Underrepresented Undergraduates in STEM at Large Research Universities: From Matriculation to Degree Completion

William T. Trent (PI) and Lorenzo D. Baber (Co-PI) College of Education, University of Illinois at Urbana-Champaign

Project Summary

This three-year study examines the matriculation, persistence, and degree attainment of full-time, first-time women, students of color, and low-income undergraduate students in the STEM fields at a consortium of large, public, research universities.

Quantitative and qualitative methods are used to comprehensively examine individual, institutional, and cross-cutting factors and programs that impact the (under)representation of these students in STEM fields at universities that are significant producers of the nation's STEM degrees. Longitudinal data on students who began college in 1999 at eight universities allows for examination of their selection into a STEM field, movement in and out of STEM majors and postsecondary outcomes. New qualitative data gathered from administrators and directors of STEM intervention programs at ten universities will focus on the design and delivery of such programs. Finally, students currently enrolled at the ten universities are being surveyed to assess what factors influence their choice of major and the impact of program intervention participation.

Collectively these data will allow the researchers to identify factors that influence students to opt in, are filtered out, and persist in STEM majors at large, public, research universities.

Project Goals

- Examine entrance, persistence and attainment of the following groups into STEM fields at large, public, research universities
  - Females
  - Non-Asian minorities
  - Non-Asian females
  - Low-income students

- Examine movement in, out, and within STEM between students' enrollment and degree attainment

- Disaggregate STEM

- 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

Data and Methodology

The project uses mixed methods to analyze the following quantitative and qualitative data:

Longitudinal Data (8 universities)
- Data originally gathered by the Mellon Foundation
- Follows students who began college in Fall 1999 for up to six academic years
- Social background, academic qualifications, semester-by-semester major and GPA, and financial aid information

STEM Program Intervention Data (10 universities)
- Interview directors and administrators
- Examine design, implementation, impact on students, and benefits of programs
- Gather existing data, reports, and evaluations from participating programs

Undergraduate Student Survey Data (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

The study compares the following types of majors:
- Math & Engineering
- Agricultural & Biological Sciences
- Health Sciences & Psychology
- Non-STEM

Movement into, out of, and between STEM majors is examined. For example, for African American females:
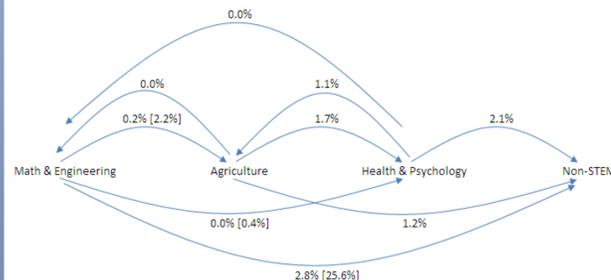
Note. Percentages in brackets are for those who began in Math & Engineering

Quantitative methods include:
- Descriptive statistics
- Nested logistic regression
- Binary logistic regression
- Discrete-time logistic regression
- Discrete-time multivariate regression

Preliminary Results

The results of this study thus far focus on the analysis of the 1999 cohort data. Findings include high levels of participation and persistence by women and non-Asian minorities when a broad definition of STEM, which includes Biological, Agricultural and Health Sciences, is used. There is also considerable movement within STEM fields even though students may not have persisted in Math & Engineering.

Initial Choice of Major
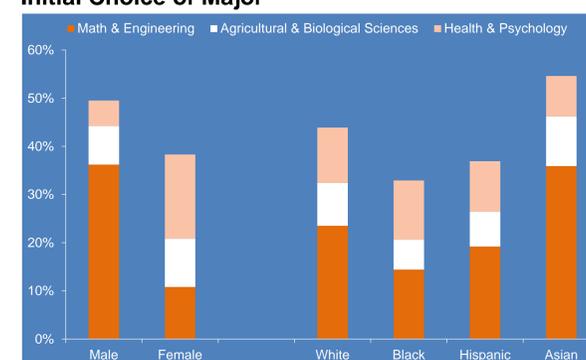
n=16,225; data from 3 universities

Persistence in Major

- Switching out of STEM can lead to better outcomes than staying put
- Although females were less likely to persist in Math & Engineering, they were more likely than males to switch into other science-based majors
- Females who persisted in Math & Engineering graduated faster than males who persisted
- Hispanics in Agricultural & Biological Sciences and African Americans in Health Sciences & Psychology who persisted in their initial major graduated at similar rates as their white counterparts in these fields
- Being female or an in-state student had a negative impact on persisting in Math & Engineering
- Being female had a positive impact on persisting in Health Sciences & Psychology
- Of students who filed FAFSA, being Hispanic had a positive impact on persisting in Math & Engineering
- Being female, receiving a Pell Grant, and initially declaring to major in Agricultural & Biological Sciences had a positive impact on degree attainment

Challenges and Opportunities

Challenge I
- Determining what undergraduate majors to include in "STEM"
- Balancing a broad definition of STEM with varying requirements of math and science courses of undergraduate majors

Opportunities
- Create a grid of required coursework by type of major at each institution included in study; examine common course requirements (e.g., units of math, number of lab sessions)
- Conduct meta-analysis of higher education literature to determine how others define STEM; critically examine what fields are most commonly included/excluded and on what basis

Challenge II
- Low number of underrepresented students in STEM fields to invite to participate in student survey

Opportunities
- Attempt to oversample underrepresented groups by distributing invitations to participate through 1) program interventions, 2) student services offices, 3) campus chapters of national organizations (e.g., NSBE)

Challenge III
- Limited background information in 1999 cohort data on students' academic qualifications

Opportunities
- Use U.S. Department of Education's *Common Core Data* and *Office of Civil Rights* datasets to augment 1999 data by merging information on students' high schools; examine opportunities for preparing to enter and succeed in a STEM major in college

ILLINOIS