Advances in Models Supporting Graduate Students and Excellence in Graduate Education

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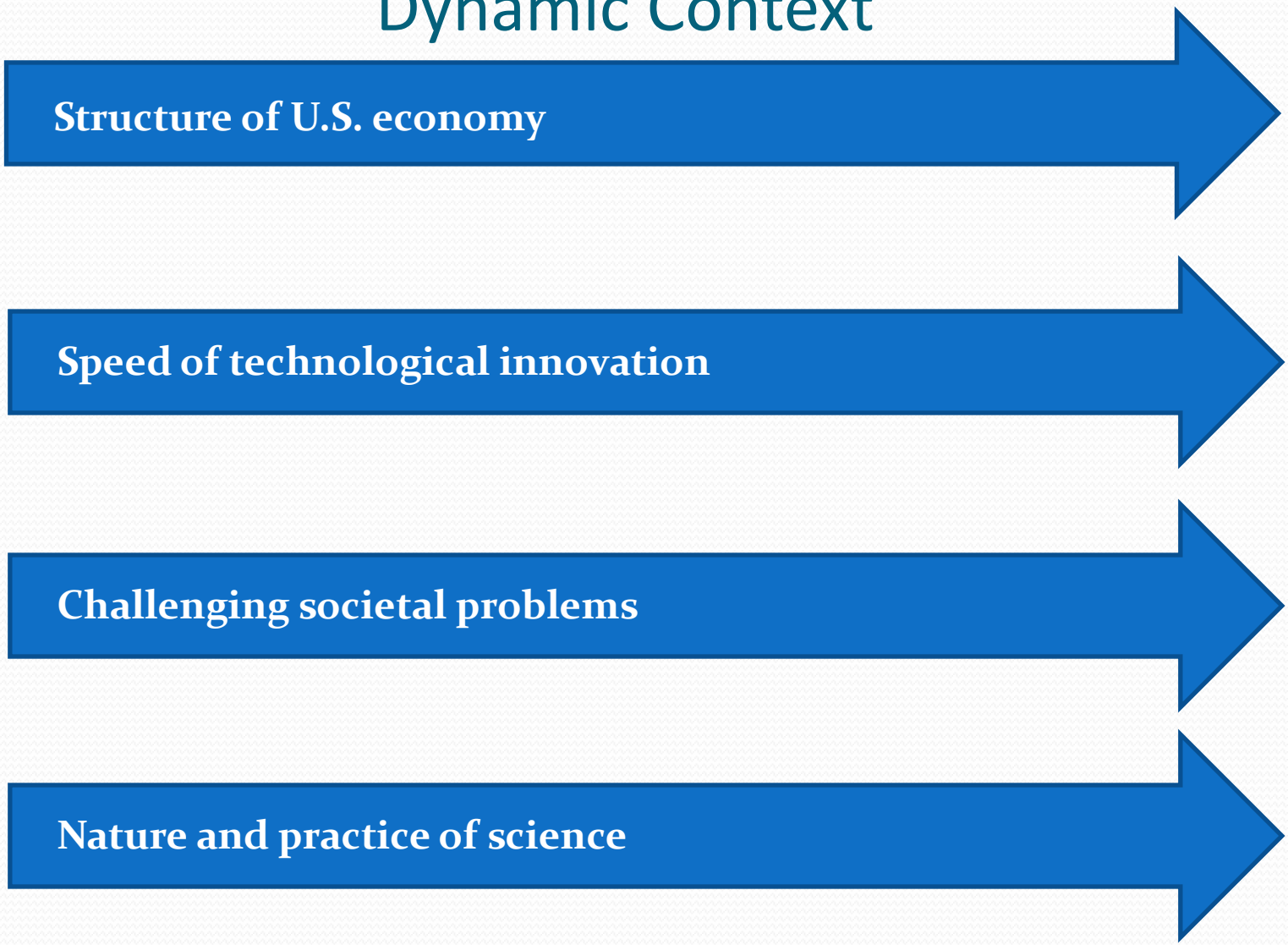
Advancing Education and U.S. Competiveness: Dynamic Context



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.

[2]*Survey of Doctorate Recipients*, NSF/National Center for Science and Engineering Statistics, 2008.

[3]*Employment Projections: 2010-2020*, Bureau of Labor Statistics, 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

Source: "Education for Life and Work", J.W. Pellegrino and M.L. Hilton, eds., Committee on Defining Deeper Learning and 21st Century Skills, NRC, 2012

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

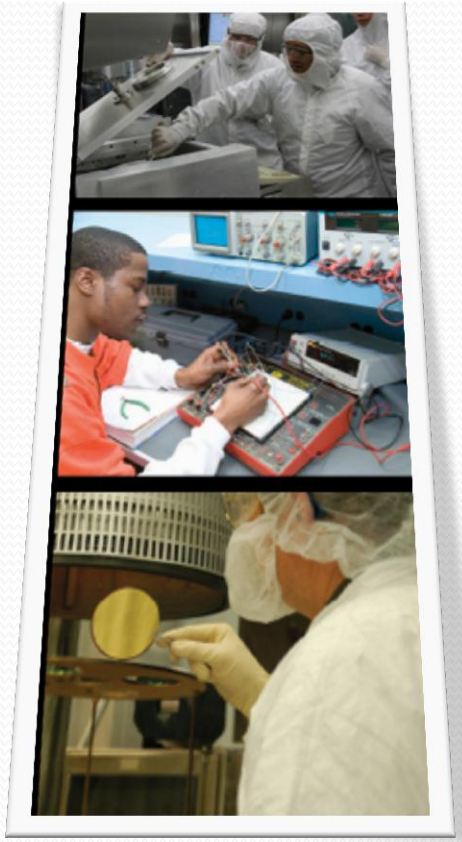
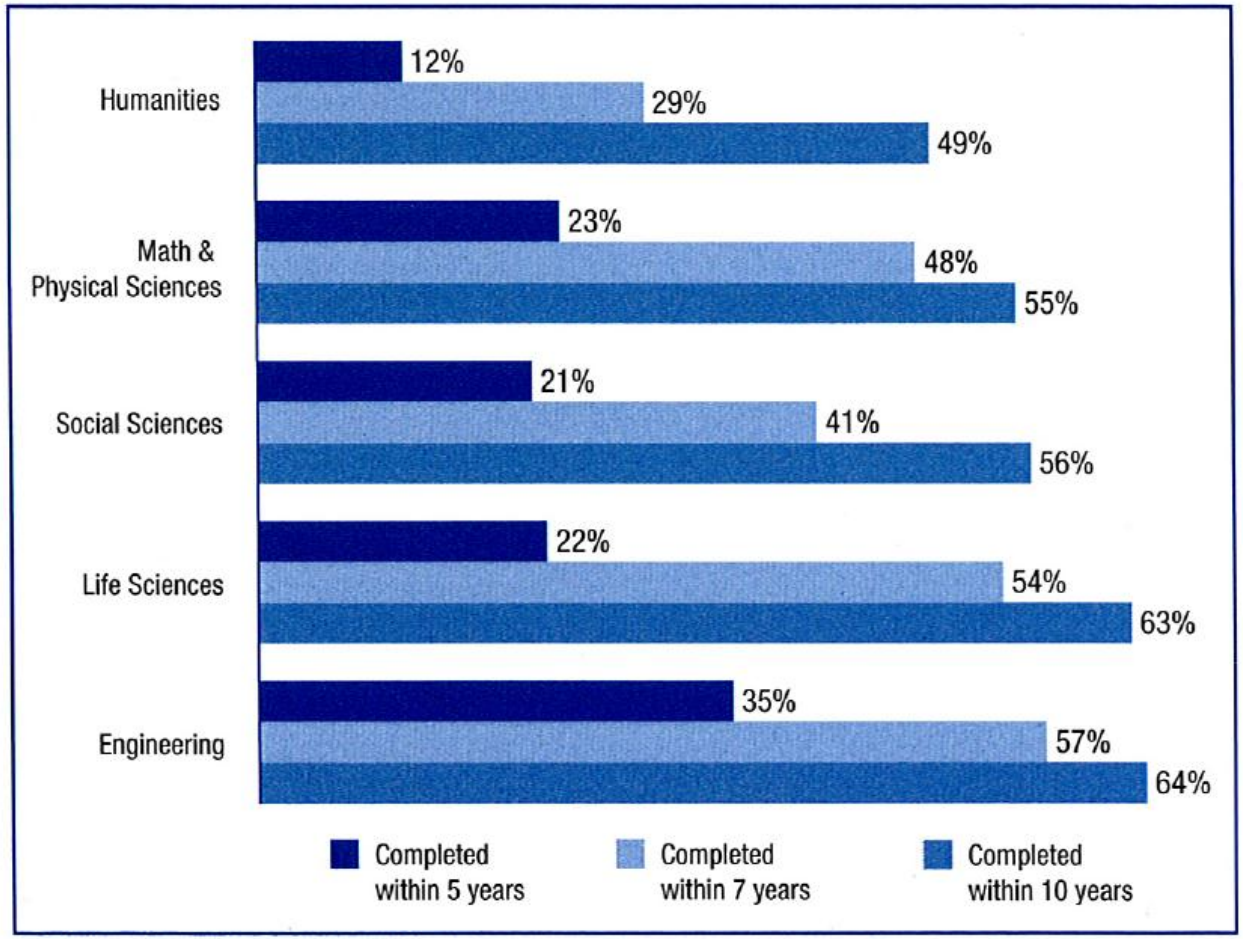


Figure 2. Doctoral completion rate, by field and number of years.



Source: Council of Graduate Schools. (2008). *Ph.D. completion and attrition: Analysis of baseline program data from the Ph.D. Completion Project*. Washington, DC: Author.

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?

Goals	Research Assistants	Traineeship	Fellowship
Conduct NSF Funded Research	++	++	
Develop STEM Workforce	+	++	+
Broaden Participation in STEM Fields		++	++
Develop Researchers in Priority Areas	+	+	
Foster Research/Innovation in Graduate Education		+	
Percentages of Students Funded (~40,000 Total)	~80%	6-8%	10-15%

NSF Program	Examples of Projects
CyberCorps: Scholarships for Service (SFS)	*IGERT: Smart Grids - Technology, Human Behavior and Policy* (#1144388)
Robert Noyce Teacher Scholarship Program	*Educating STEM Teachers with Integrated Graduate Enrollment at Augusta State University* (#1035381)
Alliances for Graduate Education & the Professoriate (AGEP)	*TX BRIDGE (Texans Building Robust, Innovative & Diverse Graduate Education)* (#1111129)
Louis Stokes Alliances for Minority Participation (LSAMP)	*Broadening Resources for Increasing Diversity in Graduate Education at LSU* (#1141152)
Research & Evaluation on Education in S&E (REESE)	*Graduate Education's Role in Preparing Engineering Students for Careers in Academia and Industry* (#0747803)
Science Master's Program (SMP)	*A Scalable, Replicable Model Addressing Current and Emerging Workforce Needs* (#1011440)

Organization/Report	Recommendations	Federal Support
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?