UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

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

Project STEP-UP

STEM Trends in Enrollment and Persistence for Underrepresented Populations

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. The study draws on:

- Archived, longitudinal data of students who began college in 1999
- Survey data of current undergraduate students
- Interview data with directors and administrators of STEM intervention programs

The original study focused on undergraduate students at a set of ten universities. Project STEP-UP received a supplemental grant in 2011, allowing for six additional universities to be included in the study. The new universities are more racially and ethnically diverse, and feature new educational contexts to be examined.

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
  - Underrepresented Students of Color
  - Low-income students
- Examine individual, institutional, and contextual factors that impact STEM participation and outcomes
- Examine movement in, out, and within STEM between students' enrollment and degree attainment
- Disaggregate STEM Fields
- 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
- Examine how contextual factors, such as legal parameters, can impact STEM education outcomes and efforts to improve racial and ethnic diversity in STEM

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Undergraduate Student Survey

Year 1: 1,881 respondents; Year 3: 3,364 respondents (2,680 new and 684 returning)

- Student identities in relation to STEM continue to be important
  - Science identity is a process of development (I *am not a scientist yet, but am working towards that position; a soon to be scientist*)
  - Dual identities (*A woman in Engineering; Engineer and scientist*)
  - Incorporating science into other identities (*A math person who enjoys science as well; I am engineer, which enables me to apply scientific principles to a much more diverse set of challenges and problems*)
- Parents as Engineers
  - 25.4% of engineering majors have a least one parent who is an engineer (vs. 15.7% of non-engineering majors)
  - 30% of engineering majors reported parents as the biggest influence in choice of major (vs. 17.4% of non-engineering majors)
  - 48.7% of engineering majors who have at least 1 parent in engineering reported parents as the biggest influence in choice of major (vs. 15.2% of non-engineering majors)
- Influences of College Major Choice- Generation Me (Figure 1)
  - Students cite themselves as the most influential person who influenced their choice of major
  - Differences by gender, race/ethnicity, and type of major were found (men, Blacks, Latinos, and Agricultural, Biological, Health Sciences, and Psychology majors most cited "*myself*")
- Academic and Social Engagement differs
  - Women in STEM are more academically engaged than men in STEM
  - Women in STEM report having to work harder than they thought they could to meet professor's expectations
  - Latinos in STEM discuss ideas and readings with other students outside of class at a higher rate than Blacks or whites.
  - Underrepresented minority students in STEM are less likely to participate in Cultural Group Events as compared to those in Non-STEM
- Families of Latino/a students provide instrumental support in their decision to attend college, as well as provide encouragement to persist and high expectations to do well.


Figure 1.
Parental and Self Influence on Choice of College Major
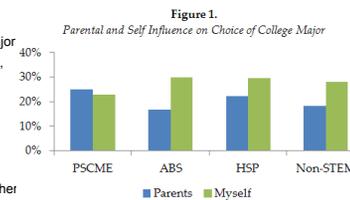
STEM Intervention Programs

Year 1: 55 participants; Year 3: 51 participants (20 new and 31 returning)

- How we talk about students matters:
  - Administrators should examine the language used in describing program participants, working to avoid deficit-oriented language
- Social capital can be fostered
  - Institutional Agents must continually work to develop their social capital in order to create opportunities for students in their programs
  - Students have opportunities to build social capital when they are exposed to new networks in STEM intervention programs
- The physical location, program visibility, and organization of program impact service delivery
- Faculty can be involved through efforts to secure funding, writing curriculum, and mentoring students
- Interest convergence is apparent through:
  - An emphasis on quantitative outcomes
  - Articulation of institutional benefits to garner program support
  - Minimizing institutional costs while maximizing benefits
- Program sustainability can be increased with the use of evaluation (Figure 2)
  - Evaluations help demonstrate the worth and value of the program
  - The program gains legitimacy in the eyes of stakeholders
  - Evaluation results can help secure recurring funding and other resources for the program
- Administrators are increasingly asked to "do more with less" – financial and other resources are scarce

Figure 2.
Legitimacy Framework: Use of Evaluation Results
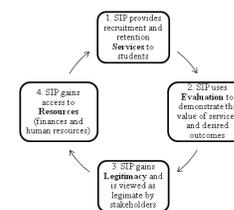
Longitudinal Data of Undergraduates

(n=42,370)

- Tuition differentials in STEM fields may impact low-income students' entrance and persistence in the STEM fields
  - Low-income students majoring in Engineering had highest calculated student need and highest total financial aid awarded
  - Amount and variety of financial aid initially offsets higher cost of Engineering, but the affordability fluctuates over time
  - Receiving a Pell Grant increases odds of completing a degree in Engineering, with a tuition differential
  - Initial access and enrollment in higher-cost STEM fields may still be an issue and represents an opportunity for financial aid counseling to students and families

Challenges and Opportunities

Challenge

STEM Intervention Program personnel have difficulty talking explicitly about racial and ethnic diversity in their program design and delivery. Legal parameters, such as restrictions on affirmative action, shape the way in which administrators talk about and address issues of diversity.

Opportunity

The six universities added under the supplemental grant offers data on more diverse student populations, as well applicant data, which is not available for the ten universities in the original study. The applicant data will allow for the exploration of "overmatching "or "mismatching" in the STEM fields. In addition, the contexts of the new universities will allow for additional insight on the many factors that impact STEM entrance and success.

Next Steps

- Continue data collection efforts at six new universities
- Analyze survey data gathered in Fall 2011 (new respondents and follow-up participants), including the examination of:
  - Changes over time for follow-up participants
  - Comparisons between first and second cohorts of respondents
  - Persistence in STEM for degree completers
- Analyze interview data gathered in Fall 2011 (new and returning participants)
- Examine and compare contextual factors on STEM participation and intervention programs

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