Replenishing STEM Pipelines: Factors that Contribute to Undecided Students’ Completion of STEM Bachelor’s Degrees

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Purpose

Increasing the number of individuals formally trained in STEM is a national priority (PCAST, 2012), given the critical role these individuals play in scientific and technological innovation and contributing to the competitiveness of the U.S. economy (National Academy of Sciences, 2011). One method campuses could employ to reach this goal is through replenishing and expanding the pool of STEM talent by attracting students who enter college undecided about their major into the STEM pipeline.

Little research has examined the factors that contribute to undecided students’ decision to pursue and complete STEM degrees. Further, institutional characteristics, such as institutional type, selectivity, minority-serving mission, shared responsibility for student success, and cooperative student peer culture, have been demonstrated to contribute to STEM degree completion (Bowen, Chingos & McPherson, 2009; Hubbard & Stage, 2010, Museus, 2011; Perna, Gasman, Gary, Lundy-Wagner, & Drezen, 2010). However, these environmental influences have only been tested for STEM aspirants.

The purpose of this study is to identify the entering characteristics and environmental factors that contribute to STEM bachelor’s degree completion among students who enter college undecided about their major.

Method and Sample

Data Sources:
- 2004 CIRP Freshman Survey
- National Student Clearinghouse
- 2011 HERI STEM Best Practices Survey
- 2007, 2011 HERI Faculty Survey
- IPEDS

Sample:
14,259 students, 294 institutions

Analyses:
Multinomial Hierarchical Generalized Linear Modeling

Dependent Variable:
Six-year STEM completion status
- STEM degree, non-STEM degree, no degree

Sample Demographics

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native American</td>
<td>2%</td>
</tr>
<tr>
<td>Black</td>
<td>4%</td>
</tr>
<tr>
<td>Latina/o</td>
<td>6%</td>
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<tr>
<td>Asian American/Pacific Islander</td>
<td>9%</td>
</tr>
<tr>
<td>White</td>
<td>79%</td>
</tr>
<tr>
<td>Other race</td>
<td>2%</td>
</tr>
</tbody>
</table>

Sex:
- Female: 64%
- Male: 36%

Background:
- Background: 10%
- Completed STEM degree: 32%
- Completed non-STEM degree: 58%

Factors that affect STEM completion relative to no completion (delta-p’s)

Institutional characteristics
- Percentage of students in STEM (10)*
- Selectivity (average SAT, scaled by 100)**
- Institution provides targeted financial aid to STEM students* -3.51%
- Institution offers undergraduates research opportunities*

Background characteristics
- Asian American***
- Either parent employed in STEM***
- Pre-college academic preparation
- Average HS GPA***
- SAT score or ACT equivalent (scaled by 100)***
- Years of study in HS: Math***
- Years of study in HS: Biology***

Pre-college experiences
- Hrs per wk in HS: studying or homework**
- Felt overwhelmed by all I had to do**

Aspirations and expectations
- Academic self-concept (10)***
- Plan to live on campus**
- Degree aspiration: medical, dental, veterinary doctor***

Factors that affect STEM completion relative to non-STEM completion (delta-p’s)

Institutional characteristics
- Pre-meds as % of STEM students*
- Undergraduate FTE (ln)***
- Institution offers undergraduates research opportunities*
- Expenditures per FTE student [$100]*

Background characteristics
- Asian American***
- Sex: female*
- Either parent employed in STEM**
- Pre-college academic preparation
- Average HS GPA***
- SAT score or ACT equivalent (scaled by 100)***
- Years of study in HS: Math***
- Years of study in HS: Biology***

Pre-college experiences
- Felt overwhelmed by all I had to do***

Aspirations and expectations
- Academic self-concept (10)***
- Degree aspiration: doctorate***
- Degree aspiration: law***

Conclusions & Significance

- Few studies examine factors that lead to undecided students choosing and completing a STEM degree
- Context matters:
  - Peer normative context affects likelihood of undecided students graduating in STEM
  - Institutional investments in STEM scholarships also make a difference
- However, simply providing undergraduate research opportunities does not appear to encourage undecided students to consider STEM
- Academic preparation influences STEM completion for undecided students the most, especially average high school GPA
- Having a parent employed in STEM also influences undecided students’ choice of major
- Undecided students with higher degree aspirations and higher academic self-concept are more likely to complete a STEM degree

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