Using Research- & Evidence-based Programs to Increase Nontraditional Student Success in STEM: The STEM Equity Pipeline Project

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Welcoming Awareness

Introduce yourself to the class

- **Name**
- **Title**
- **Organization/unit**

Objectives for Today

- Learn about NAPE and its NSF-funded STEM Equity Pipeline Project, which has led to increases in nontraditional student participation/completion in STEM
- Understand why we need to focus on girls and women in STEM, as well as African American males, Latinos, and Native American males
- Present a new model for educator engagement to transform the classroom called “Micromessaging”

Who is NAPE?

Who is NAPE?

National Alliance for Partnerships in Equity

Professional Development: STEM Equity Pipeline	Research and Evaluation	Technical Support	Public Policy and Advocacy
Provide tools and curricula for educators through conferences, presentations, webinars, and formal training	Develop reports. Identify research-based promising practices. Provide input to others' research.	Develop tools and resources for education agencies. Provide consulting services. Offer expertise on issues pertaining to access, equity, and diversity.	Work with federal agencies. Educate legislators on career equity and diversity issues. Develop policy briefs. Alert membership to legislative or policy issues.

Professional Development for Educators: STEM (including CTE) Access, Equity, Diversity

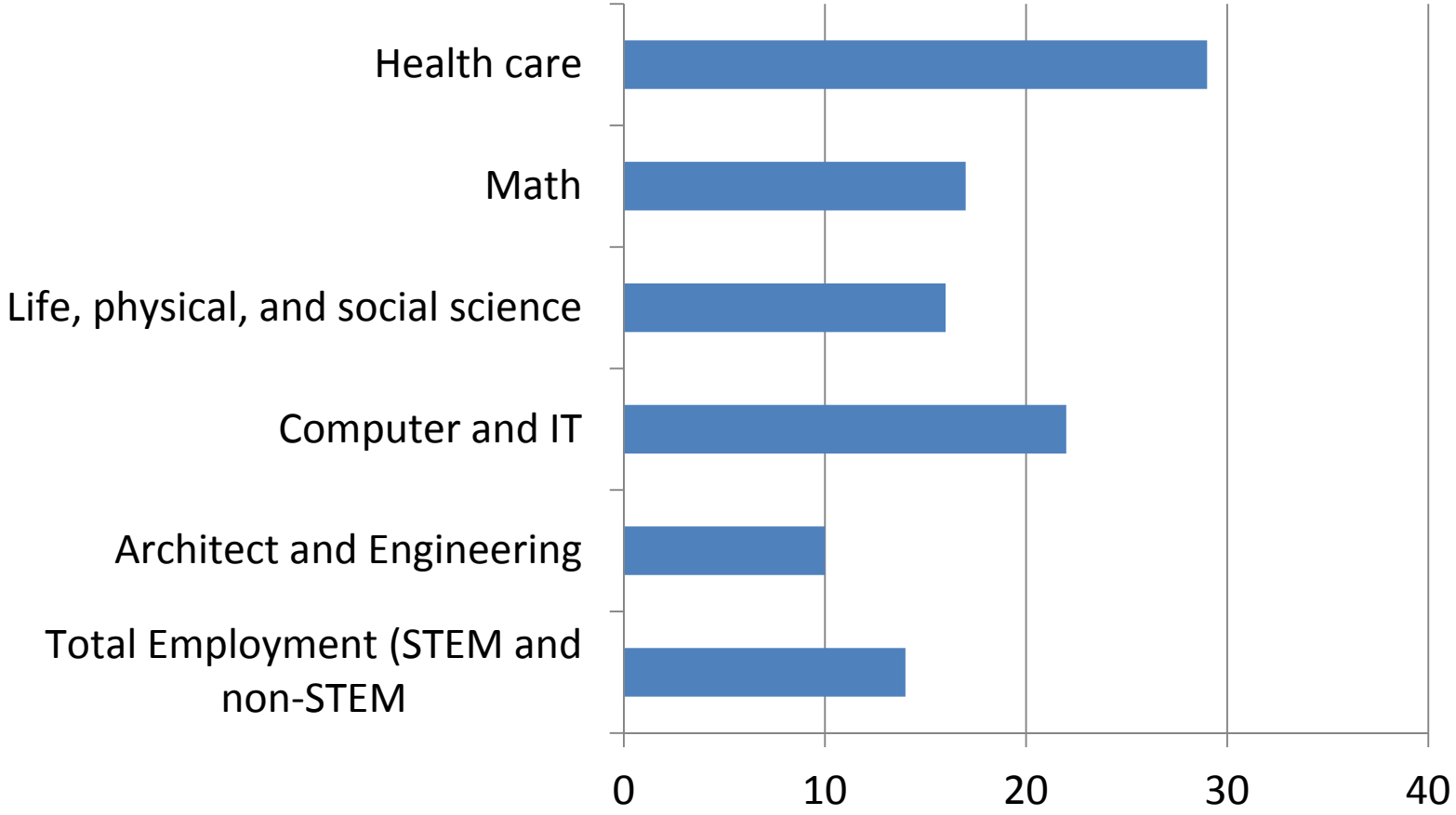
STEM Equity Pipeline™

Program Improvement Process for Equity in STEM	STEM Equity Teacher Training	STEM Equity Counselor Training	Tools & Resources
Institutional program that improves enrollment, retention & completion of girls & under-represented populations in STEM courses	Training teachers to use pedagogy that improves enrollment, retention & completion of girls & under-represented populations in STEM courses	Coaching counselors to encourage girls and under-represented populations in STEM careers	Tools to support teachers' & counselors' learning and assist their students, e.g., camps , partner orgs, books

The Education Foundation supports NAPE's professional development LOB with funding and resources.

Why We still Care...

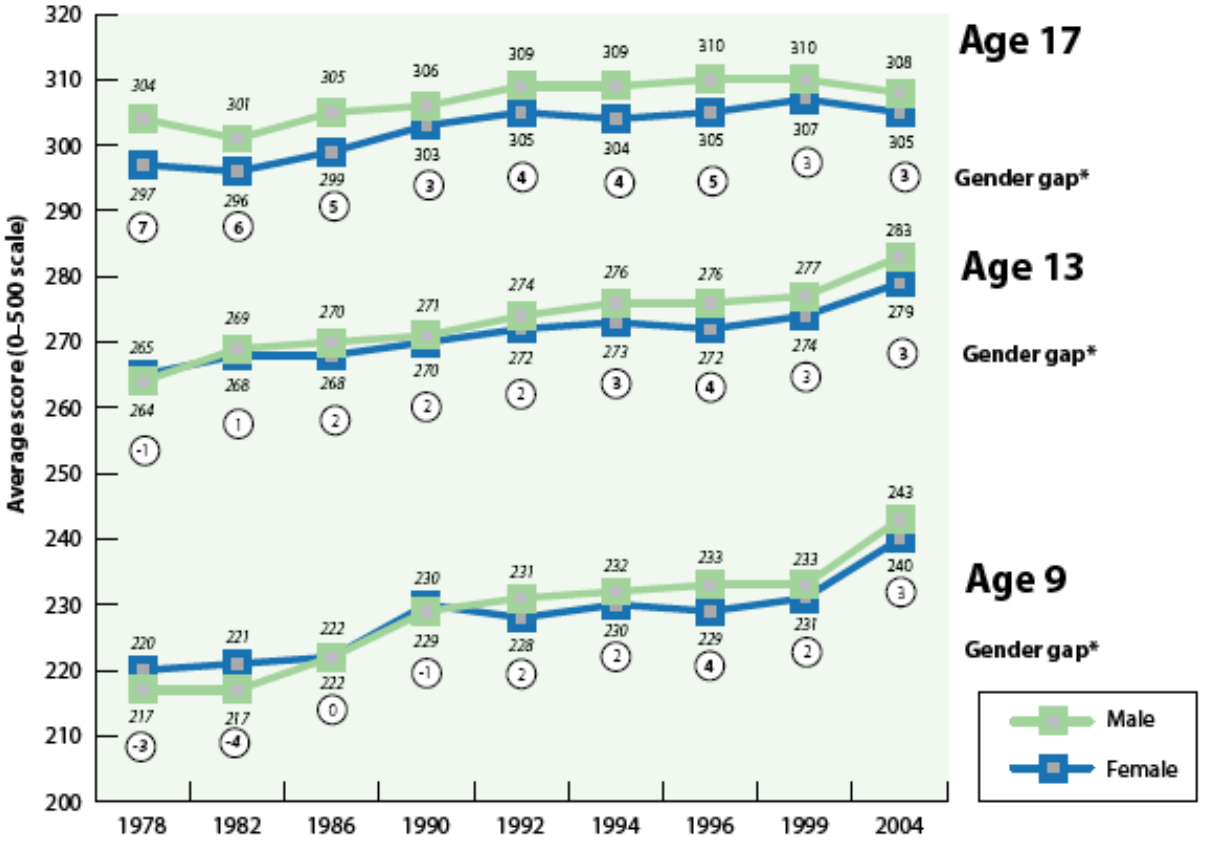
Projected Growth in Employment in Selected STEM Occupations, 2010-2020



Source: Bureau of Labor Statistics. Chart 5. *Occupational Outlook Handbook, 2011-12 Edition.*

STEM Performance–
Core Academic–Longitudinal Data

FIGURE 2. NAEP-LTT MATHEMATICS ASSESSMENT AVERAGE SCORES, BY GENDER, 1978–2004

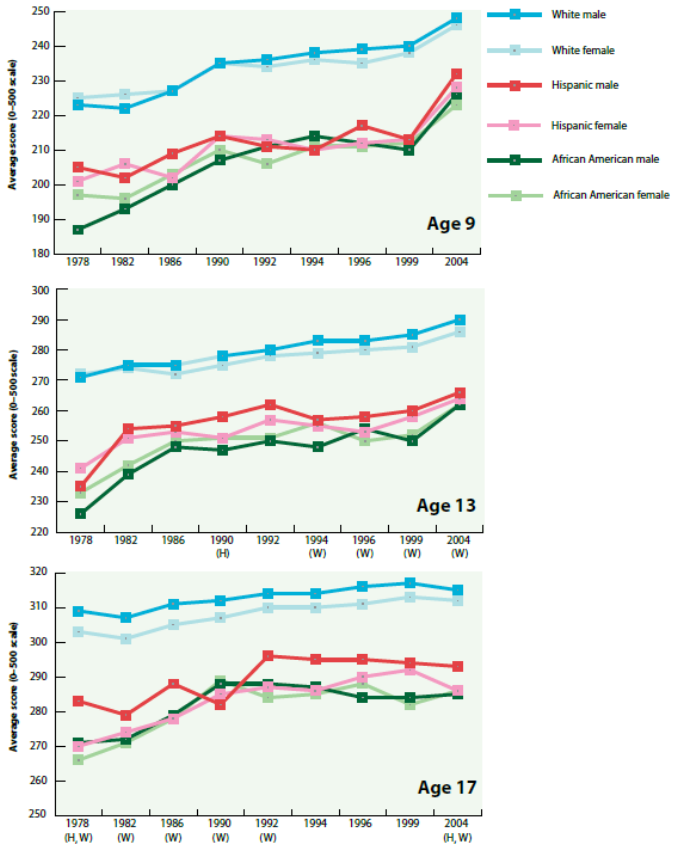


STEM Performance Gaps–Race

- White males and females out perform Hispanic and African Americans on the National Assessment of Educational Progress – Mathematics Assessment

Race

FIGURE 4. NAEP-LTT MATHEMATICS ASSESSMENT AVERAGE SCORES, BY GENDER AND RACE/ETHNICITY, 1978–2004

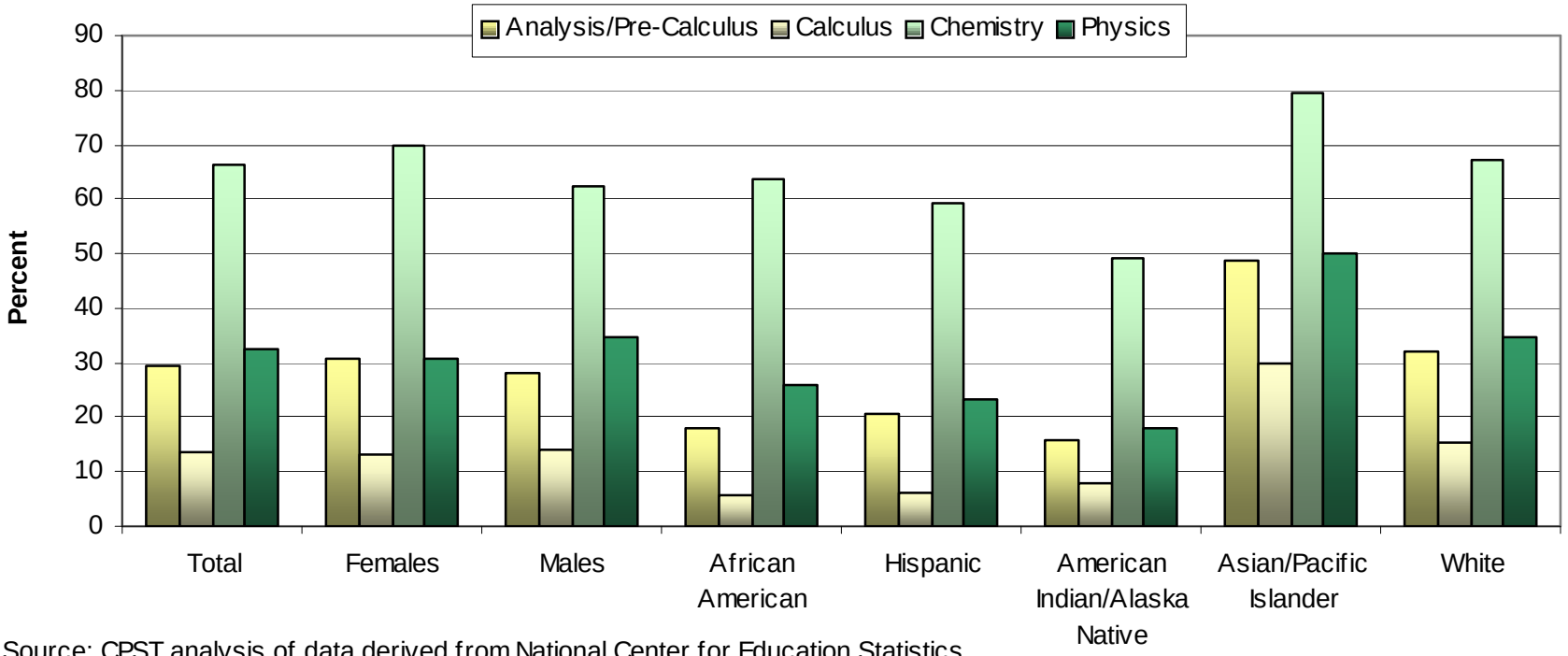


Note: A, H, and W indicate years in which there was a significant gender difference in scores among African American (A), Hispanic (H), or white (W) students.

Source: U.S. Department of Education, National Center for Education Statistics, *NAEP Data Explorer*. Washington, DC: Author.

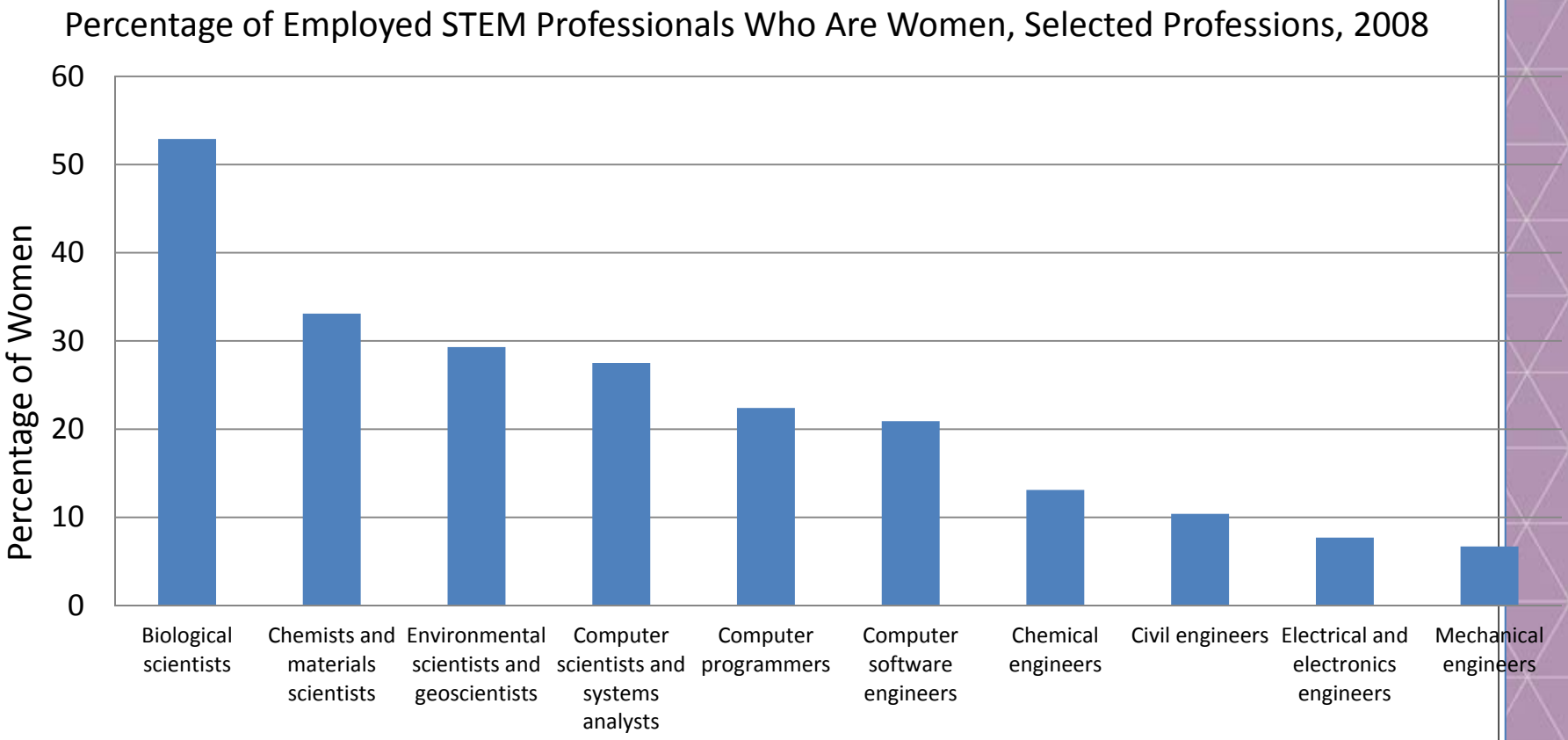
Racialized Participation Gaps in High Schools Across STEM Courses

Figure 1-7. High School Graduates' Science and Mathematics Course Taking, Selected Courses, 2005 by Gender and Race/Ethnicity



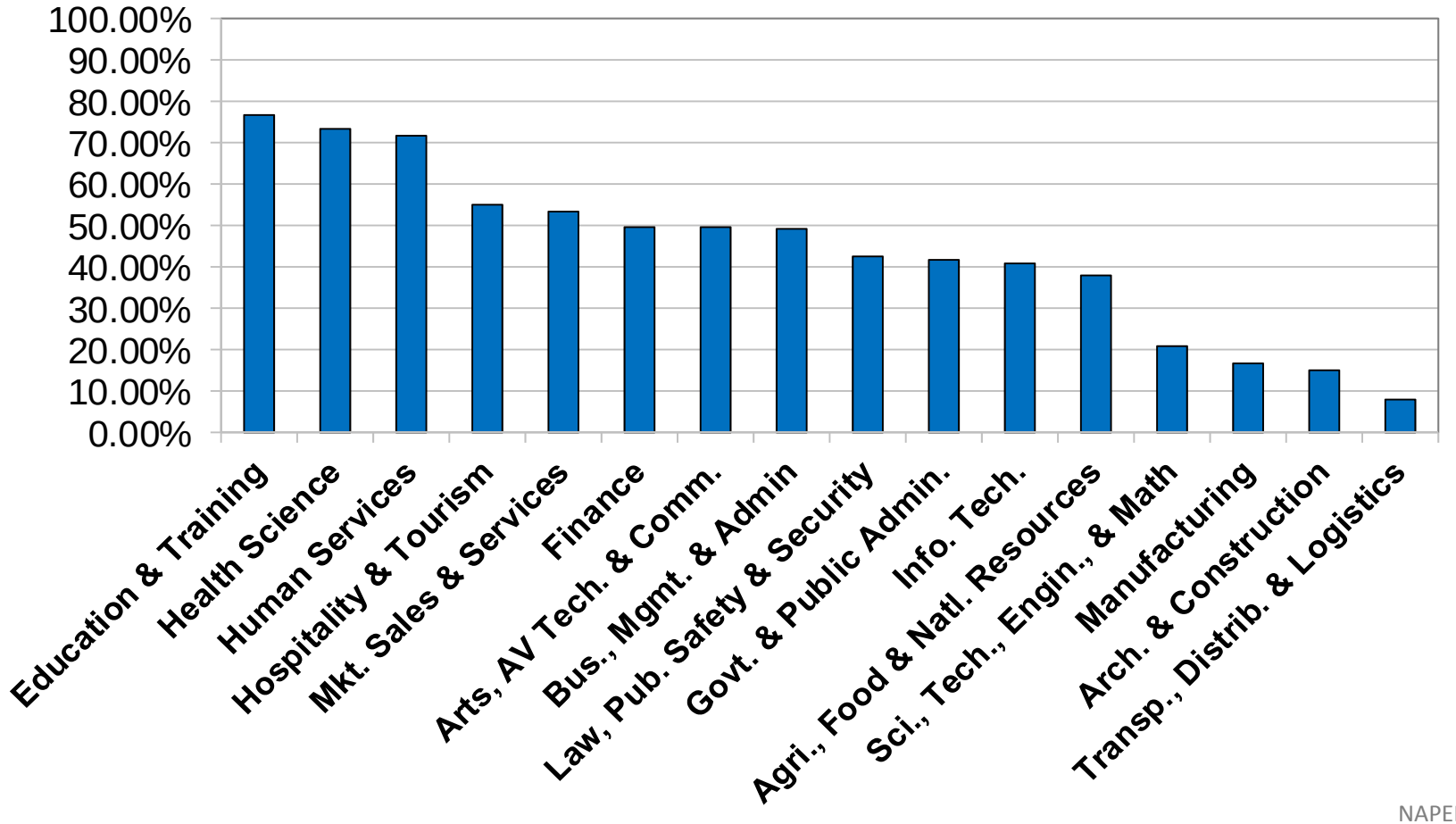
Source: CPST analysis of data derived from National Center for Education Statistics *Digest of Education Statistics, 2007.*

Gendered Participation in the STEM Workforce at the End of the Core Academic STEM Pipeline



Source: U.S. Department of Labor, Bureau of Labor Statistics, 2009, *Women in the labor force: A databook* (Report 1018) (Washington, DC), Table 11.

Female Participation in Secondary Career and Technical Education 2009-10



Female Participation in Post-Secondary CTE Education 2009-10

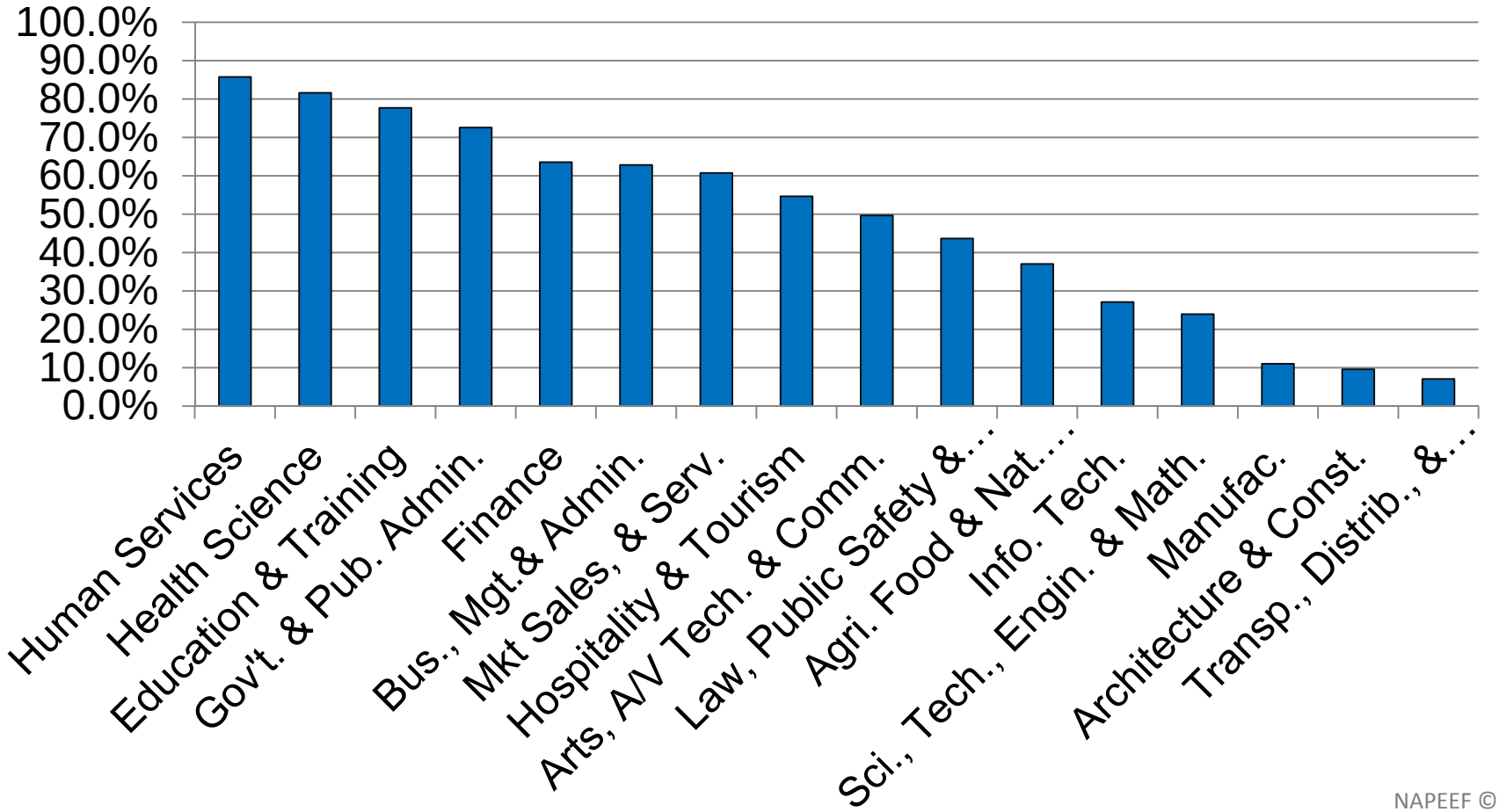
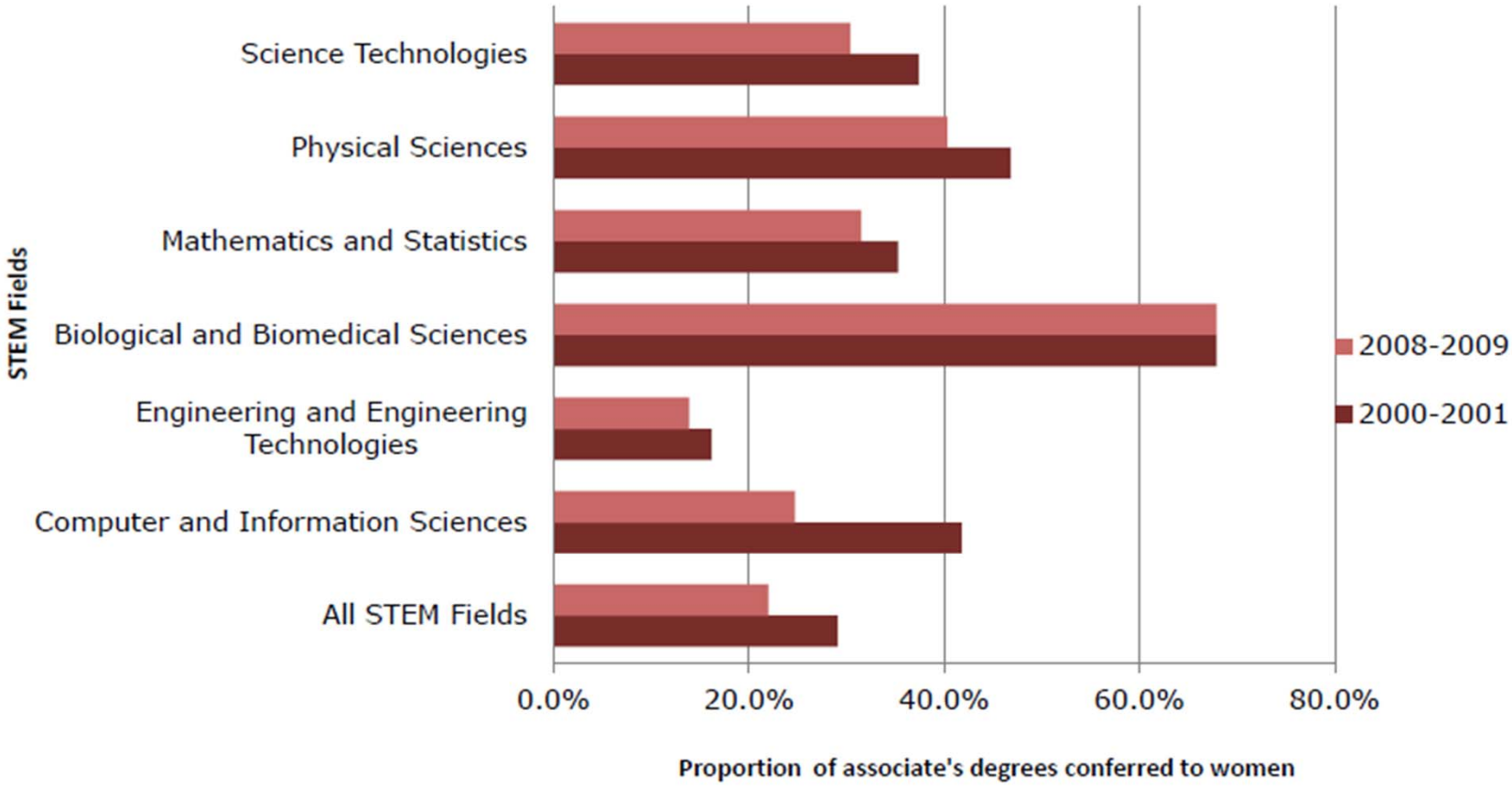
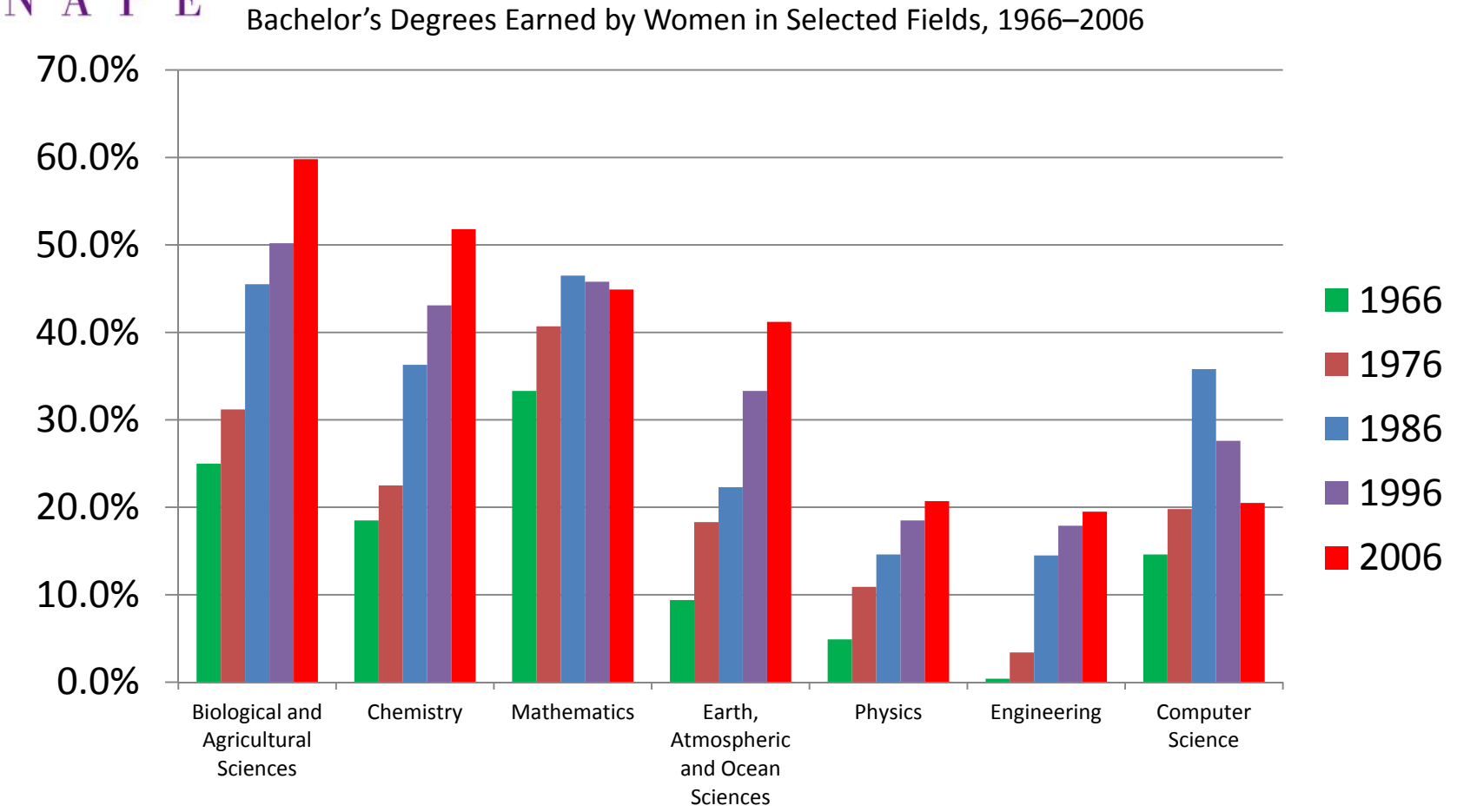


Figure 2. Percentage of Associate's Degrees Awarded to Women by STEM Field, 2000-2001 and 2008-09



Source: U.S. Department of Education. National Center for Education Statistics. Postsecondary Awards

Women's Representation among STEM Bachelor's Degree Holders has Improved over Time but Varies by Field



Source: National Science Foundation, Division of Science Resources Statistics, 2008, *Science and engineering degrees: 1966–2006* (Detailed Statistical Tables) (NSF 08-321) (Arlington, VA), Table 11, Author's analysis of Tables 34, 35, 38, & 39.

STEM Equity Pipeline Goals

- Build formal education's capacity to provide high quality professional development on gender equity in STEM education
- Institutionalize implemented strategies by connecting outcomes to existing accountability systems
- Broaden the commitment to gender equity in STEM education

States that have participated

- California
- Illinois
- Missouri
- Wisconsin
- Minnesota
- Iowa
- Ohio
- New Hampshire
- Georgia
- Texas
- Oklahoma
- Idaho
- 10 more ’12-’17

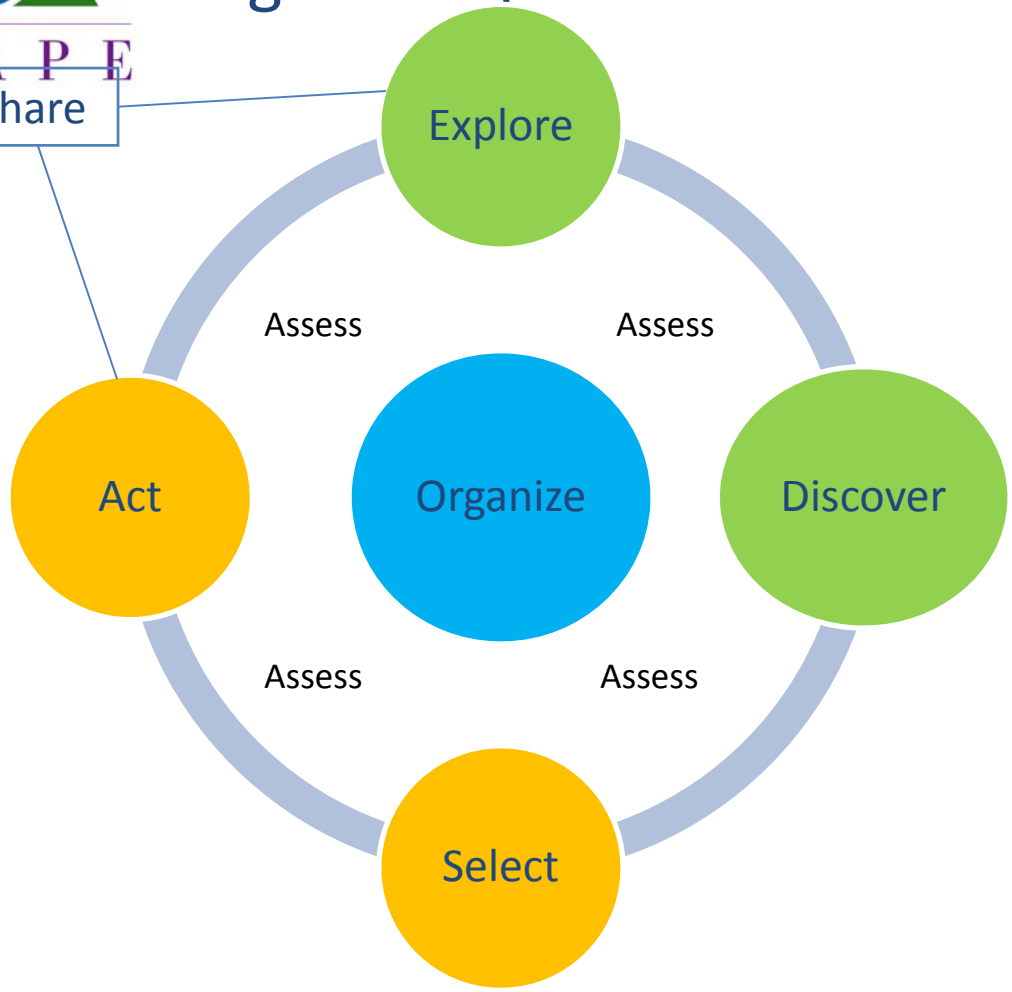
Ohio Project

- 12 Collaborative Projects currently underway throughout the state:
  - Career Centers and CTE Programs
  - Adult Career Center(s)
  - Community Colleges and Four-Year Partners
  - Business & Industry
  - Middle Schools, in some cases

- Use PIPE-STEM Model - see NAPE webpage at http://www.stemequitypipeline.org/

STEM Equity Pipeline

Program Improvement Process For Equity ™



- Phase One - Orientation
- Phase Two – Data and Root Cause Analysis
- Phase Three – Implementation and Evaluation

Perkins Act Accountability

Core Indicators on Nontraditional CTE

- Participation in CTE programs preparing students for nontraditional fields (**6S1**/**5P1**)
- Completion of CTE programs preparing students for nontraditional fields (**6S2**/**5P2**)

STEM Equity Pipeline

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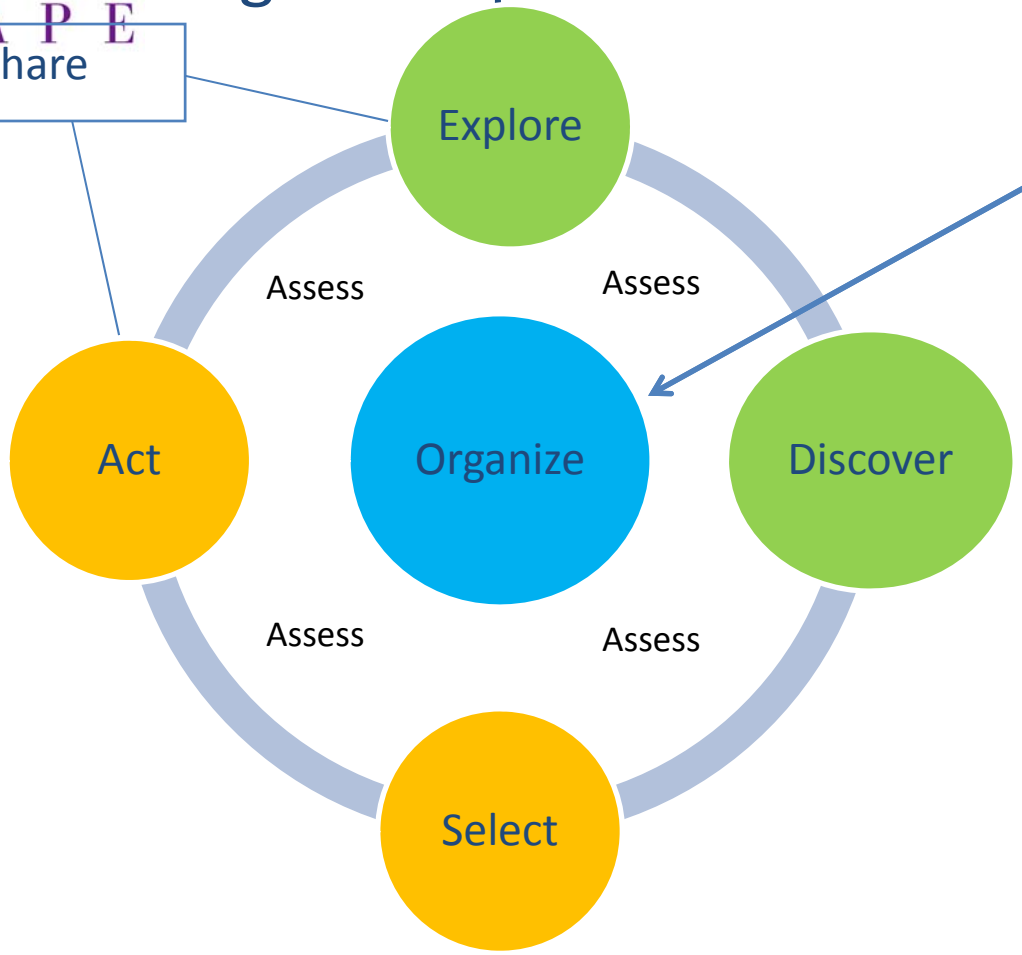

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Phase Two – Data and Root Cause Analysis

Phase Three – Implementation and Evaluation

STEM Equity Pipeline

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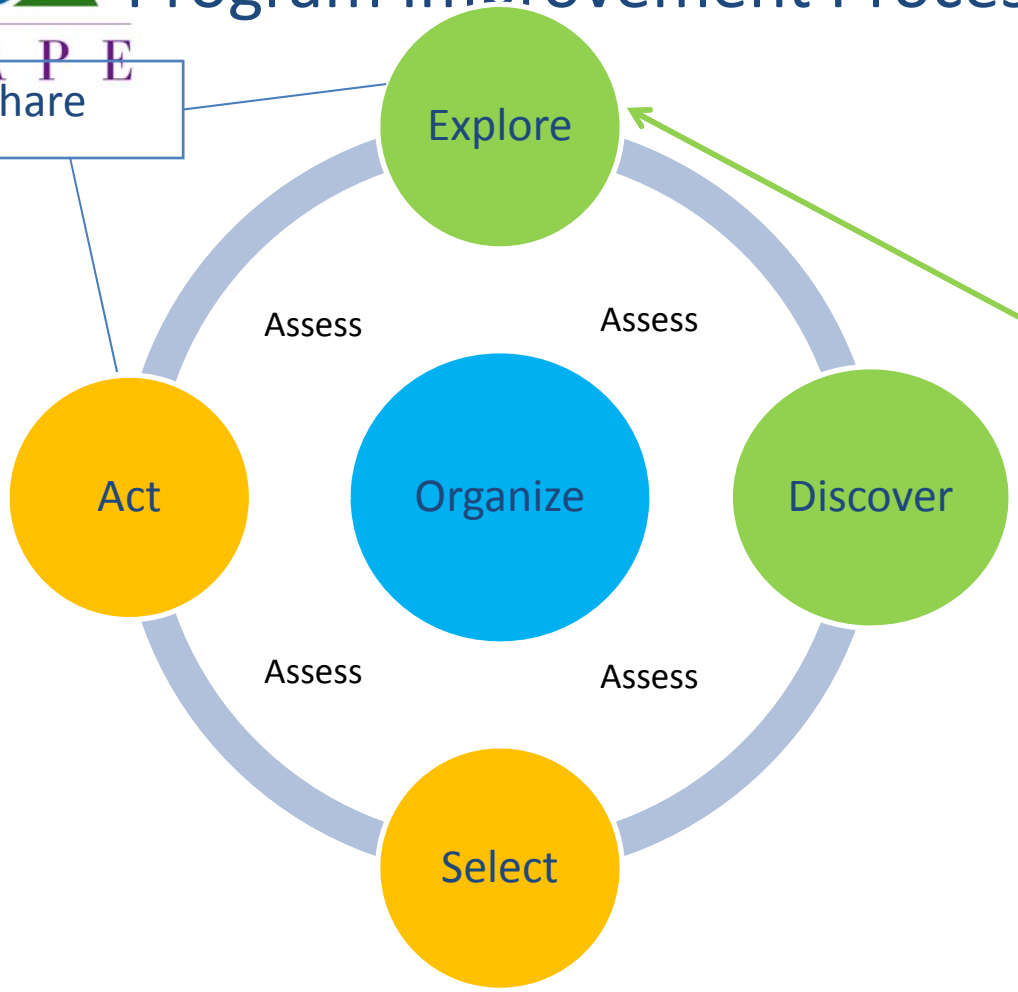

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Defining STEM

- Science, Technology, Engineering and Math
- Agriculture, Food and Natural Resources
- Health Science
- Information Technology
- Manufacturing
- Transportation, Distribution and Logistics
- Architecture and Construction

Data Collection
Disaggregation required in Perkins IV

- ***Gender***
  - –Male
  - –Female
- ***Race/Ethnicity***
  - –American Indian or Alaskan Native
  - –Asian or Pacific Islander
  - –Black, non-Hispanic
  - –Hispanic
  - –White- non-Hispanic

Special Population

- –Underrepresented gender students in a nontraditional CTE program
- –Single Parent
- –Displaced Homemaker
- –Limited English Proficiency
- –Individuals with a Disability
- –Economically Disadvantaged

Recommended Analyses

Comparisons

- State performance level
- Best performer in state
- Selected peer benchmark
- Set your own benchmark

Trends

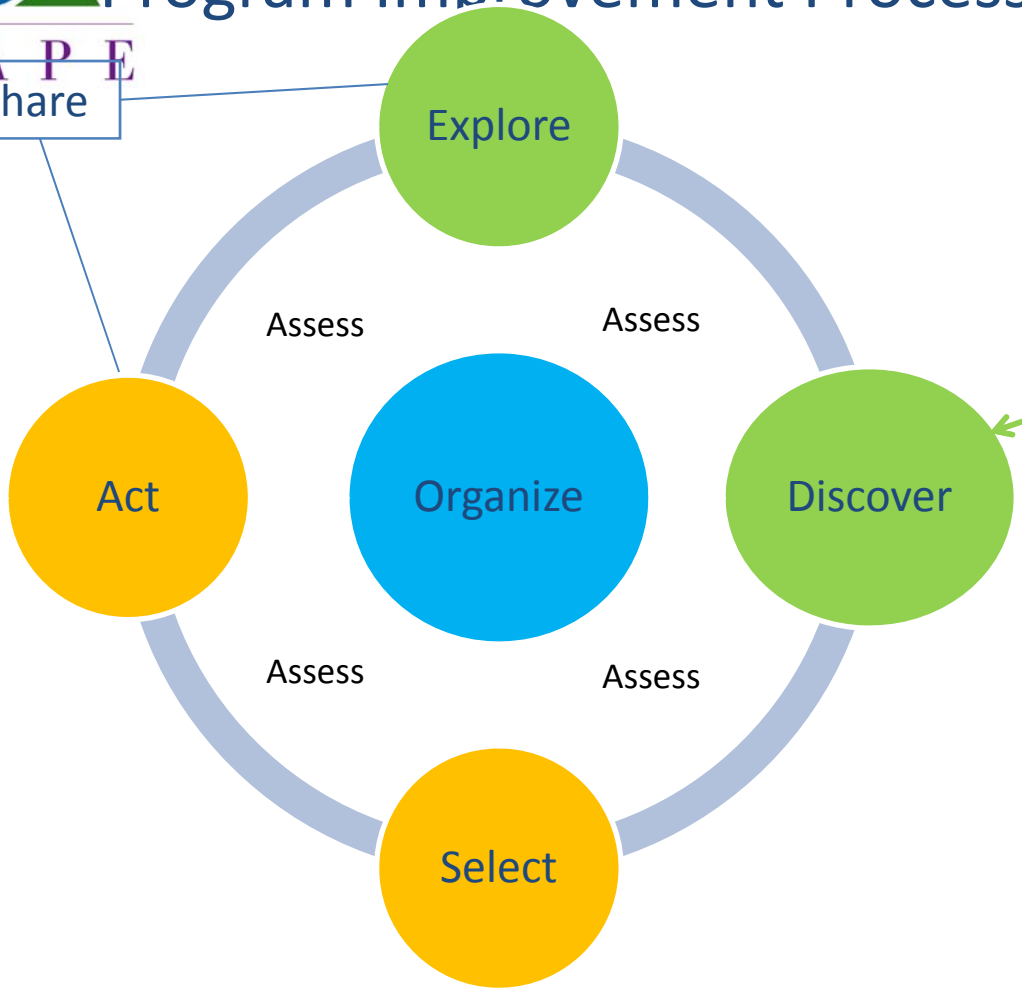
- At least 2 yrs
- Prefer 3-5 yrs

Site specific

- Statewide
- District
- School/College
- Programs

STEM Equity Pipeline

Program Improvement Process For Equity ™



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Review Research Summary

- "*Nontraditional Career Preparation: Root Causes and Strategies*"

  Authors: Lynn Reha, ICSPS; Mimi Lufkin, C.E.O. NAPE; Laurie Harrison, Foothill Associates

Root Causes

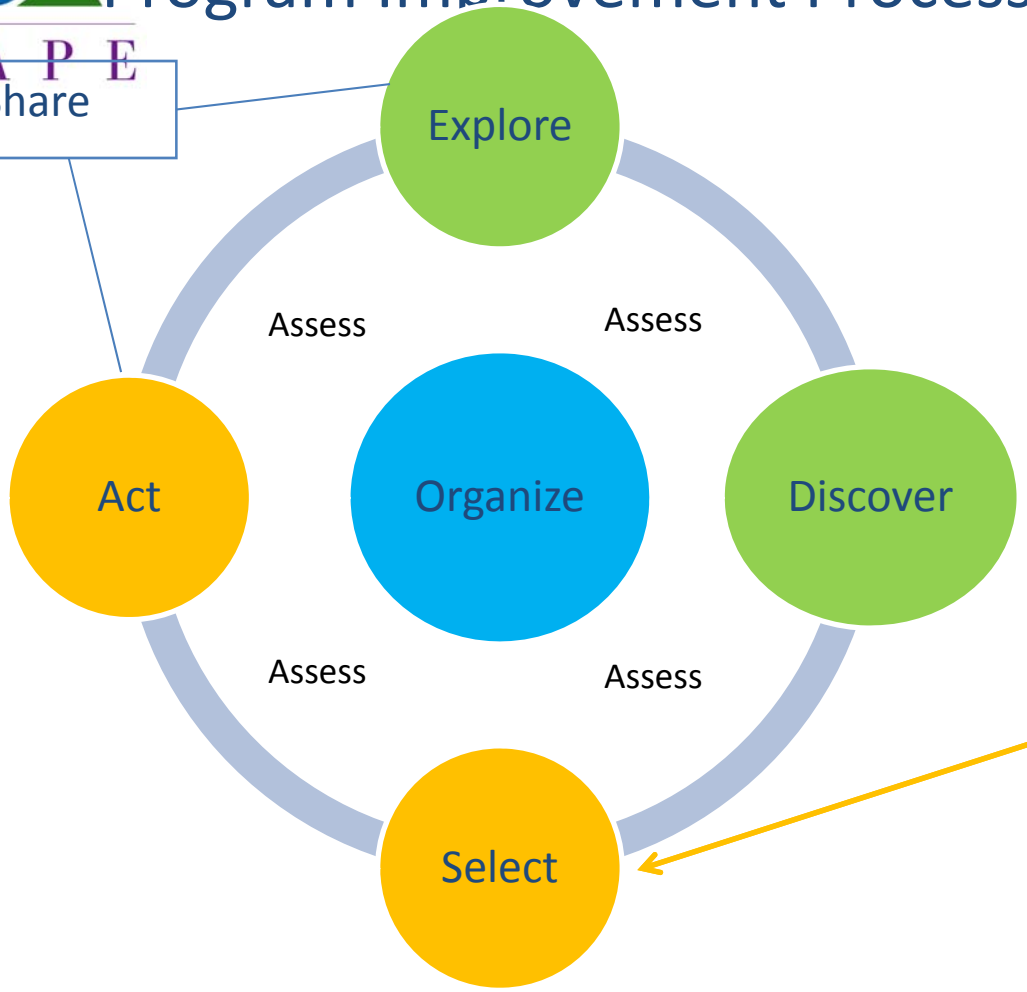
- Educational Environment
- Career Information
- Family Characteristics (Family Perceptions)
- Individual Factors
- Societal Issues

Confirming your hypotheses

- Conduct a root cause analysis
  - **Conduct equity audit**
    - School environment: physical space, support services
    - Curriculum & instruction
    - Publicity (website, recruitment materials, etc.)
  - **Interview students**
    - Who drops out of nontraditional programs?
    - Who stays in nontraditional programs?
    - Who never chooses?
  - **Conduct focus groups**
    - Teachers of nontraditional programs
    - Parents
    - Business/Industry/Advisory committee members

STEM Equity Pipeline

Program Improvement Process For Equity ™



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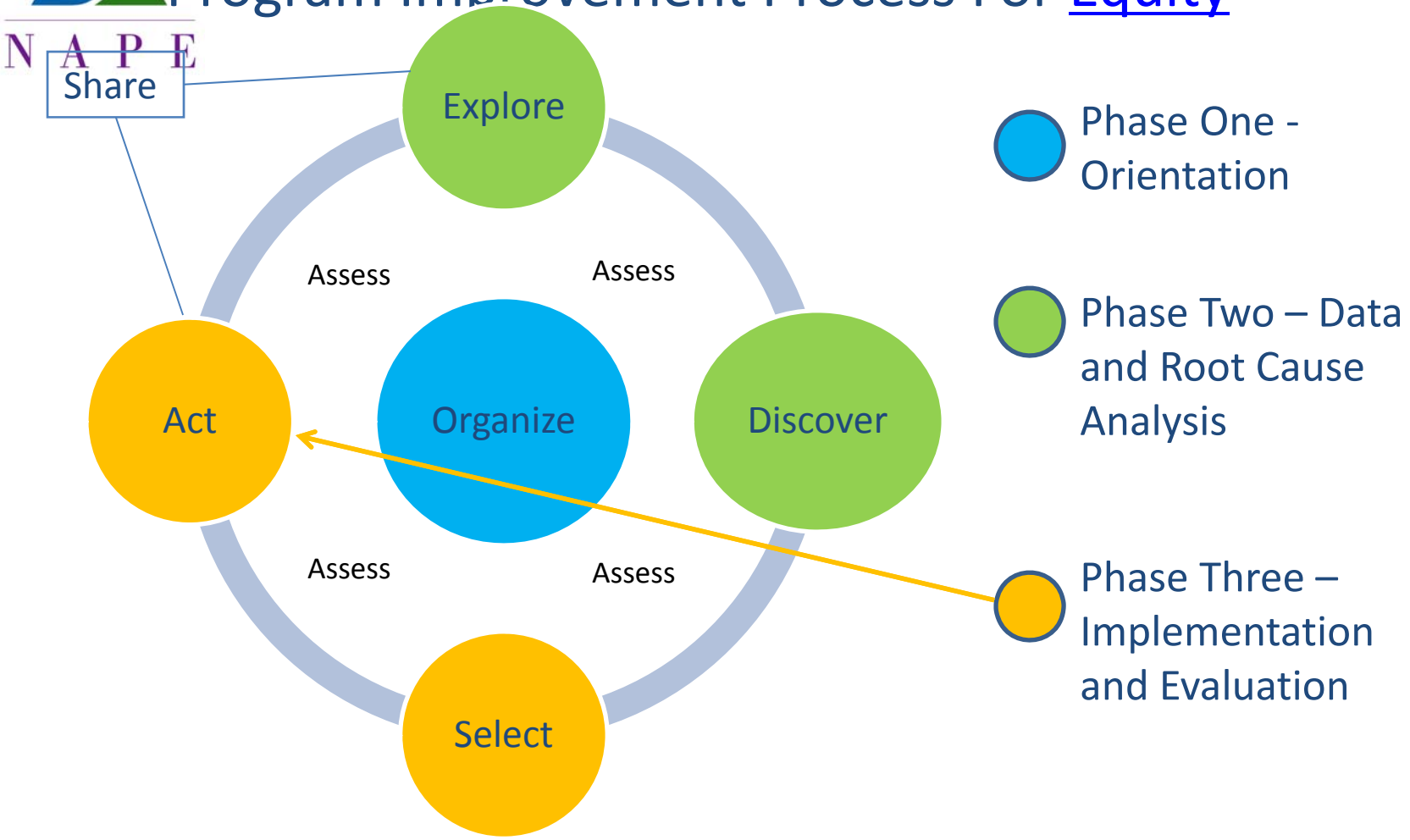
STEM Equity Pipeline

Program Improvement Process For Equity ™

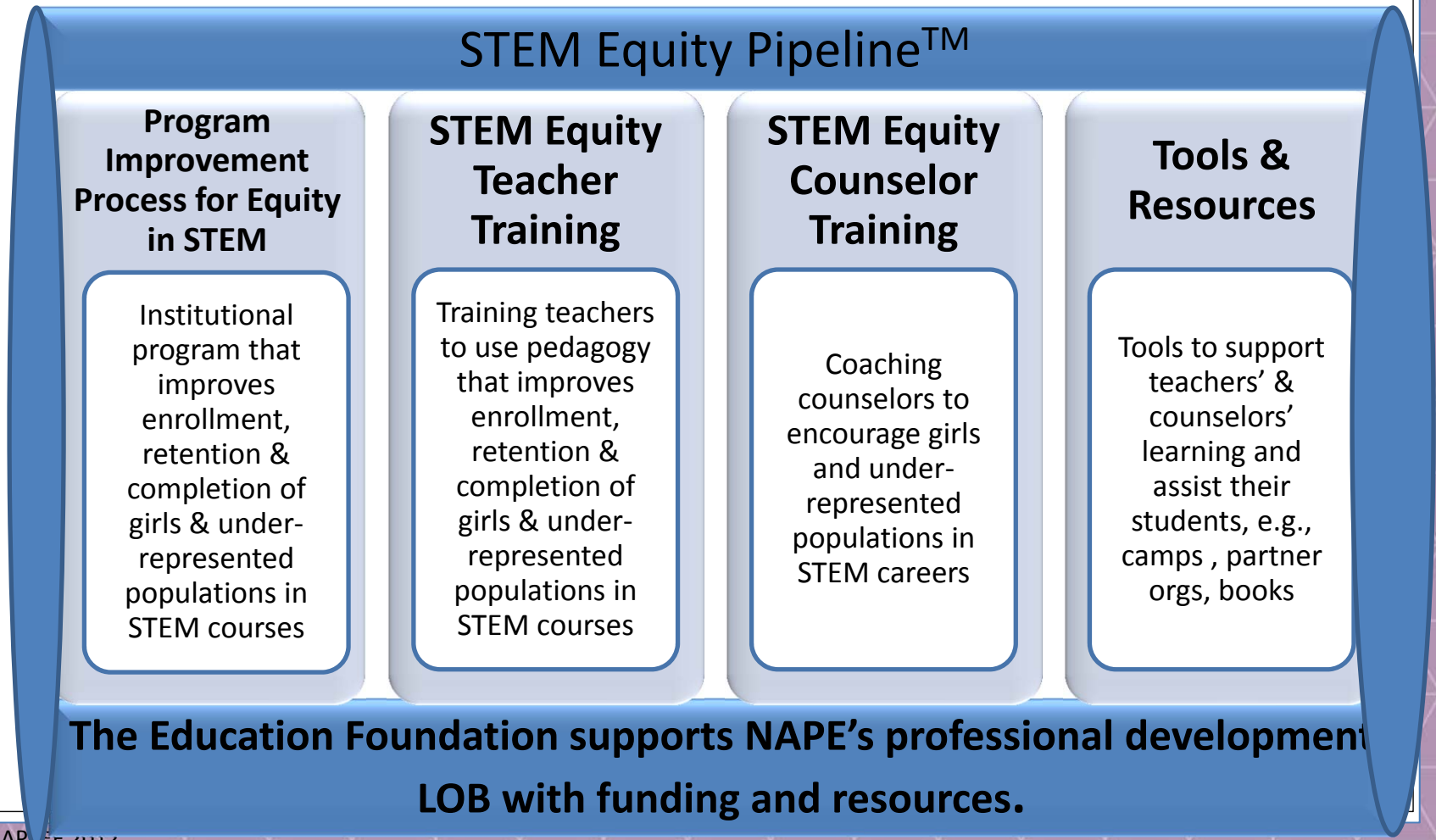


Themes in Strategies

- Career Development/Early intervention
- Collaboration between secondary and post-secondary in getting students excited about nontraditional STEM occupational pathways
- Educating parents, teachers, guidance counselors, & administrators about STEM opportunities and CTE
- Providing additional supports to under-represented students:
  - Mentors and Role Models
  - Ex. Summer orientation for students in STEM at Stark State College

CLASSROOM CLIMATE – KEY ROOT CAUSE

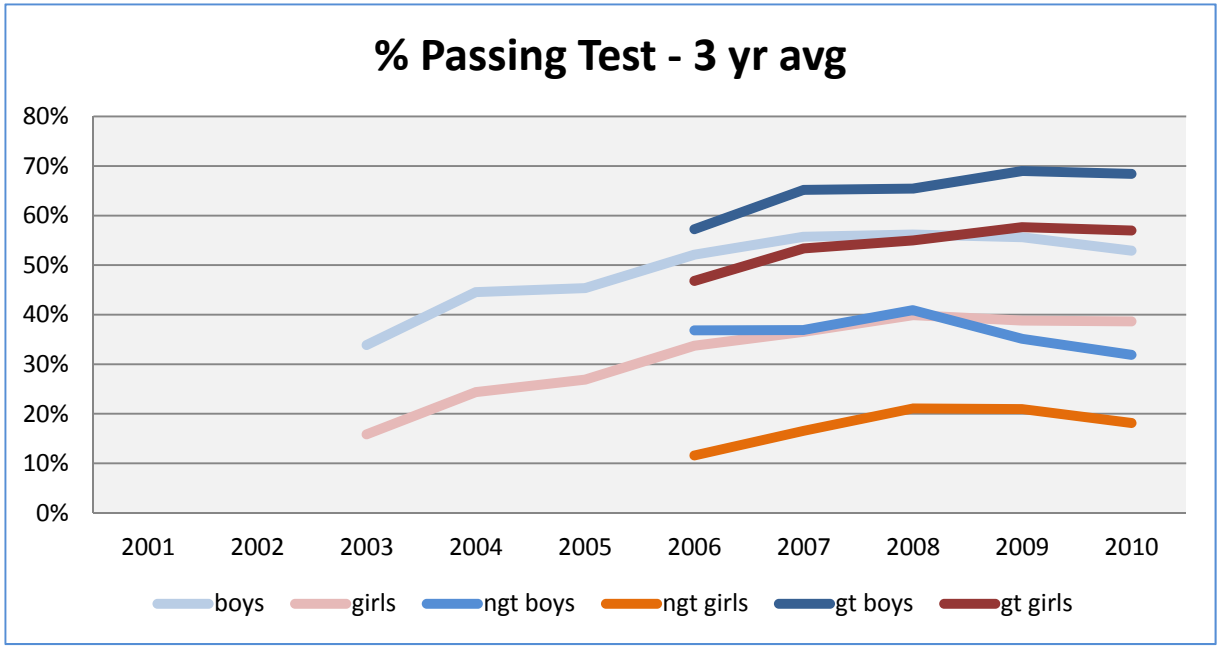
Professional Development for Educators: STEM (including CTE) Access, Equity, Diversity



Rethinking an old paradigm

1. Find an effective pilot program
2. Adapt a recognized model for continuous improvement
3. Develop a new understanding of culture delivery (The missing link in culture change)

Effective Pilot Program
DFW Gender Equity Training



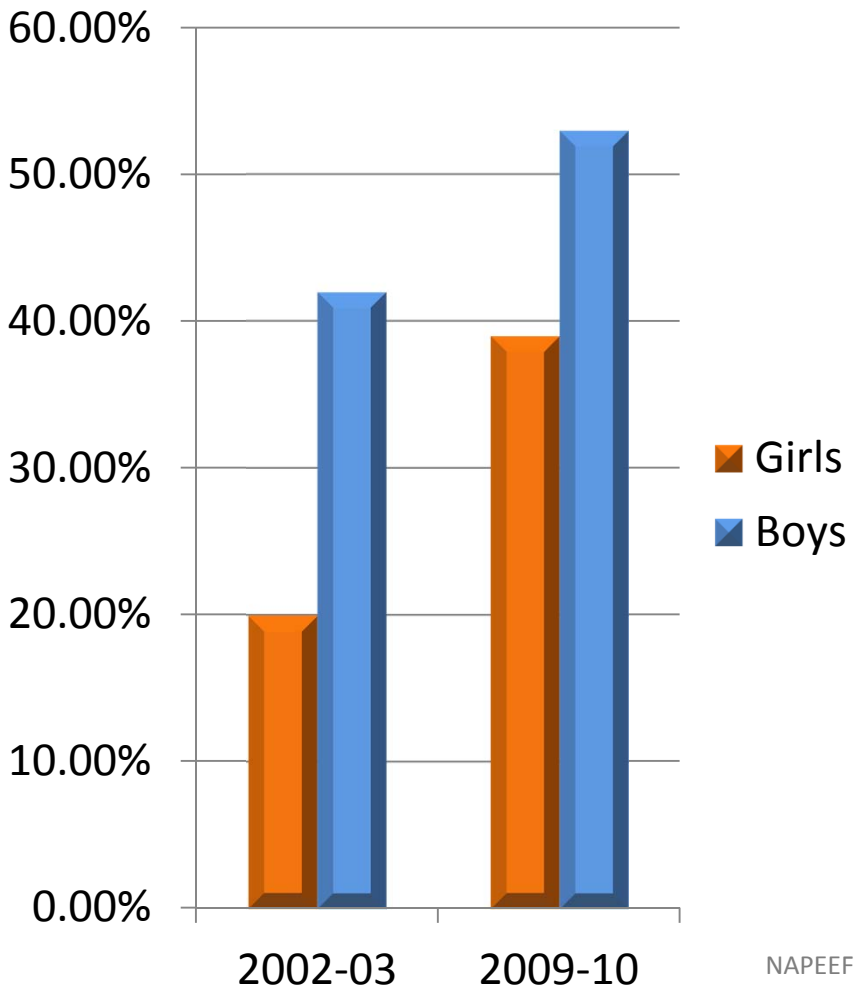
Both boys and girls of the teachers that had Gender Equity training are passing at 20-30% points higher than students of teachers without the training

DFW: Professional Development

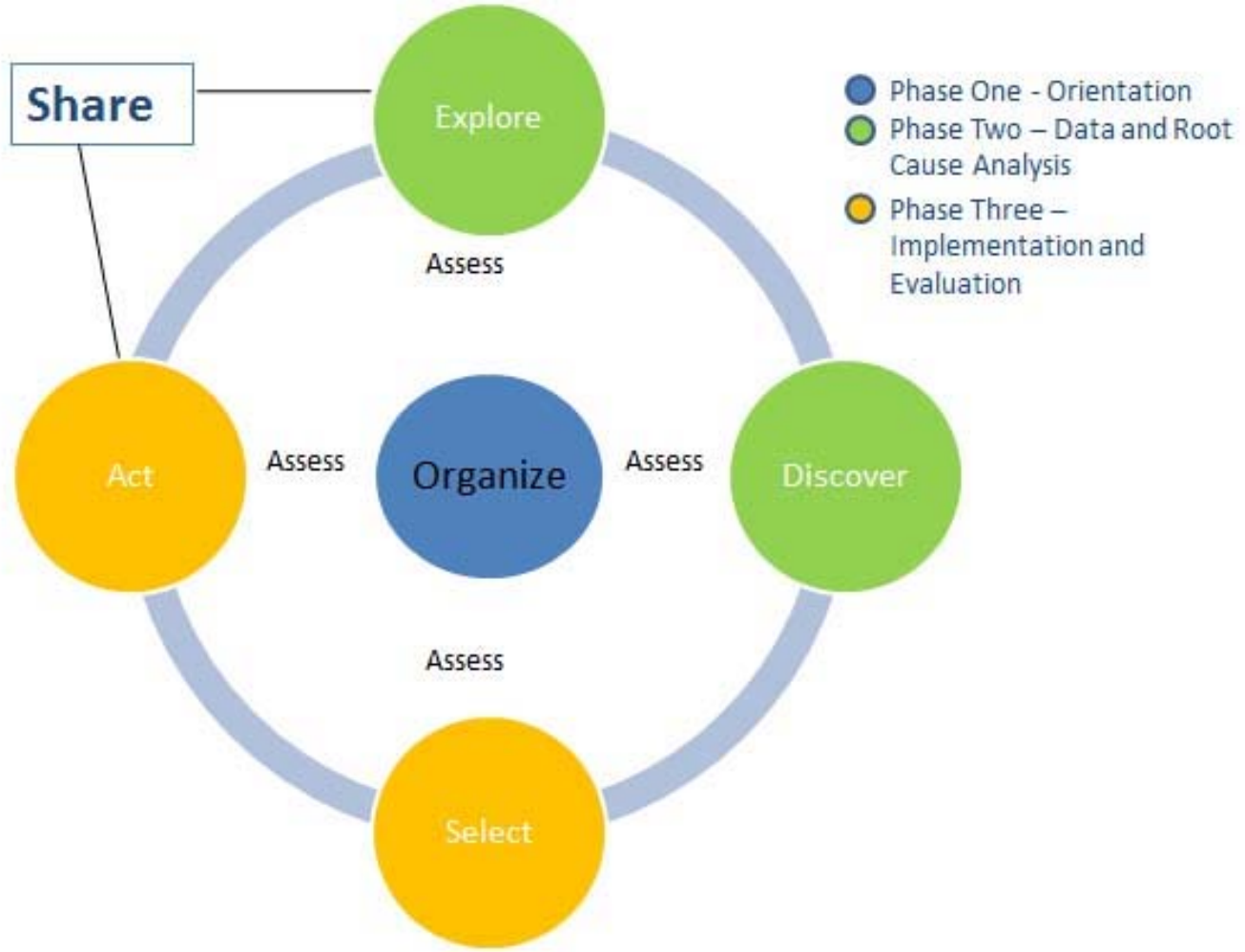
Since implementation in 2003,

AP Physics test pass rates improved for both girls and boys:

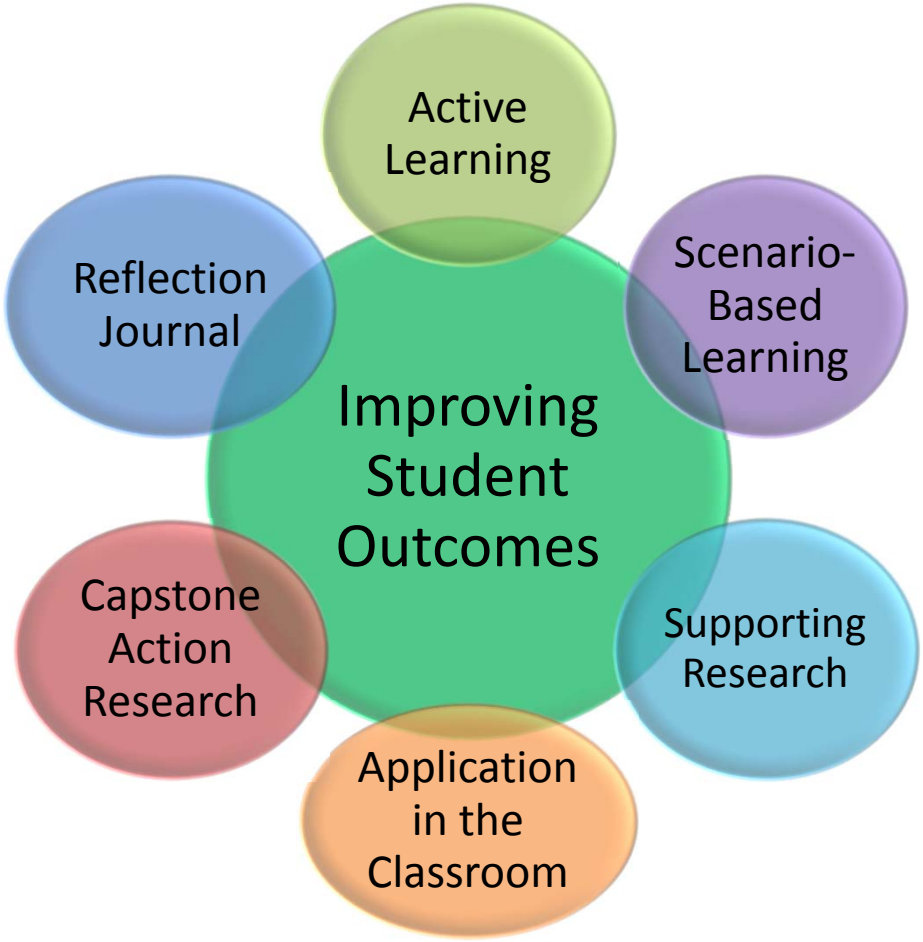
- 4x tests passed by girls
- 4x tests by African Americans
- 6x tests passed by Hispanics



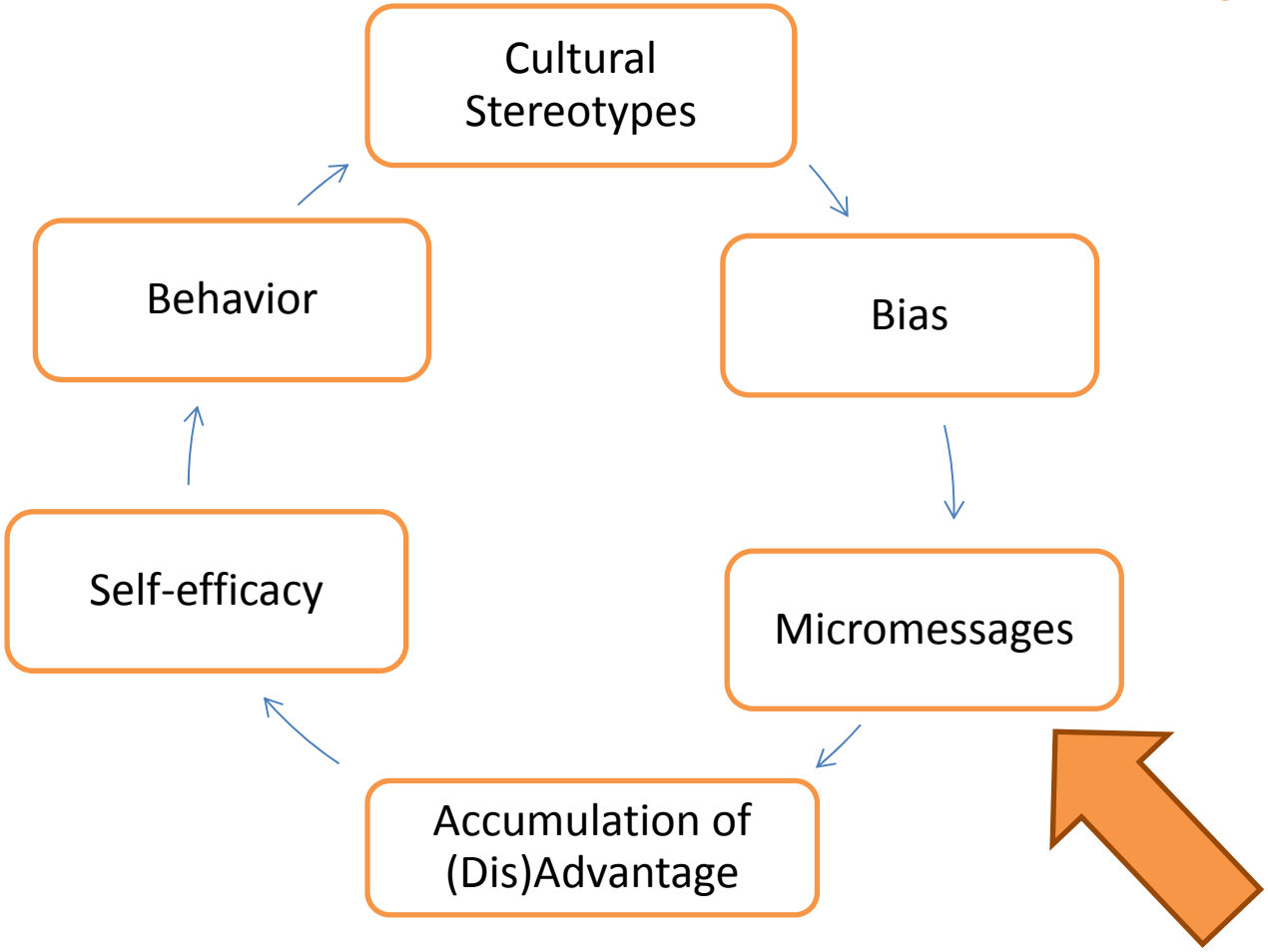
Adapt a Recognized Model: The Educator as Classroom Scientist: PIPESTEM™



Making It Happen



Micromessages: The Missing Link in Culture Delivery



Micromessaging

Micromessages

- Small, subtle, semi-conscious messages we send and receive when we interact with others

Micro-inequities

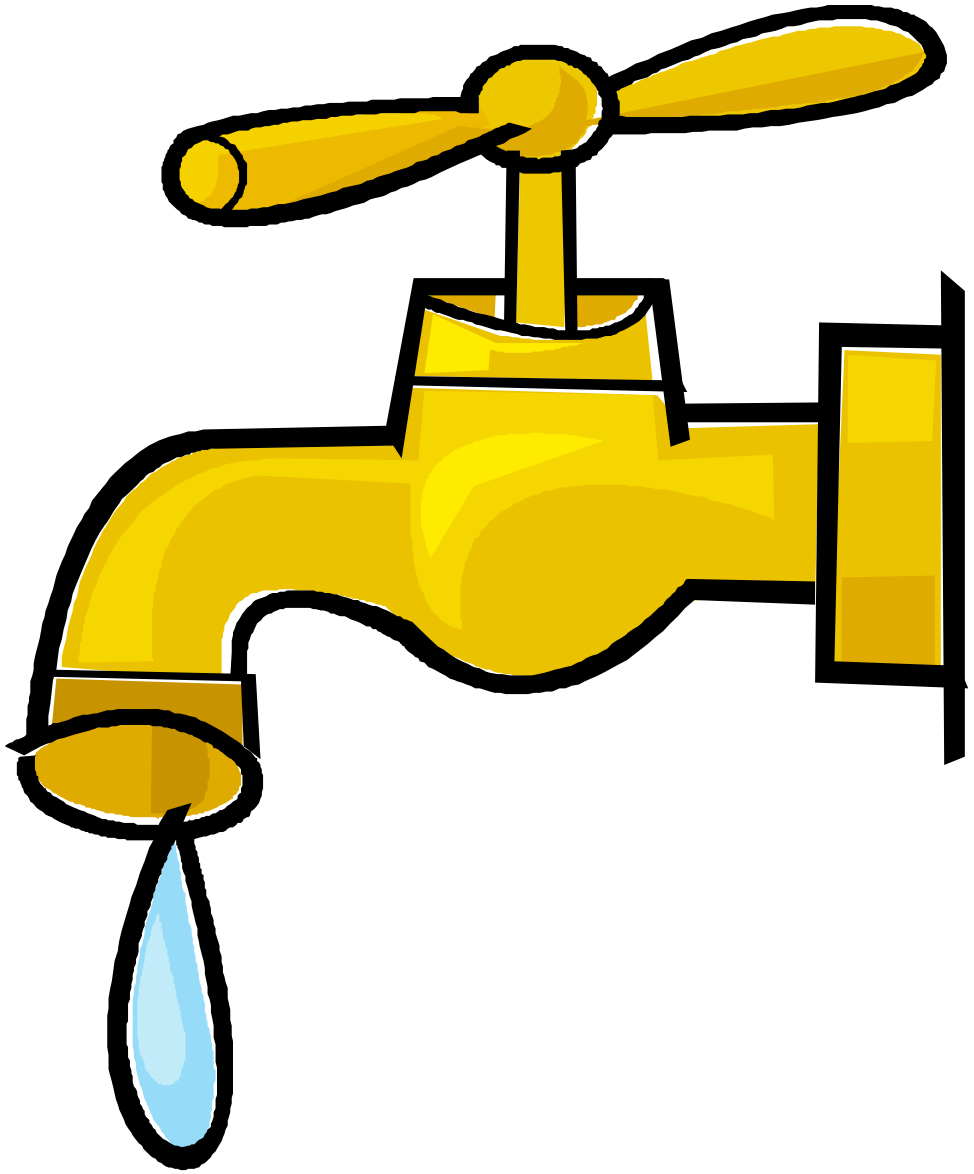
- Negative micro-messages we send other people that cause them to feel devalued, slighted, discouraged or excluded

Micro-affirmations

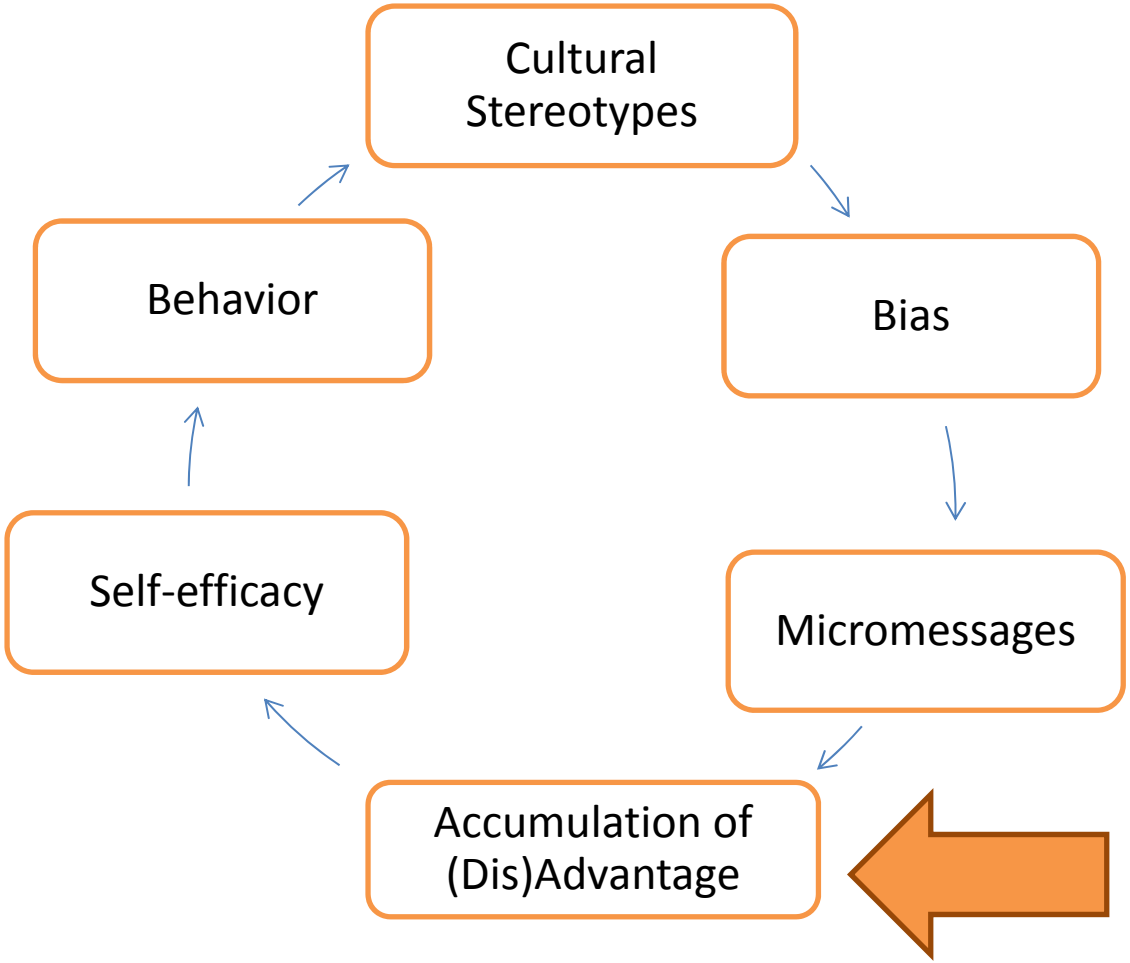
- Positive micro-messages that cause people to feel valued, included, or encouraged

Lands End Catalog 2012

Lands End Catalog 2012



Micromessages: The Missing Link Between Bias and Behavior



Gender Bias = Micro-Inequities

Unconscious

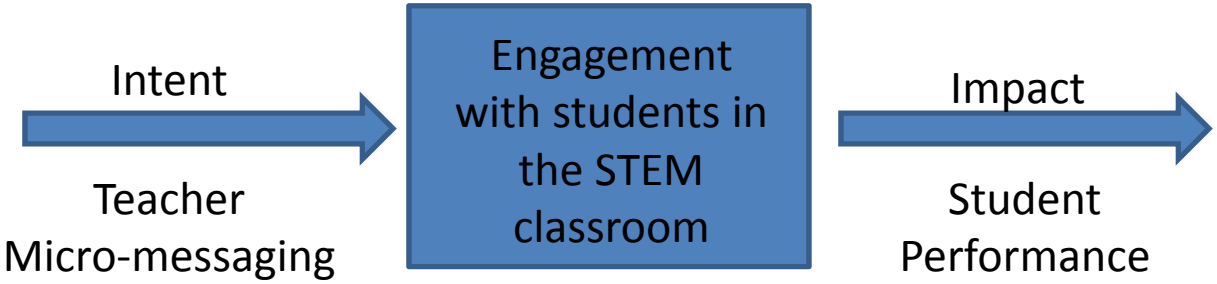
Unintentional

Subtle

PERVASIVE

POWERFUL

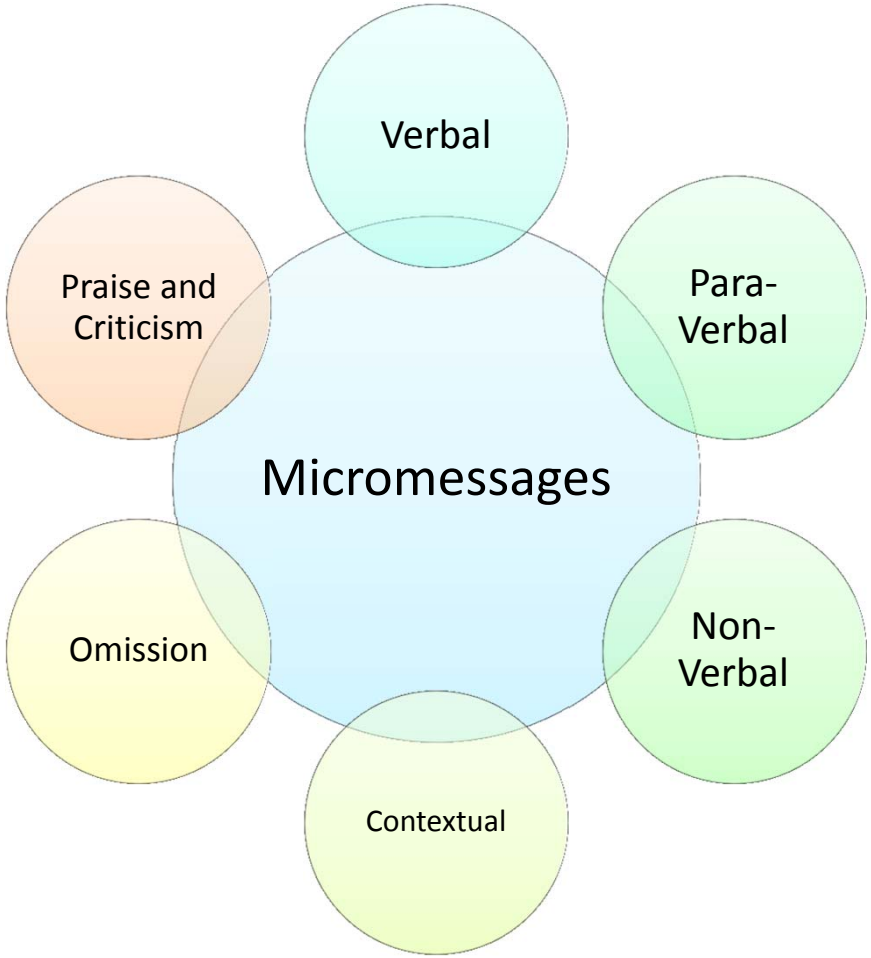
Why Think About Micromessaging?



Small and seemingly insignificant behaviors may result in unfavorable learning outcomes.

Impact is More Important Than Intent!

Key Micromessaging Elements



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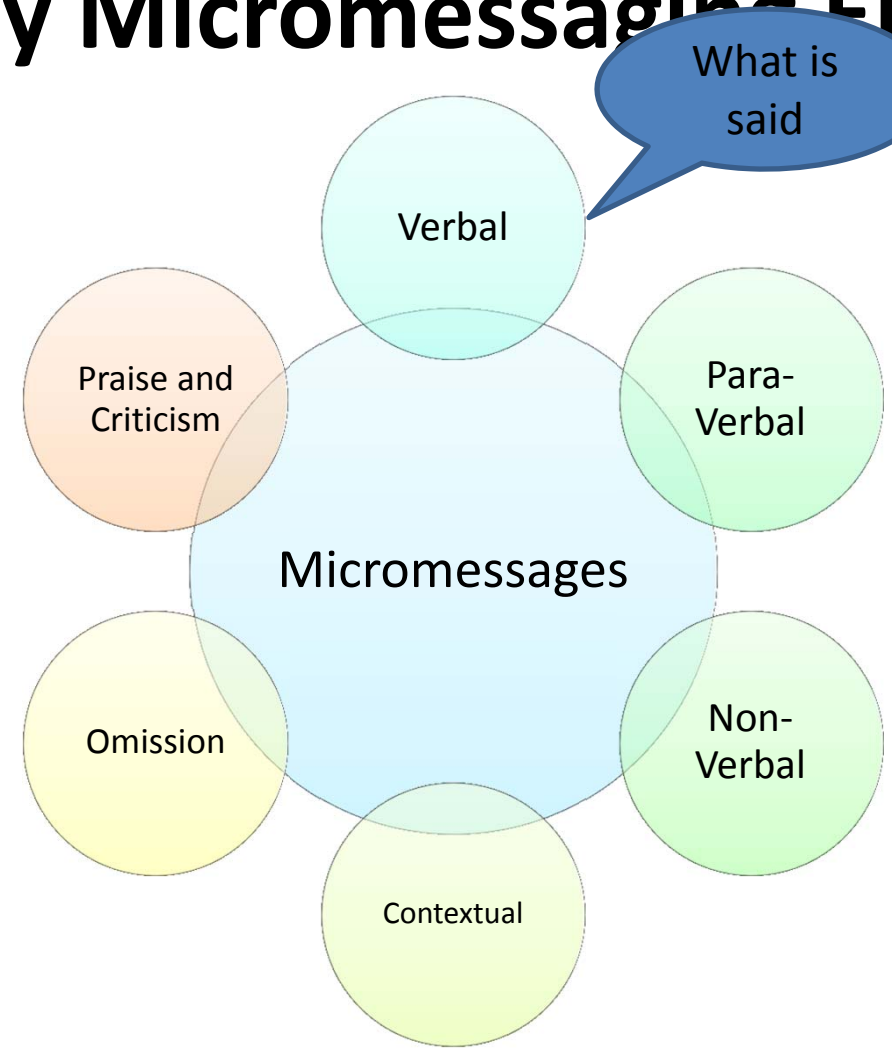

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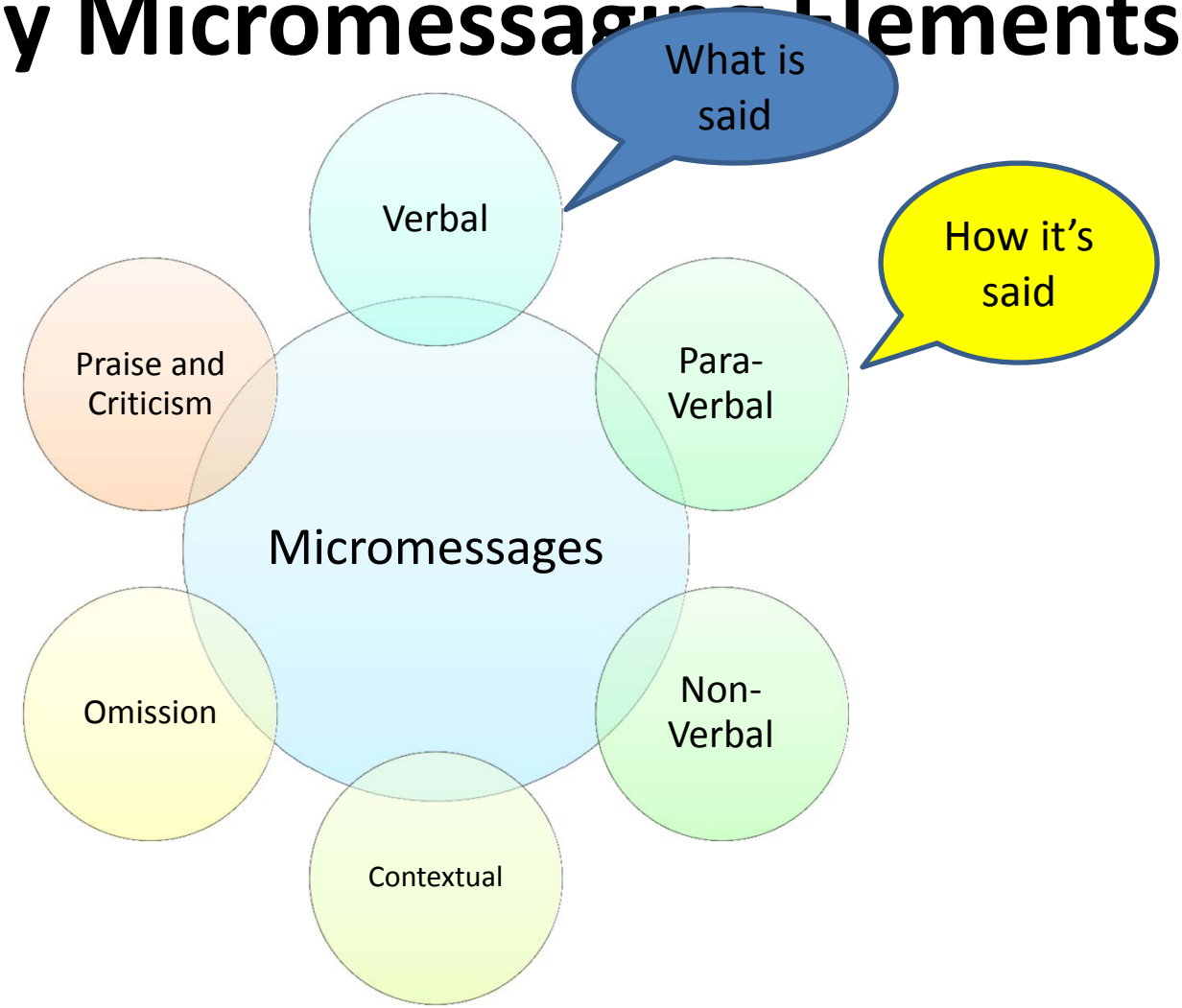

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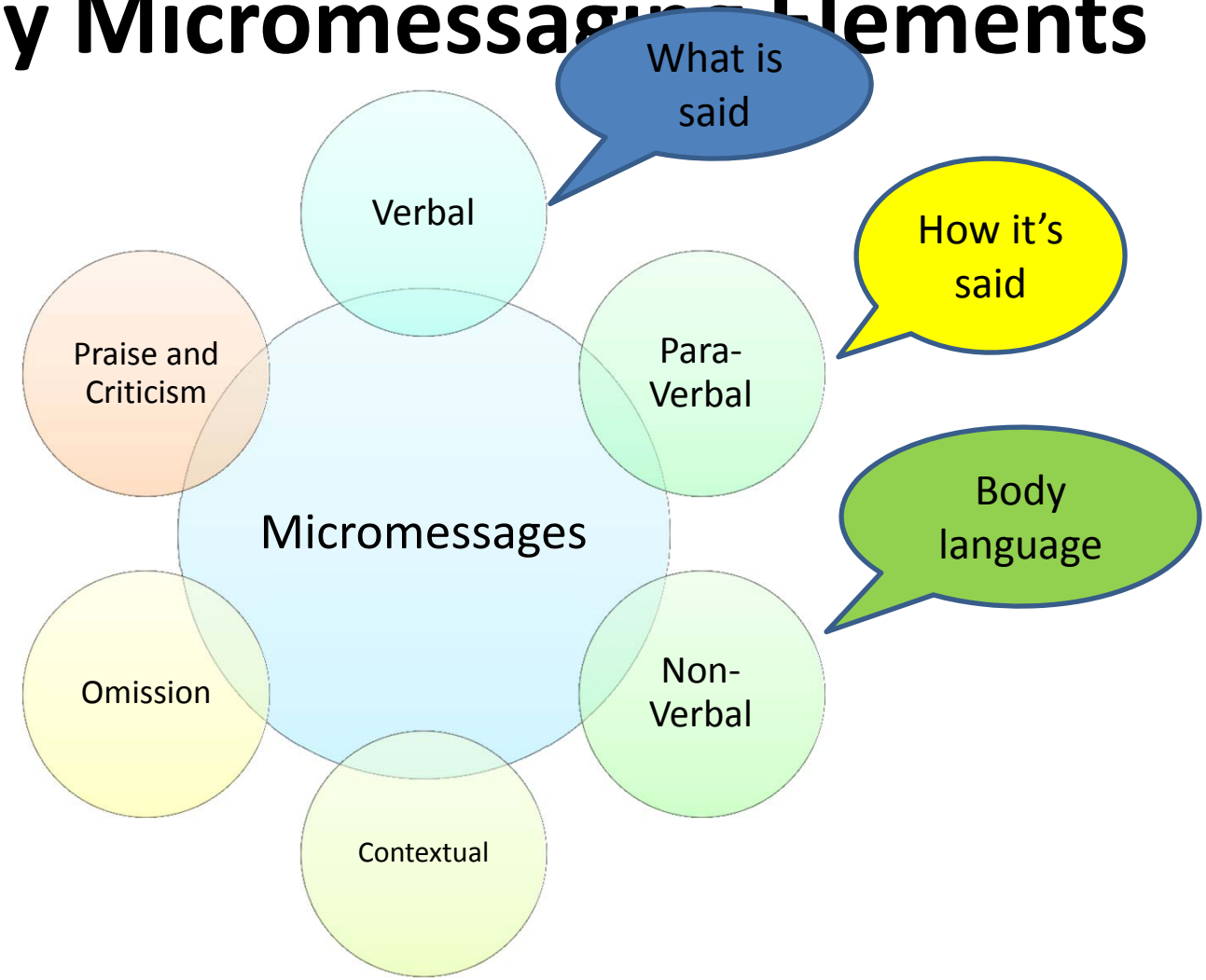

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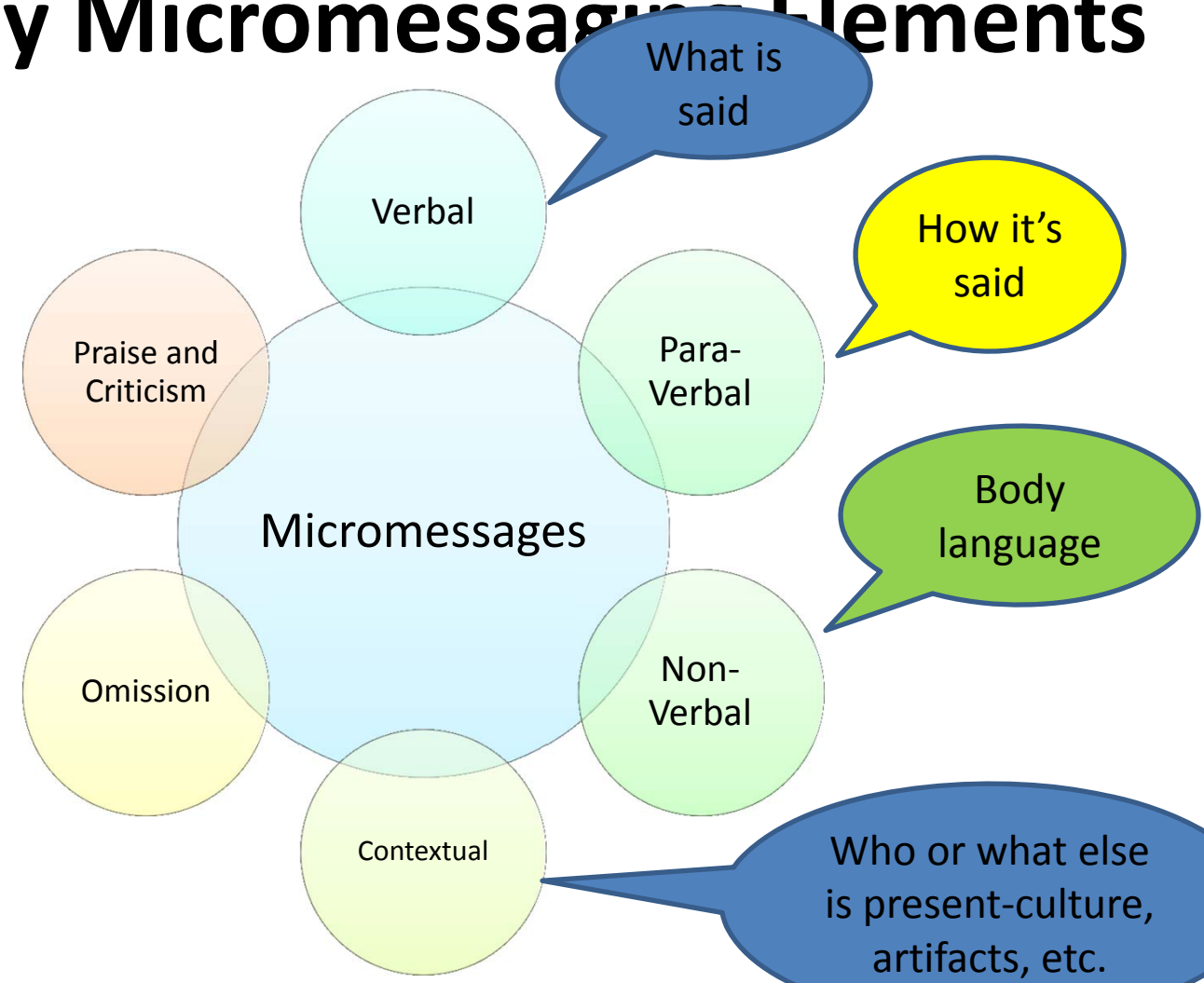

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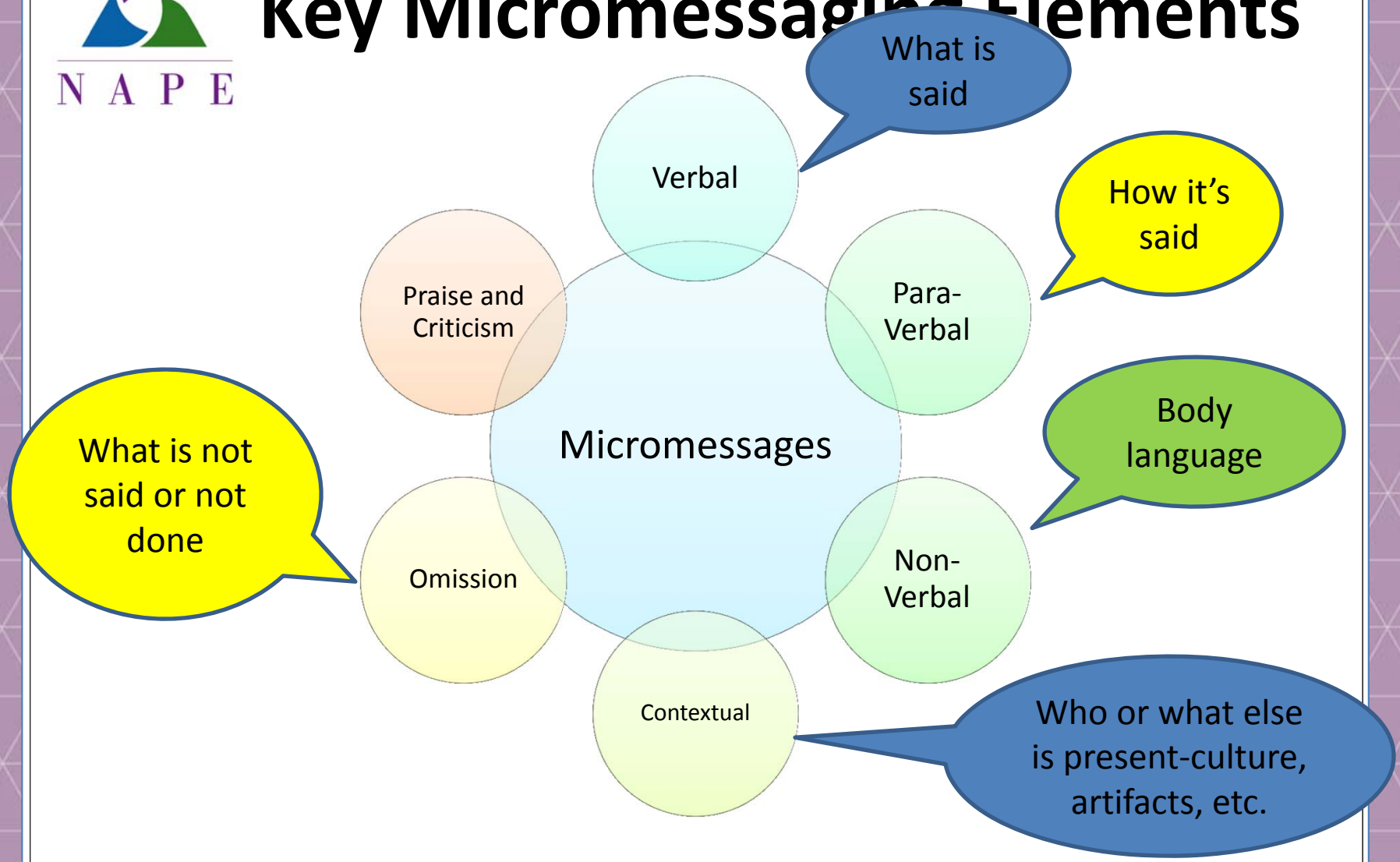

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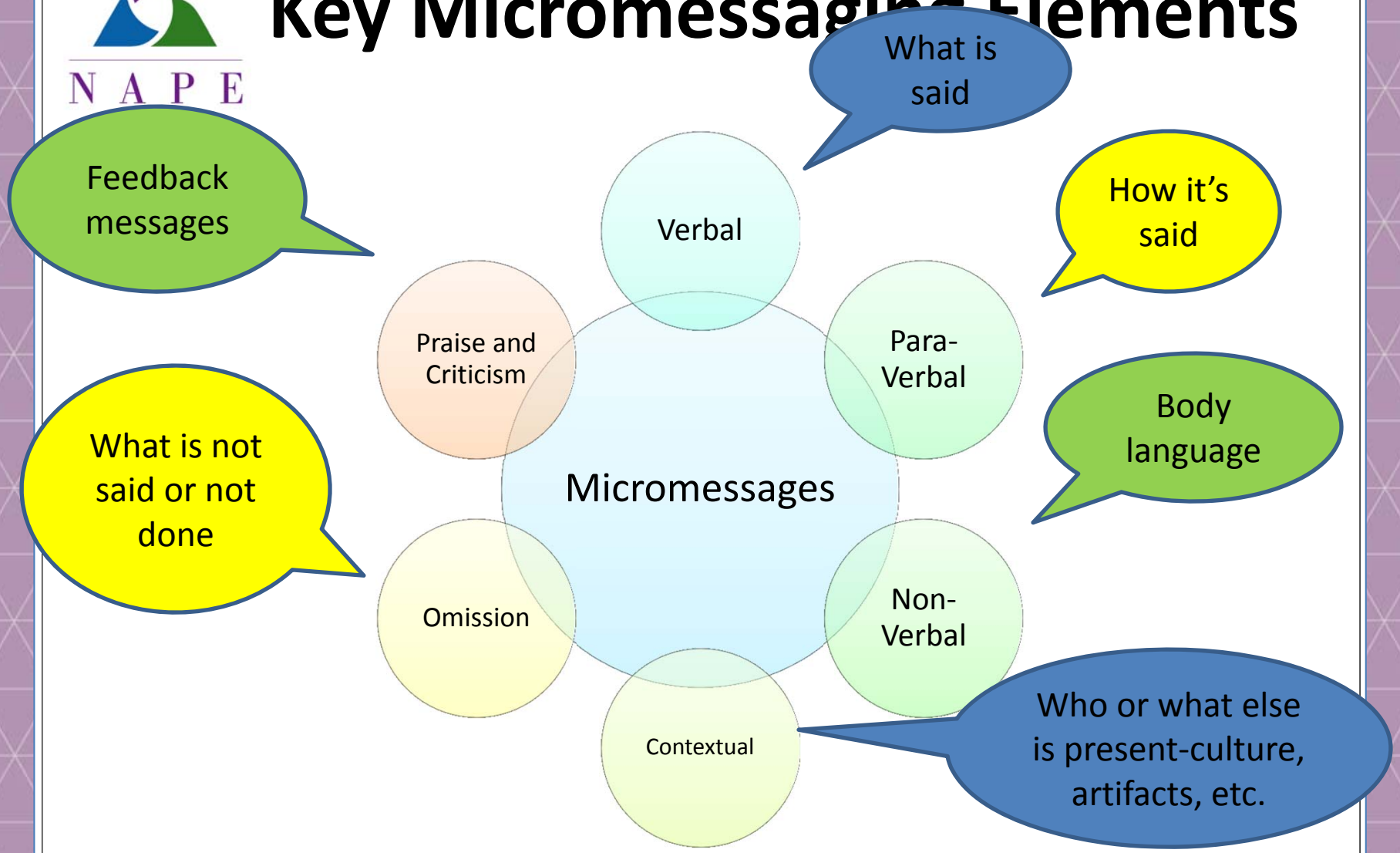


Examining the Small

On a piece of paper write a specific incident when you were being…

- unintentionally discouraged or hurt by something SMALL someone said or did
- deeply valued by your colleague or family member in a SMALL yet powerful way.

- How did you know? What did that person do to communicate your value?

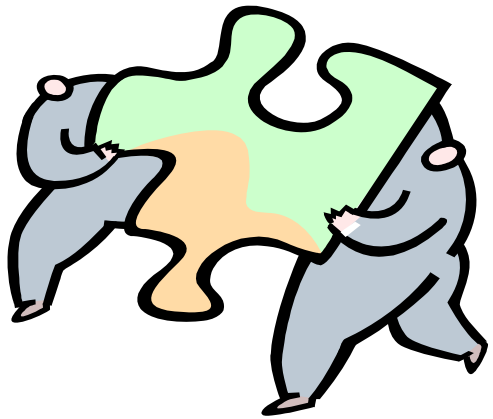
Positive Micromessages

Micro-affirmations are micromessages we send that validate and recognize other people in positive and supportive ways.

Inoculate and Be Affirmative!

Make a concerted over-effort to become affirmative:

- It takes time (a year or more!)
- It takes effort (a conscious plan)
- It takes support (peers and a learning community)



Impact of Micro-Affirmations on Women in STEM

- Enhanced creativity and innovation and willingness to take risks
- Increased engagement in complex tasks and open-ended thinking
- Improved caring about learning
- Increased interest in STEM and development of girls' STEM-identity

Creating Simplicity out of Complexity

NAPEEF ©

Four unique key components:

- A data-driven process funded through NSF
- Two or more teachers/faculty in a school
- Year-long professional development process
- Virtual, peer-supported learning community

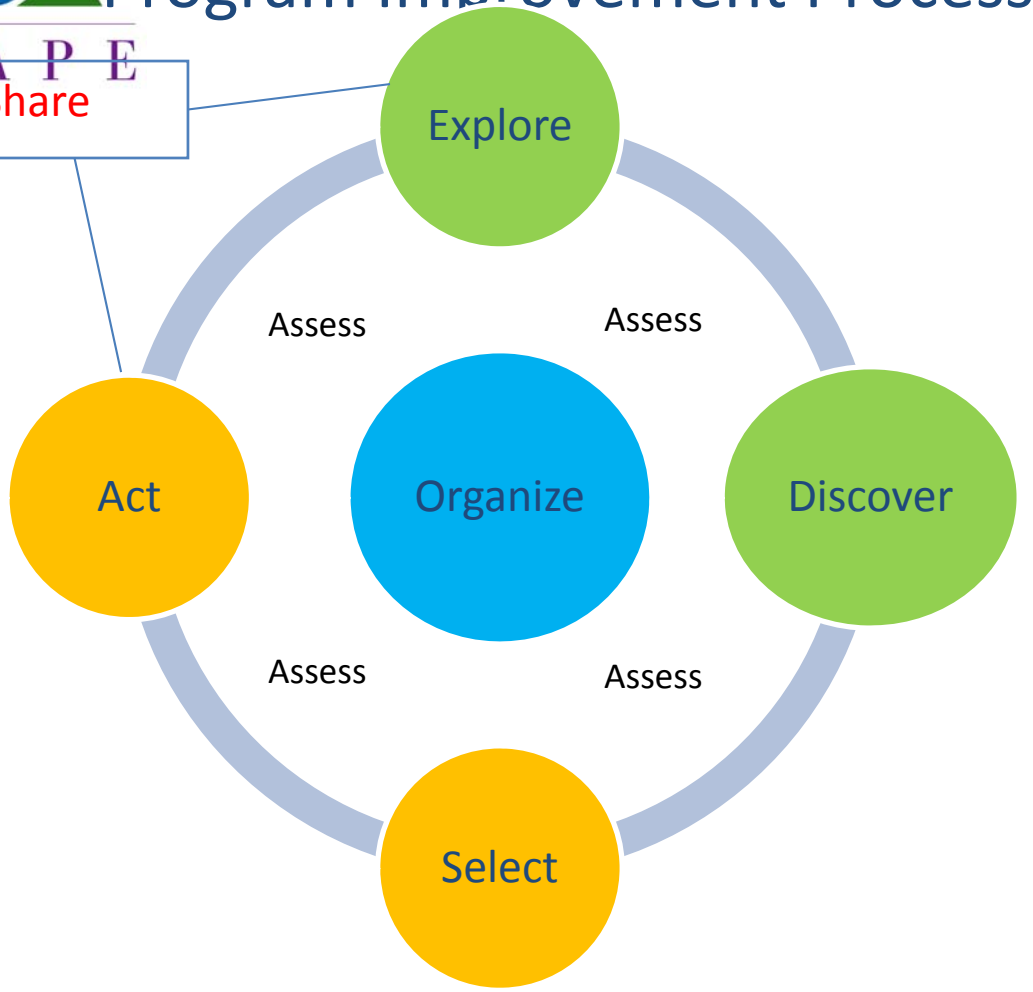
Transformed and sustained teacher practice that **results in measurable student outcomes, particularly for Hispanic and African-American female students**

Strengths of PIPE-STEM

- Data driven (national and local)
- Collaborative across the pipeline
- Assessment, Assessment, Assessment
- Continuous improvement and learning
- Evidence that it has made a difference
- A national model
- NSF-supported…twice

STEM Equity Pipeline

Program Improvement Process For Equity ™



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Virtual Learning Community

www.stemequitypipeline.org

- Public portal for the STEM equity pipeline community
  - Listserv
  - Links
  - Articles, Resources, Reports and Research
  - Calendar of Events in STEM
  - Webcasts, Webinars, Video, Podcasts, Power Points
  - Online courses and Tutorials
  - Performance Data on Women & Girls in STEM
  - Professional Development Needs Assessment
  - Project Evaluation Instruments and Surveys
  - More!

Helpful resources

- www.stemequitypipeline.org
- www.napequity.org
- www.changetheequation.org

Reports of Interest

- *Pathways to Prosperity* (Harvard 2011)
- *STEM* (Georgetown 2011)
- *Increasing opportunities for low-income women and student parents in community colleges* (Costello, 2012)
- *The quest for excellence: Supporting the academic success of minority males in Science, Technology, Engineering, and Mathematics (STEM Disciplines)* (Toldson & Esters, 2012)

Additional reports

- U.S. Department of Commerce (2011). *STEM: Good jobs now and for the future.* ESA Issue Brief #03-11. Washington, D.C.

- U.S. Department of Commerce (2011). *Women in STEM: A gender gap to innovation.* ESA Issue Brief #04-11. Washington, D.C.

Reflections

Questions?
Contact Information

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http://www.stemequitypipeline.org/StateTeams/OH.aspx

Thank you for your participation this afternoon!

National Alliance for Partnerships in Equity
www.stemequitypipeline.org
www.napequity.org