UNIVERSITY OF ILLINOIS

AT URBANA-CHAMPAIGN

# Exploring STEM Trends in Enrollment and Persistence for Underrepresented Populations

Higher Education Collaborative

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# Presentation Overview

- What is STEM?
- Reasons for Investigating STEM
- Historic Trends of STEM Participation
- Purpose of the Study
- Project Components
- Longitudinal Data
- Undergraduate Student Survey
- STEM Intervention Programs

# What is STEM?

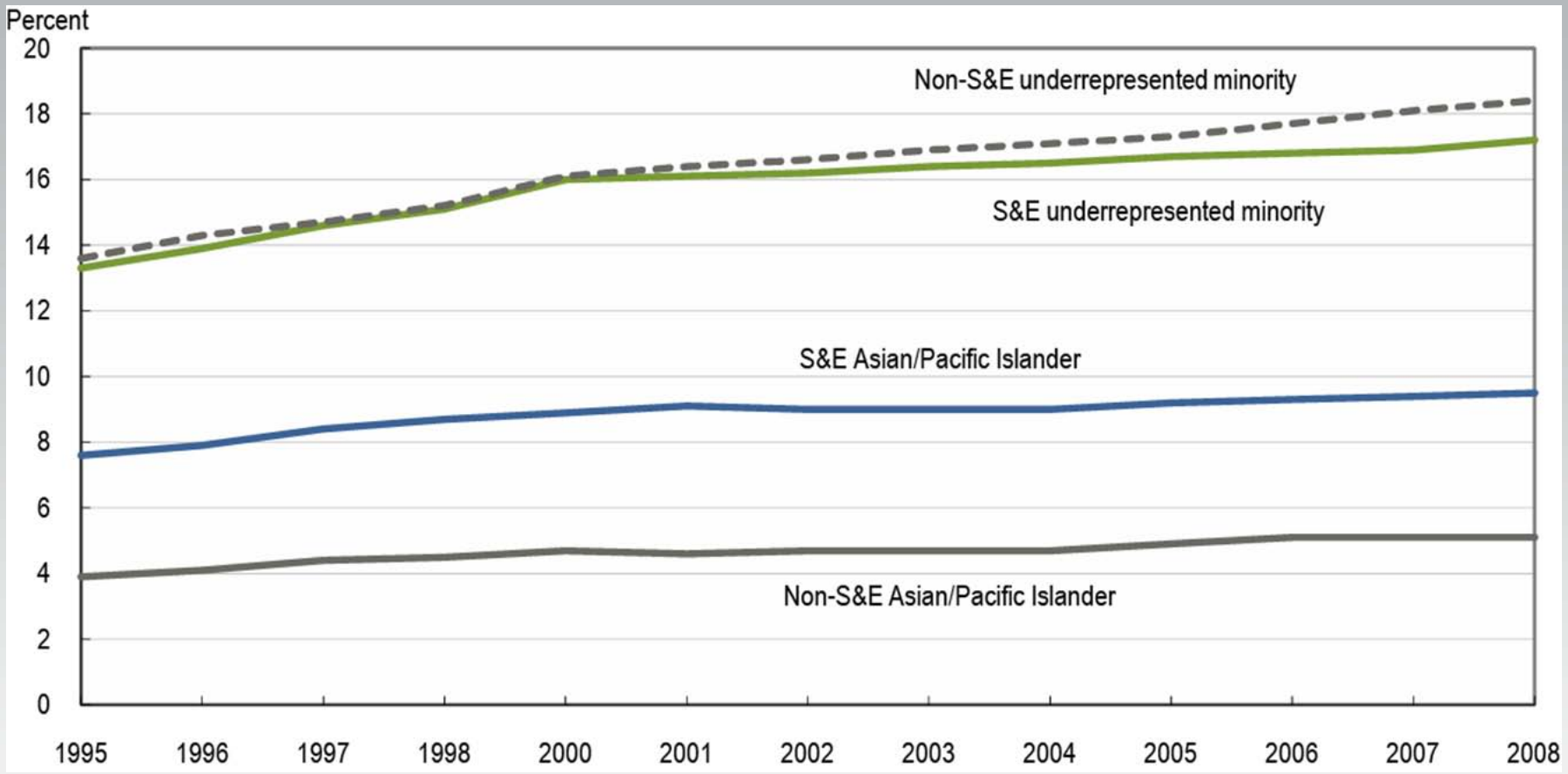
- Science, Technology, Engineering, and Mathematics (STEM)
- Disaggregating STEM
  - Physical Science, Computer Science, Mathematics, and Engineering (PSCSME)
  - Agricultural and Biological Sciences (ABS)
  - Health Sciences and Psychology (HSP)

# Reasons for Investigation

- Social justice – Reducing inequality and improving opportunities
- Workforce preparation and economic competitiveness
- Changing demographics
- Benefits of diversity
- Connection between social stratification, opportunities for social mobility, and higher education

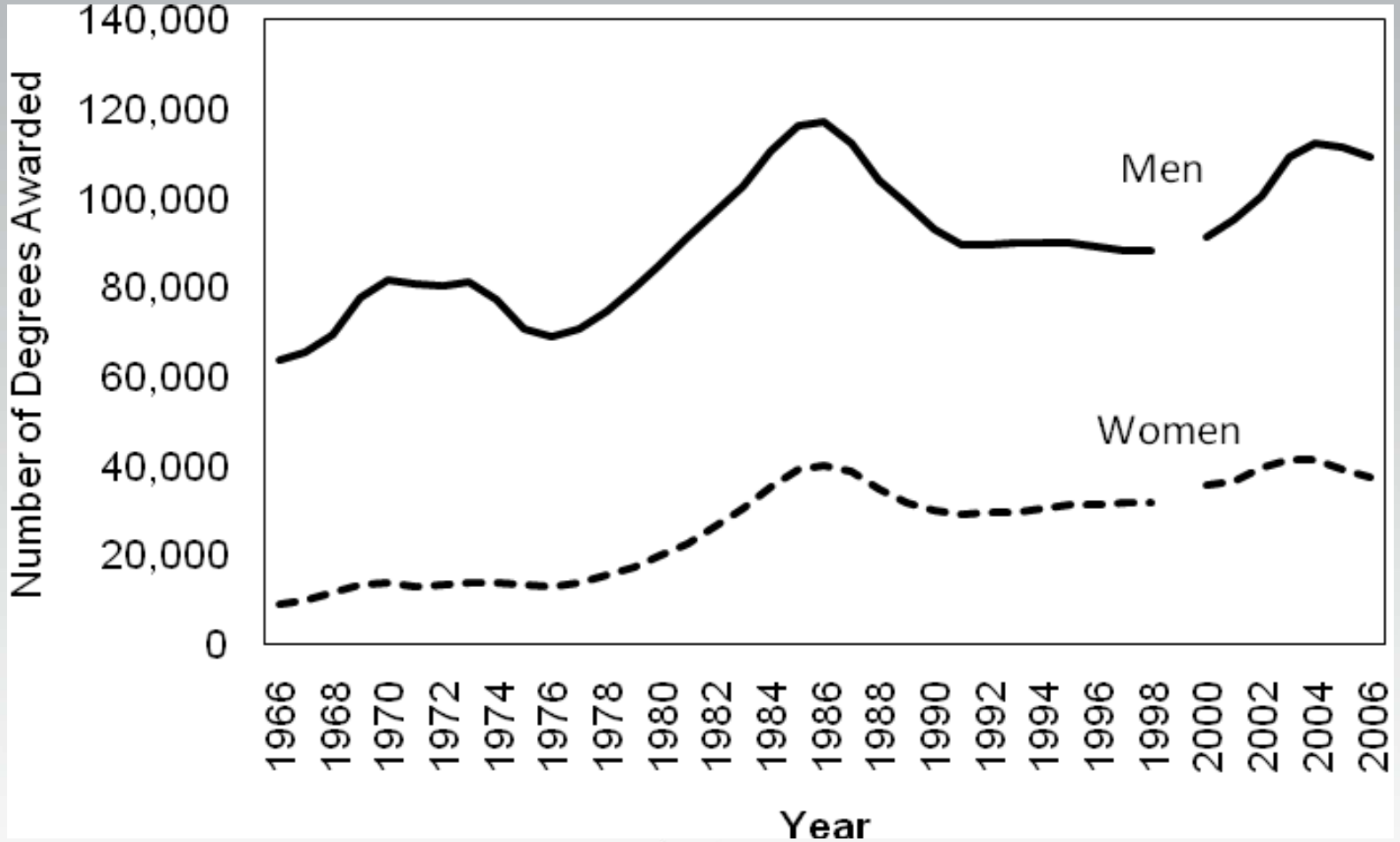
# Historic Trends of STEM Participation

# Figure 1. Minority Share of S&E and Non-S&E bachelor's degrees (1995—2008)




SOURCE: National Science Foundation, Division of Science Resources Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 1995–2008.

# Figure 2. Bachelor's degrees earned in Physical Science, Computer Science, Math and Engineering, by sex, 1966–2006




SOURCE: National Science Foundation (2008), *Science and Engineering Degrees: 1966–2006.*

# Purpose of the Study

- Examine entrance into, persistence in and attainment in the STEM fields at large, public, research universities
  - By gender
  - By race/ethnicity
  - By SES
- Examine movement in, out, and within STEM between students' enrollment and degree attainment

# Purpose of the Study (con't)

- Examine the design, implementation, and impact of STEM intervention programs on underrepresented undergraduate students
- Understand the reasons for and influences on students' choice of major and persistence in major, including participation in intervention programs
- Disaggregate STEM fields

# Project Components

- Longitudinal Student-Level Data (8 universities)
  - Transcript Data
- Online Survey of Current Undergraduate Students (10 universities)
- STEM Intervention Programs (10 universities)
  - Interviews with Program Directors & Administrators
  - Content Analysis of Intervention Program Documents

# Longitudinal Data

# Longitudinal Data

- Mellon Foundation's *Public University Database*
- Fall 1999—Spring 2005
- 8 Universities
- Variables
  - Social background information
  - Academic qualifications
  - Semester-by-semester major
  - Semester-by-semester GPA
  - Financial aid information (for FAFSA filers)
- Transcript Data for Select Institutions

# Topics of Investigation

- Initial choice of major
- Persistence in initial major
- Patterns of switching between majors
- Factors that impact persistence in initial major
- Comparisons between
  - Men and Women
  - Women by Race/Ethnicity

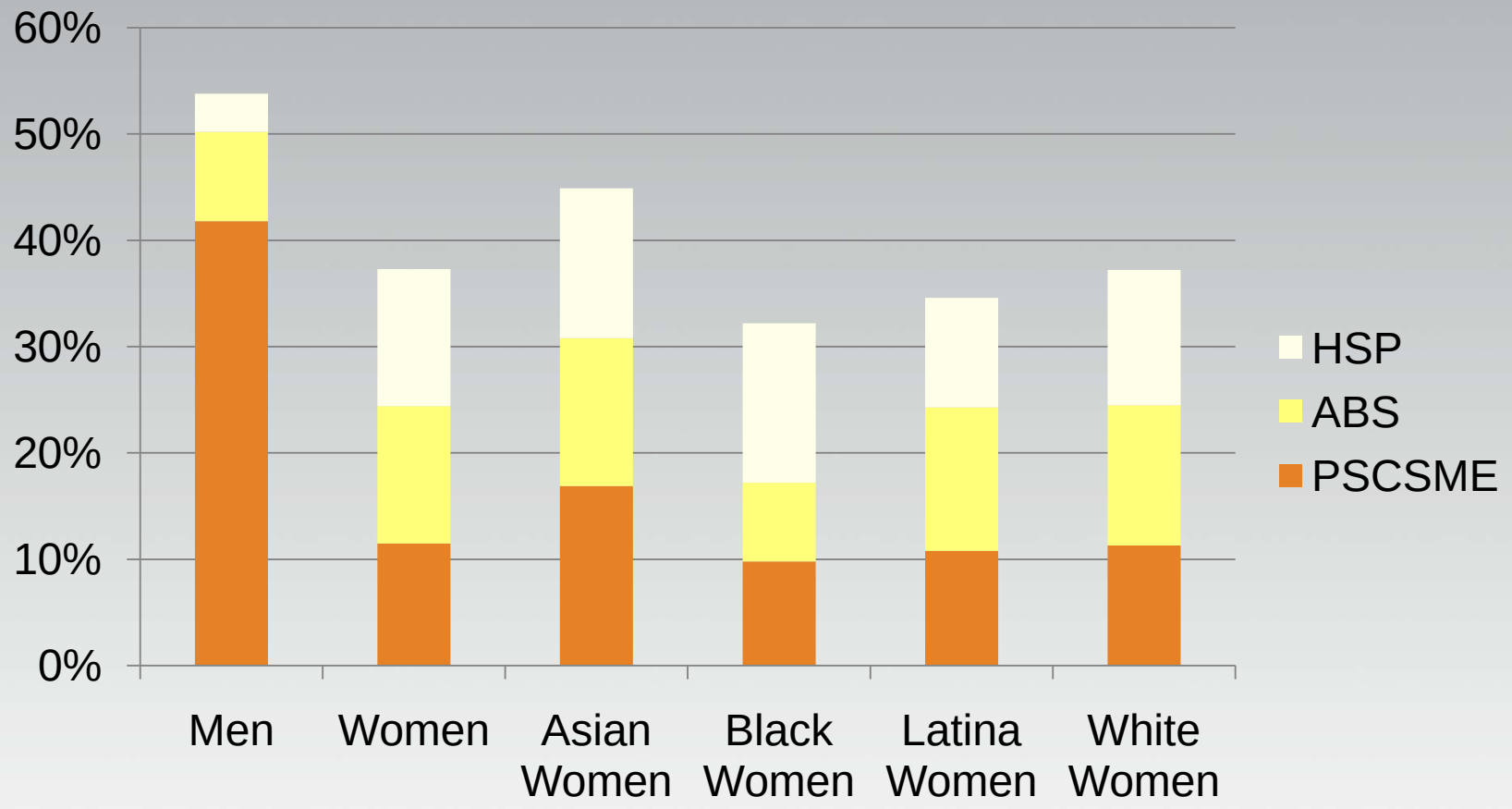
# Data & Methodology

- Data:
  - 5 land-grant universities
  - First-time, full-time, domestic freshman who began college in Fall 1999 and completed a bachelor's degree within 6 years
  - n=16,850
- Methods
  - Descriptive Statistics
  - Binary Logistic Regression

# Profile of Undergraduates

| | |
|---|---|
| Male | 50.8% |
| Female | 49.2% |
| Asian | 5.9% |
| Black | 4.1% |
| Latino/a | 2.4% |
| Native American, Other, Unknown | 1.5% |
| White | 86% |
| Out-of-State | 34.3% |
| In-State | 65.7% |
| Average SAT Math | 603 |
| Average SAT Verbal | 579 |
| Average SAT Total | 1181 |

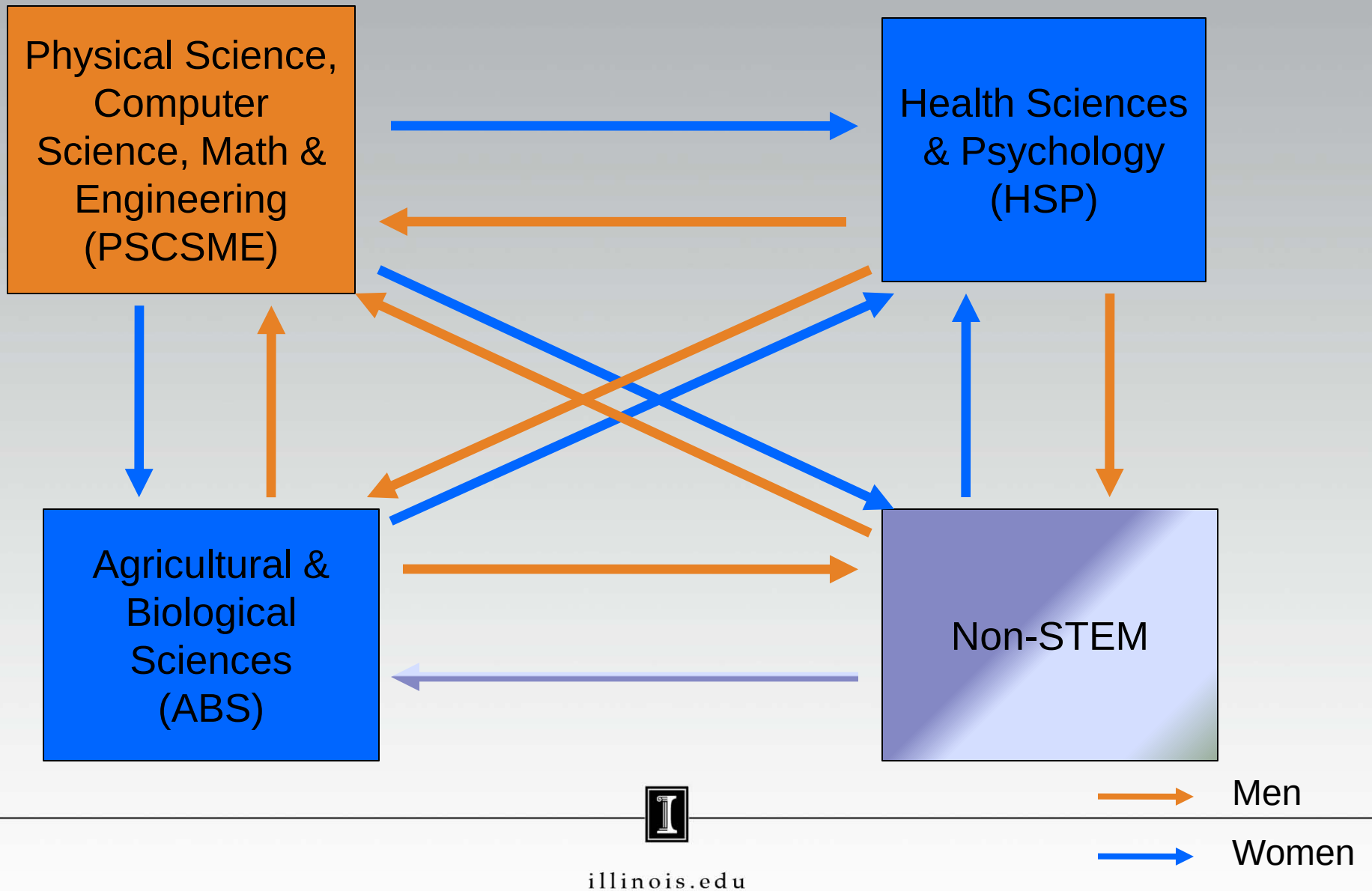
# Figure 3. Initial Major Choice, by field, sex, and race/ethnicity



# Persistence in Major

- PSCSME- Men out-persisted women
- ABS and HSP- Women out-persisted men
- Asian women persisted at higher rates in PSCSME
- Black women have lowest levels of persistence in PSCSME and ABS
- Latinas persisted at the same rate as white women in PSCSME and ABS, and a higher rates than Asian and Black women in ABS
- Regardless of persistence status and their last major category, women graduated faster than men

# Figure 4. Switching Majors, by sex and field



# Factors that Impact Persistence

- Being female had a negative impact on persisting in PSCSME but a positive impact on HSP
- Context matters, particularly for female students
- Being an in-state resident had a negative impact on persisting in PSCSME
- Lower levels of parental income had a negative impact on persisting in HSP and Non-STEM
- Within women, race and ethnicity were non-significant (FAFSA: Latinas had a positive impact on PSCSME)

# Limitations: Longitudinal Data

- Data
  - Secondary data
  - Limited generalizability
  - Selection bias
- Methodology
  - First and last major
  - Movement within major fields

# Main Findings

- Importance of disaggregating STEM
- Importance of examining where students “go”
  - A departure from some STEM fields is not necessarily a departure from science
- Understanding the complexity of STEM participation

# Undergraduate Student Survey

# Undergraduate Student Survey

- 10 Universities
- Survey current undergraduate students
- Examine factors that influence choice of major and persistence in major, including:
  - Participation in intervention programs
  - Pre-College experiences
  - College experiences
  - Financial Aid
  - Influence of peers, family members, teachers, and counselors

# Topics of Interest

- Science Identity
  - Do science identities differ by gender? If so, how do they differ?
  - Do students' perceived self-efficacy in math and science differ by gender?
- Campus Climate
  - To what extent do undergraduate students experience campus climate differently?
    - By Gender
    - By Race/Ethnicity

# Science Identity

- One campus (n = 448)
- 47% male, 51.6% female
- Science Identity Constructs
  - I identify as a scientist
  - My faculty recognize me as a scientist
  - My peers recognize me as a scientist
  - Seeing other people who look like me within my field reinforces my scientist identity

# Science Identity Results

- A greater percentage of women identify as scientists
- A greater percentage of females agree or strongly agree that faculty recognize them as scientists
- Females report having to work harder than males in order to be recognized as a scientist by others due to their gender

# Science Identity Results (con't)

- 60% of women and 73% of men reported feeling very confident in their math and science skills
- Women who reported no or little confidence in math and science skills felt the need to have a female role model to reinforce their science identity.

# Climate Study

- Two campuses (n=892)
- 38.7% male, 42.5% female
- 55% white, 10% Asian or Pacific Islander, 3.7% Black, 5.2% Latino, 0.5% Native American or Alaskan Native
- Current majors:
  - 25.9% Engineering
  - 20.5% Biological and Biomedical Sciences
  - 16.4% Health Professions and Related Clinical Sciences
  - 8.5% Physical Sciences
  - 3.4% Computer and Information Sciences
  - 2.8% Mathematics/Statistics
  - 0.6% Natural Resources and Conservation

# Climate Study Constructs

- My major field department is my intellectual home
- The faculty in my department make me feel welcome
- The students in my department make me feel welcome
- I have a sense of belonging in my major
- The faculty in my department want me to succeed.

# Climate Study Findings

- Female and males both reported feeling that their department served as their intellectual home
- Female students were less likely to perceive departmental faculty as welcoming as compared to male students
- Latino/a students were less likely to identify their department as their intellectual home
- Latino/a students were less likely to perceive their department faculty and peers as welcoming in comparison to white and Black students.

# Limitations: Survey Data

- Data collection is on-going
  - Responses have varied by university
- Representation of STEM fields varies
- Low number of responses by students of color
- Length of survey

# STEM Intervention Programs

# STEM Intervention Programs

- 10 Universities
- Interviews with directors and administrators
- Examined design, implementation, impact on students, and benefits of programs
- Gathered existing data, reports, and evaluations from participating programs

# Guiding Questions

- What theories or perspectives guide the design of STEM intervention programs?
- How are STEM intervention programs
  - Structured?
  - Staffed?
  - Funded?
- What are the common challenges that STEM intervention programs face?

# Profile of Participants

- Data
  - Interview data has been gathered from 9 large, public, research universities.
  - 47 participants
  - 11 male, 36 female
  - 27  white, 19 African American, 4 Hispanic, 1 Native American, and 1 Asian American
  - A total of 97 documents and reports were gathered from the STEM intervention programs.
- Methods
  - Qualitative Methods
  - Semi- structured interviews with program administrators
  - Content Analysis*

# Common Trends Among Intervention Programs

- Evolution of Programs
  - Change of Mission
  - Selection of Participants
  - Student Qualifications
- Collaborative Efforts
- Financial Support and the Impact on Delivery of Services
  - National & State Budget Deficits
  - Sources of Funding
- Assessment Efforts in Measuring Outcomes
- Staff/ Program Expertise

# Recommendations

- Pursue stable, recurring funding
- Purposeful staffing
- Investigate opportunities for collaboration inside & outside home institution to assist with
  - Service delivery
  - Program design
  - Program assessment
  - Funding

# Limitations: Interview Data

- Nine large, four-year, research-intensive, and predominantly white universities
- Response rate based on self-selection
- Recruitment to participate based on publicly available information of STEM intervention programs on each institutions' website
- Programs are housed in certain STEM fields
- No contemporaneous statements from students participating in programs

# Future Research & Next Steps

- Incorporate transcript-level data
- Additional analyses of Mellon data
  - Merge *Common Core Data* on high schools
- Complete survey data collection and expand analysis
- Content Analysis of STEM intervention programs' documents
- CIC-wide graduate-level course on Access to and Success in STEM (Spring 2012)

# Questions & Discussion

*Contact Information*

Project STEP-UP

217-244-5274

stem@education.illinois.edu

http://stepup.education.illinois.edu/

http://twitter.com/ProjectStepUP

Facebook: step-up project

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# Project Staff

- William Trent (Principal Investigator)
- Lorenzo Baber (Co-Principal Investigator)
- Casey E. George-Jackson (Project Director)
- Chanee Anderson (Research Assistant)
- Shywon Berry (Research Assistant)
- Diane Fuselier-Thompson (Research Assistant)
- Blanca Rincon (Research Assistant)
- Kimberly S. Walker (Research Assistant)
- Montrischa Williams (Research Assistant