Advances in Models Supporting Graduate Students and Excellence in Graduate Education

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Advancing Education and U.S. Competitiveness: Dynamic Context

- Structure of U.S. economy
- Speed of technological innovation
- Challenging societal problems
- Nature and practice of science
National Context: What are the Drivers for Transforming Graduate Education?

- Approximately 60,000 doctorates are awarded by US academic institutions per year\(^1\)
- More than 50% of doctorate holders work in fields outside of academia\(^2\)
- Between 2010 and 2020, 2.6 million jobs are expected to require an advanced degree\(^3\)

\(^1\)Graduate Enrollment and Degrees: 2001-2011, Council of Graduate Schools, 2012.
Developing Transferable Knowledge & Skills for the 21st Century

Three Competency Clusters:

- *Cognitive Domain*: cognitive processes, knowledge, creativity
- *Intrapersonal Domain*: intellectual openness, work ethic, self-evaluation
- *Interpersonal Domain*: teamwork, collaboration, leadership

Grand Challenge - STEM Workforce

Cohesive national strategy to assure a competitive 21st century STEM workforce:

- Define overarching themes for investments
- Broaden and deepen participation of underrepresented groups
- Address attrition rates
- More effectively deploy resources to transform STEM education and advance workforce development
Figure 2. Doctoral completion rate, by field and number of years.

Questions Driving NSF Priorities in STEM Education

• As the nature and practice of science evolve, reflecting new technologies, societal challenges, and growing interdisciplinarity, how can the education of tomorrow’s scientists be advanced?
• How could research scientists be better prepared for the full range of STEM career pathways?
• How can the full diversity of the U.S. population be represented in the STEM workforce?

What transformations of STEM graduate education are needed?
<table>
<thead>
<tr>
<th>Goals</th>
<th>Research Assistants</th>
<th>Traineeship</th>
<th>Fellowship</th>
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<tbody>
<tr>
<td>Conduct NSF Funded Research</td>
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<td>Develop STEM Workforce</td>
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<td>Broaden Participation in STEM Fields</td>
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<td>Develop Researchers in Priority Areas</td>
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<td>Foster Research/Innovation in Graduate Education</td>
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<td>Percentages of Students Funded (~40,000 Total)</td>
<td>~80%</td>
<td>6–8%</td>
<td>10–15%</td>
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<td>NSF Program</td>
<td>Examples of Projects</td>
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<td>CyberCorps: Scholarships for Service (SFS)</td>
<td>IGERT: Smart Grids - Technology, Human Behavior and Policy (#1144388)</td>
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<td>Robert Noyce Teacher Scholarship Program</td>
<td>Educating STEM Teachers with Integrated Graduate Enrollment at Augusta State University (#1035381)</td>
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<td>Alliances for Graduate Education &amp; the Professoriate (AGEP)</td>
<td>TX BRIDGE (Texans Building Robust, Innovative &amp; Diverse Graduate Education) (#1111129)</td>
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<td>Louis Stokes Alliances for Minority Participation (LSAMP)</td>
<td>Broadening Resources for Increasing Diversity in Graduate Education at LSU (#1141152)</td>
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<td>Research &amp; Evaluation on Education in S&amp;E (REESE)</td>
<td>Graduate Education's Role in Preparing Engineering Students for Careers in Academia and Industry (#0747803)</td>
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<td>Science Master's Program (SMP)</td>
<td>A Scalable, Replicable Model Addressing Current and Emerging Workforce Needs (#1011440)</td>
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<td>Organization/Report</td>
<td>Recommendations</td>
<td>Federal Support</td>
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| Council of Graduate Schools (CGS): "Pathways into Careers" report (April 2012) | - Foster professional development and track career outcomes  
- Enhance industry collaborations | - Establish “Professional Plus” program for RAs and a “COMPETES” graduate traineeship program |
| National Research Council (NRC): "Research Universities" report (June 2012) | - Strengthen career preparation and STEM pathways for minorities  
- Deepen employer-university engagement | - Expand federally financed S&E graduate fellowships and traineeships by 5,000 per year for 5 years |
| National Institutes of Health (NIH): "Biomedical Workforce" report (June 2012) | - Provide supplemental training and career development programs  
- Involve employers in design of training paths | - Increase proportion of graduate students supported by training grants and fellowships |
Looking to the future: How can NSF investments support and catalyze the transformation of graduate education?

Considerations:

- the NSF portfolio in light of national context and recommendations
- principles for future NSF investment emphases
- engagement with stakeholders: CGS graduate deans, and disciplinary deans, professional societies, graduate students
- research agendas around graduate education
Discussion Questions (For Panel and Audience)

- How could NSF’s portfolio of investments in graduate education be stronger and more systemic?

- What kinds of outcomes should be the goals of NSF’s investment in graduate education?

- What would incentivize faculty to become more engaged in transforming graduate education in their respective areas?

- What new partnerships are needed?

- What would it take for U.S. S&E graduate education to fully engage the diversity of the nation?