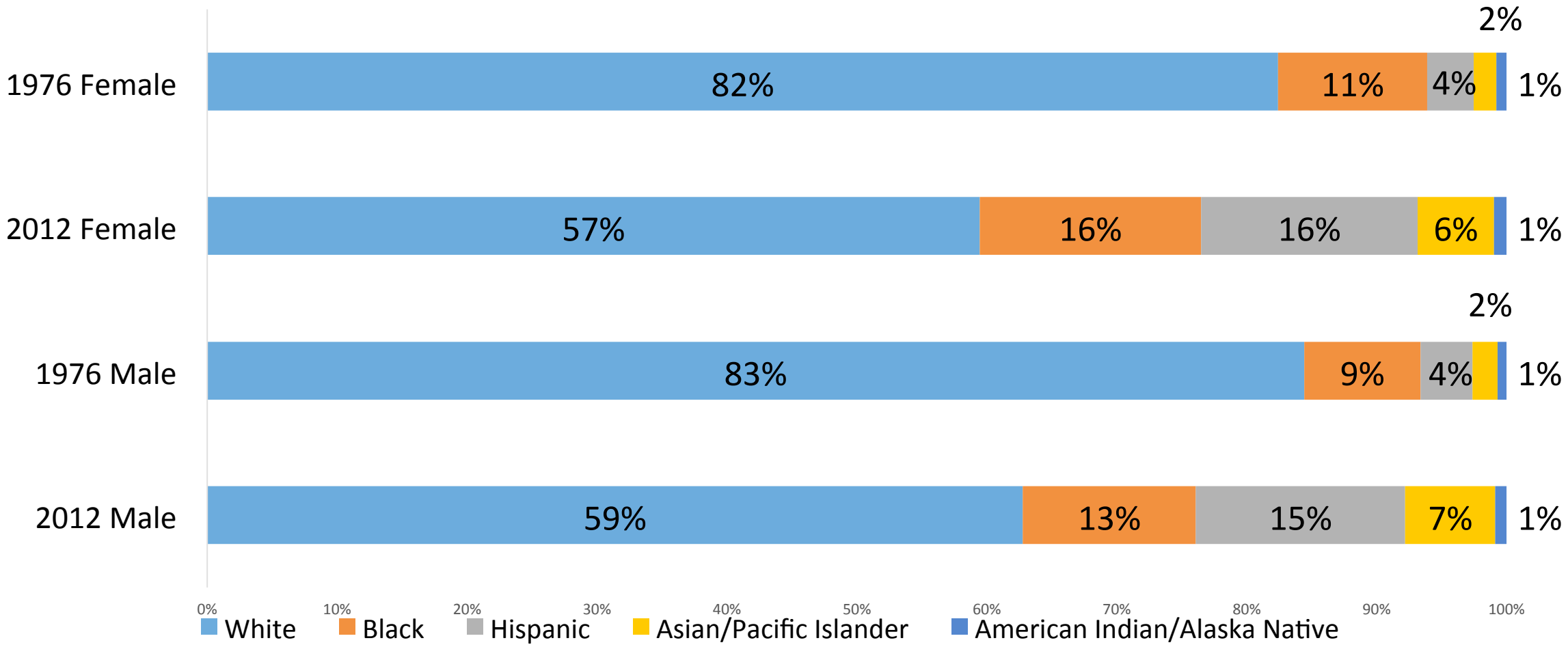
Sources: https://nces.ed.gov/programs/digest/d12/tables/dt12_349.asp
http://www.census.gov/quickfacts/table/PST045214/00

US Computer Science Degrees by Race/Ethnicity



Sources: http://www.census.gov/quickfacts/table/PST045214/00
http://www.nsf.gov/statistics/seind14/index.cfm/appendix/tables.htm#c2

All Undergraduate Students by Race by Sex

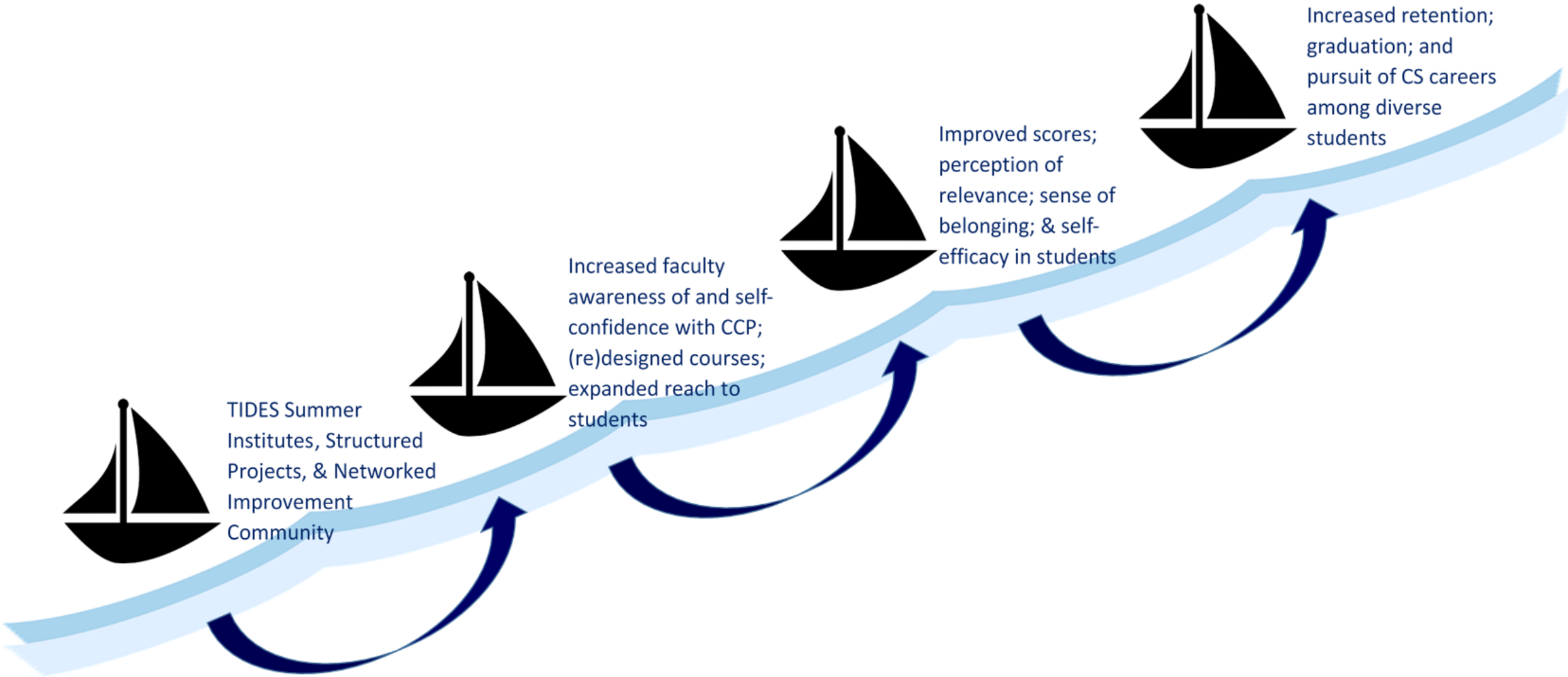


Source: http://nces.ed.gov/programs/digest/d13/tables/dt13_306.10.asp?referrer=report

What Is TIDES?

- Teaching to Increase Diversity and Equity in STEM
- 3-year professional development intervention for CS faculty, with course redesign projects
- Brainchild of Dr. Kelly Mack, Vice President for Undergraduate STEM Education and Executive Director of Project Kaleidoscope, AAC&U
- Networked Improvement Community of teams from 19 institutions of higher education (14 fully funded)
- Funded by the Helmsley Charitable Trust

Simplified Logic Model



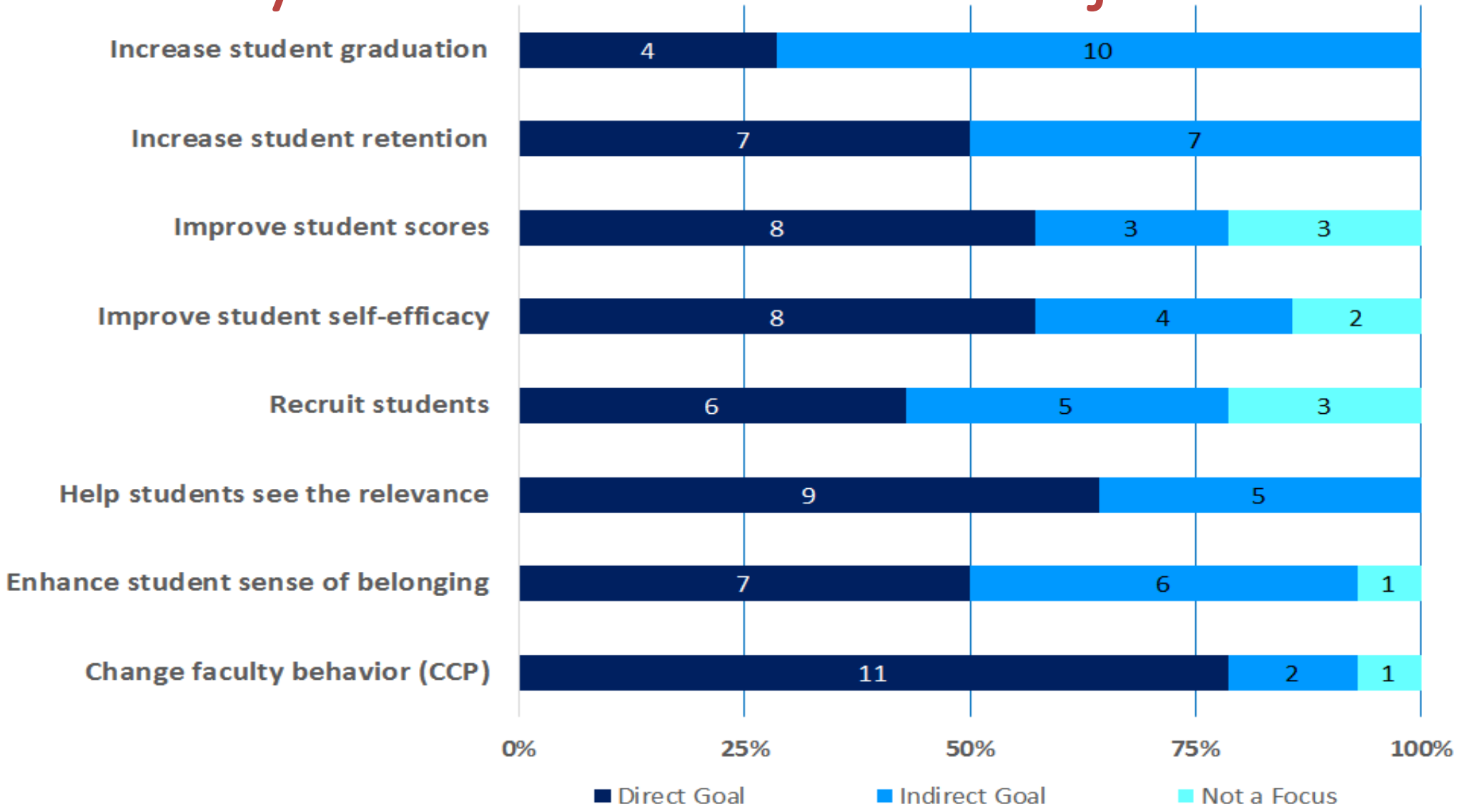
Outcomes and Indicator Measures

Outcome	Indicator
The broadest reach possible to "touch" URM students in STEM by bringing together a diverse group of institutions as a networked improvement community	• Number of institutions serving predominantly diverse students • Number of courses/students taught by TIDES faculty • Number of additional institutions, faculty, and students "touched"
Increased faculty awareness of and confidence with culturally responsive pedagogy	Changes in faculty and administrator responses on the assessment instruments
(Re)designed computer science courses intended to be relevant and engaging to diverse students	# of (re)designed courses
CS is more appealing and relevant to diverse students	Changes in student survey responses (From project outcome data)
Increased number and diversity of CS students	Changes from baselines in institutional data
Increased CS scores and retention of diverse students	Changes from baselines in institutional data
Increased Sense of Belonging in STEM and self-efficacy of diverse students	Changes in student survey responses (From project outcome data)
Increased graduation rates in CS of diverse students	Changes from baselines in institutional data

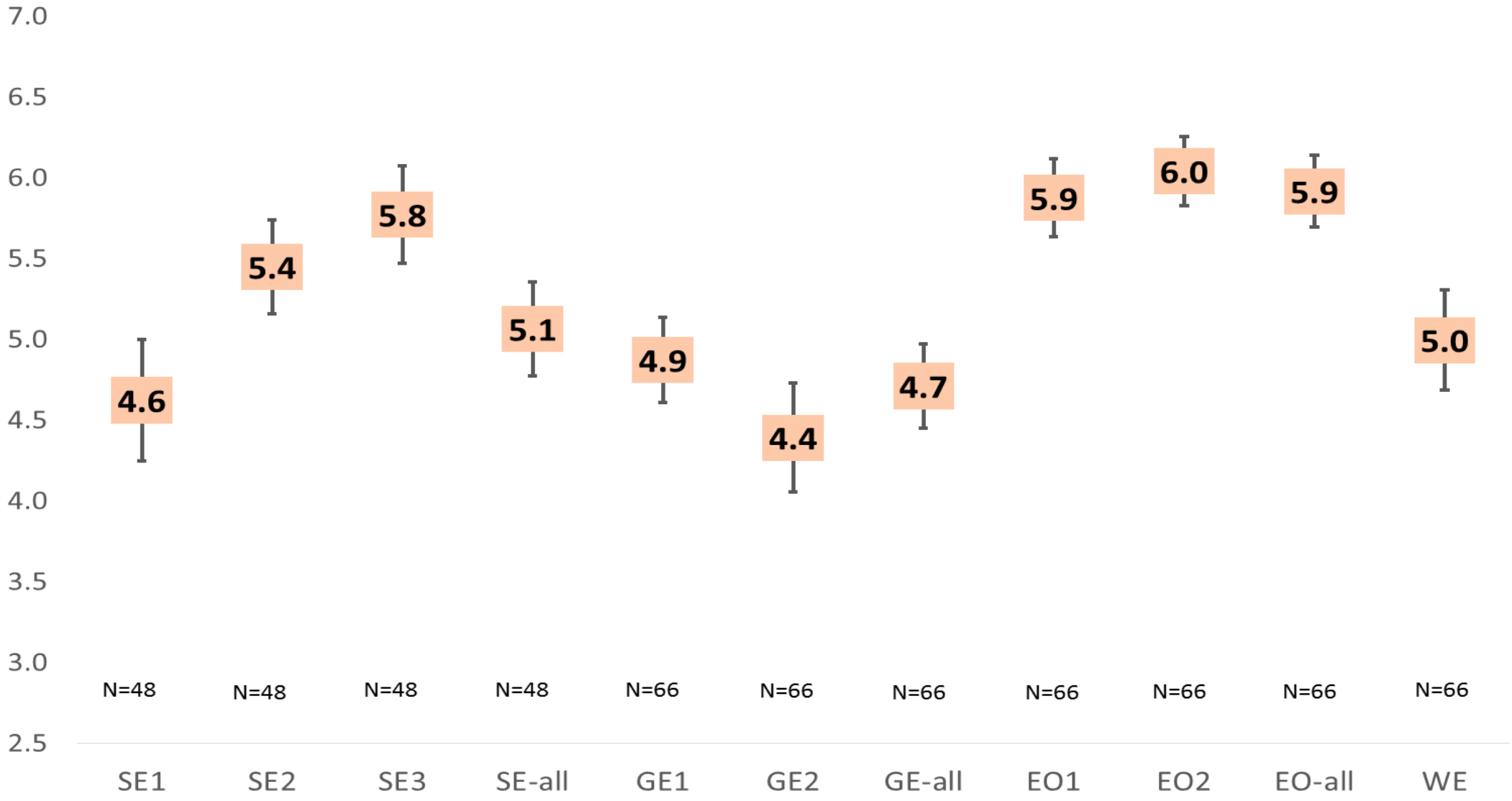
Methods

- Annual week-long summer institutes
- Annual autumn STEM conference
- Course (re)design projects
- Support from an expert “institution coach”
- Webinars and online resources (STEM Central.com)
- Annual assessment of faculty self-efficacy with CCP
- Pre- and post- course survey of student perceptions
- Annual assessment of student data

Goals by Number of Funded Projects

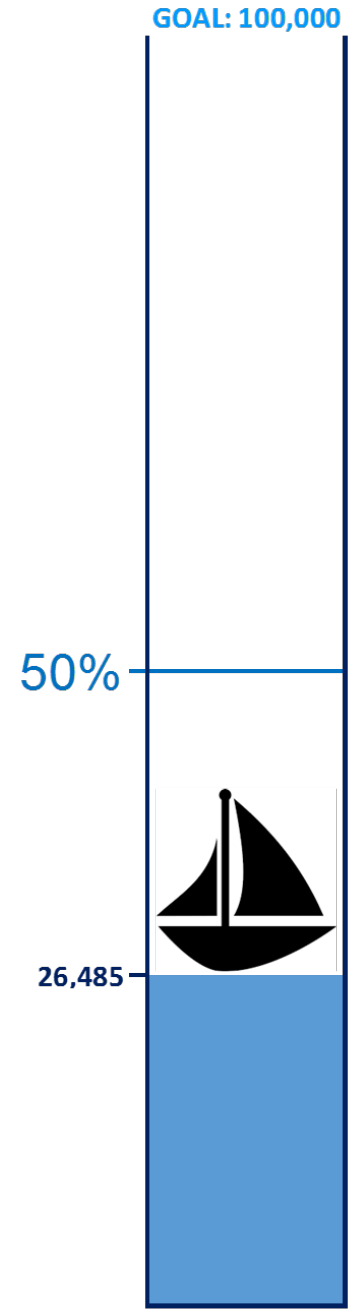


Faculty/Admin Baselines (mean and 95% CI)



Where We Are Now

- Just finishing 2nd project year, evaluating the 1st year of full implementation
- Working with 49 faculty members:
  - 6,659 students have taken TIDES courses
    - 10 New courses created
    - 58 New modules created
    - >60 offerings of redesigned courses
  - >500 faculty participants in workshops/trainings
  - ~20,000 students estimated to be indirectly touched
- 2 Summer Institutes, 1 fall STEM conference (next week is second in Seattle)



Changes in Faculty Self-Efficacy from Y1 to Y2

To What Extent Am I Confident in My Ability to:

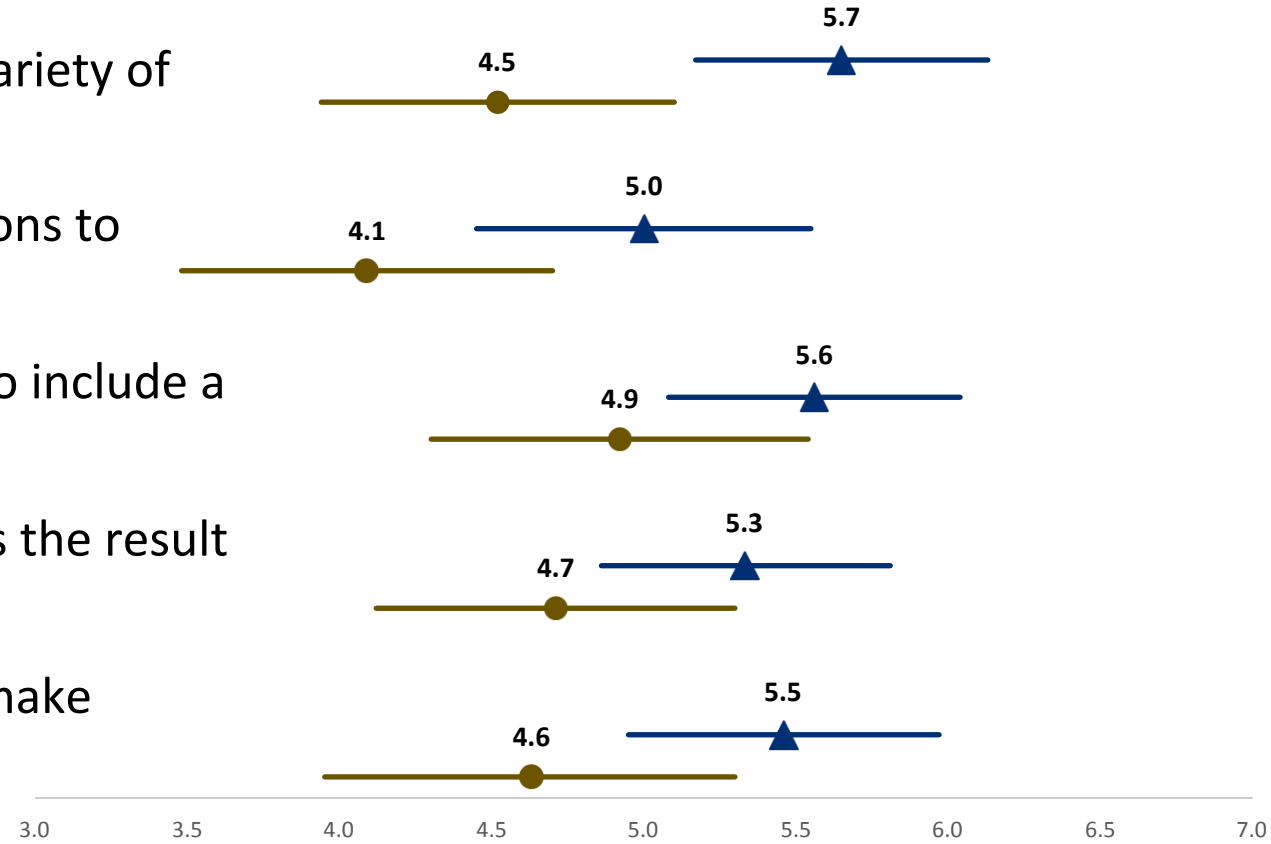
Create a learning environment that reflects a variety of cultures (n=23)

Teach students about their cultures' contributions to science (n=22)

Revise and/or prepare instructional materials to include a better representation of cultural groups (n=25)

Identify solutions to problems that may arise as the result of diversity (n=24)

Use my students' cultural background to help make learning meaningful (n=24)



BLUE represents 2015 "post" data, **BROWN** represents 2014 "pre" data, shapes represent means, bars represent 95% Confidence Intervals
Scale: 1=To an extremely small extent, 2=To a very small extent, 3=To a small extent, 4=To a moderate extent, 5=To a large extent, 6=To a very large extent, 7=To an extremely large extent

Assessment of Changes in Student Outcomes

- Fairleigh Dickinson University (NJ):
  - Black, Native American, and Hispanic students up from 33% to 39%
  - Female students up from 11% to 22%
  - 79% of females earned an A or B in new courses compared to the class average of 59%
- Montgomery College (MD):
  - Female students up from 19% to 21%
  - URM students up 44% to 54% (women 39% to 56%; men 45% to 54%)
  - Retention up from 35% to 47% for women, from 46% to 51% for men, and from 39% to 50% for URM students.
  - Women earning As from 17% to 27%, URM 17% to 22%

Next Steps

- Continue project implementation and monitoring
- Continue implementation and outcomes assessment
- Increase network activities (STEM Central.com, webinar series, journal club, sharing of resources for grant writing and publishing)
- Disseminate promising practices through other US funding agencies' projects

Questions or Comments?