CAN THE M.S. DEGREE INCREASE STEM PH.D. COMPLETION RATES AND INCREASE DIVERSITY?

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PART I

THE MASTER’S DEGREE
AND
PhD COMPLETION RATES IN STEM
## Canada (Queen’s University) and US Completion Rates

<table>
<thead>
<tr>
<th>BROAD DISCIPLINE</th>
<th>U.S. 10-YEAR COMPLETION RATE</th>
<th>CANADA 7-YEAR COMPLETION RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>63.6</td>
<td>82.2</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>62.9</td>
<td>77.1</td>
</tr>
<tr>
<td>Mathematics &amp; Physical Sciences</td>
<td>54.7</td>
<td>80.0</td>
</tr>
<tr>
<td><strong>Total SEM Fields</strong></td>
<td><strong>59.1</strong></td>
<td><strong>80.3</strong></td>
</tr>
</tbody>
</table>
Purdue University 10-Year Completion Rates

<table>
<thead>
<tr>
<th>BROAD DISCIPLINE</th>
<th>ENTERING WITH B.Sc.</th>
<th>ENTERING WITH M.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>48%</td>
<td>82%</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>51%</td>
<td>80%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>30%</td>
<td>65%</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>57%</td>
<td>80%</td>
</tr>
</tbody>
</table>
THREE REASONS FOR HIGH PhD ATTRITION AND THE ROLE OF THE MASTER’S

1. Decision to Pursue Graduate Education. Inadequate information at the time a student makes the decision regarding enrollment in a PhD program can result in higher early attrition rates.

M.S. degree increases the likelihood that students have exposure to the expectations and the demands of the programs.
2. Program Selection

“Nearly half (49.1%) of respondents report that they would or might select a different university. Additionally, 36.8% and 41.8% answered “yes” or “maybe” to whether they might select a different advisor or dissertation topic, respectively.”  

_Pew Survey_

Master’s education increase the probability of making the right choices, thus reducing the probability of attrition once enrolled in a doctoral program.
3. Graduate Degrees Appropriate for Career Goals

“Fully one quarter of graduate students have doubts as to whether a doctoral program is the right choice.”

The Pew Survey

Master’s program provides an opportunity to decide whether career goals are best served by earning the doctorate or by obtaining an M.S.
Adopting a system similar to that of Canadian universities where all entering graduate students are first admitted to Master’s programs and then admitted to the PhD programs after completion of the MS degree will result in significantly higher PhD completion rates.
PART II
FINANCING GRADUATE EDUCATION AND
THE SUPPLY OF MINORITIES IN STEM PhD EDUCATION
## Pathways of Doctoral Recipients in STEM Fields

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black</th>
<th>Native American</th>
<th>Asian/Pacific Islanders</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master’s</td>
<td>61</td>
<td>77.2</td>
<td>73.2</td>
<td>61.7</td>
<td>73.9</td>
</tr>
<tr>
<td>No Master’s</td>
<td>38</td>
<td>21.5</td>
<td>26.8</td>
<td>38.3</td>
<td>26.1</td>
</tr>
<tr>
<td>Change Institution</td>
<td>25.3</td>
<td>39.0</td>
<td>32.6</td>
<td>23.1</td>
<td>29.3</td>
</tr>
</tbody>
</table>

PERCENTAGE OF STUDENTS RECEIVING AID 2007-08

Source: Data from National Center for Educational Statistics: http://nces.ed.gov/programs/digest/d09/tables/dt09_349.asp
Total Cost = Tuition + Books + Materials + Living Costs  
Net Cost = Total Cost – [Grants + Assistantships]

“Both low income and non-white borrowers are more likely than others to feel burdened by their education debt payments. ... Borrowers with lower incomes, who are African American or Hispanic, and older borrowers tend to feel more burdened at given debt levels.”
• Underrepresented minorities are more likely to obtain an M.S. prior to pursuing the PhD.

• Master students are disadvantaged in financing their education through fellowships/assistantships and are more dependent on loans.

• Low-income, African-American and Hispanic students feel more burdened by any given loan level than other students.

• The prospect of financing an M.S. by loans may discourage students from underrepresented populations from going to graduate school.
1. Adopt a policy similar to that of Canada requiring completion of an M.S. prior to admission to a PhD program. This will increase the PhD completion rates.

“Promotion” to the PhD program after the first year are made for highly promising students.
2. Universities and federal agencies need to restructure their support programs. Support would be initially for 2 or 3 years for students entering with a B.S. degree. Support for 3 additional years would be contingent on completion of an M.S. and admission to the PhD program.
Effects of Restructuring Financial Support

1. This re-structuring provides a level field for students from underrepresented populations who are more likely to pursue the M.S. prior to the PhD in the competition for support: all applicants for admission to PhD programs will have the same opportunities for support.
2. As financial support is opened for M.S. students, students from underrepresented populations will not need to depend on loans more extensively. This can result in significant increase of willingness of African Americans and Hispanics, to pursue the PhD in STEM fields.