PhD Career Pathways

A PROJECT OF THE COUNCIL OF GRADUATE SCHOOLS

Closing Gaps in our Knowledge of PhD Career Pathways: How Well Did a STEM PhD Train Degree Recipients for Their Careers?

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The vast majority of STEM PhDs work in fields related to their doctoral education and are satisfied with their jobs. According to the National Science Foundation's (NSF) Survey of Doctoral Recipients, 92% of employed doctoral scientists and engineers in 2017 held jobs that are closely or somewhat related to their PhDs (NSF, 2019). Using data from the Council of Graduate Schools' (CGS) PhD Career Pathways project, this brief provides new insight into how STEM PhDs apply their doctoral training in the workforce.

Table 1. Percent Responding "Extremely Well" or "Very Well" to Survey Item, "How well did your PhD prepare you for [your current] job?" by Selected Employment Sector for Selected Fields & Doctoral Cohorts 3, 8, and 15 Years Post-Graduation.

		Academic	Non-Academic
Biological Sciences	3 Year	**80%**	**62%**
	8 Year	**81%**	**66%**
	15 Year	79%	72%
Engineering	3 Year	**87%**	**76%**
	8 Year	**87%**	**74%**
	15 Year	89%	81%
Physical & Earth Sciences	3 Year	**84%**	**75%**
	8 Year	**84%**	**71%**
	15 Year	**92%**	**67%**
Soc & Behavioral Sciences	3 Year	78%	67%
	8 Year	82%	76%
	15 Year	83%	86%

Boldface denotes statistically significant difference by employment sector. P<0.05

See 'About the Data Source' on page 3 for data collection information.

Key Findings:

- A large majority of survey respondents in various stages of their postdoctoral careers believe that their STEM PhD education prepared them well for their jobs. However, there are some differences between those employed by colleges and universities and those employed elsewhere.
- Among those who earned their PhDs in Life Sciences, Physical Sciences, or Engineering, fewer graduates who worked outside of the academy felt that their PhD education prepared them extremely well or very well for their current jobs. There was no difference by sector of employment between those who earned a PhD in the Social Sciences and those who earned a PhD in the Behavioral Sciences. (See Table 1)
- A large majority of survey respondents report that they "definitely" or "probably" would still pursue a PhD in general and in the same field again. Across different STEM broad fields and different PhD cohorts, alumni in both employment sectors were equally likely to say that they would pursue a PhD again. Notable exceptions are for Engineering and Physical & Earth Sciences alumni 15 years out. Although more than a half of them would still pursue PhDs again, fewer graduates in jobs outside of the academy, compared to those working for colleges and universities, indicated that they would definitely or probably do so. (See Table 2)
- PhD graduates within and outside of academia identify similar job skills and attributes as important. Across different STEM broad fields and employment sectors, there are many similarities in terms of attributes and skills crucial to successfully perform work. Persistence was one of the most important attributes across fields and was particularly important for those who work at colleges and universities. On the other hand, cooperation was important for those working outside of the academy. (See Figure 1 & Table 3)

Table 2. Percent Responding "Definitely Would" or "Probably Would" to survey item, "Given the perspective that you have gained since completing your PhD, if you had to start again, how likely would you do the following?" by Selected Employment Sector for Selected Fields & Doctoral Cohorts 3, 8, and 15 Years Post-Graduation.

		Pursue a PhD in General		Pursue a PhD in the Same Field	
		Academic	Non-Academic	Academic	Non-Academic
Biological Sciences	3 Year	84%	82%	**80%**	**67%**
	8 Year	83%	83%	83%	76%
	15 Year	88%	87%	82%	85%
Engineering	3 Year	**93%**	**83%**	85%	77%
	8 Year	87%	83%	**87%**	**77%**
	15 Year	**100%**	**88%**	**98%**	**82%**
Physical & Earth Sciences	3 Year	88%	83%	81%	74%
	8 Year	89%	90%	82%	77%
	15 Year	**96%**	**81%**	**88%**	**69%**
Soc & Behavioral Sciences	3 Year	82%	78%	77%	75%
	8 Year	87%	89%	82%	78%
	15 Year	92%	94%	88%	83%

Boldface denotes statistically significant difference by employment sector. P<0.05

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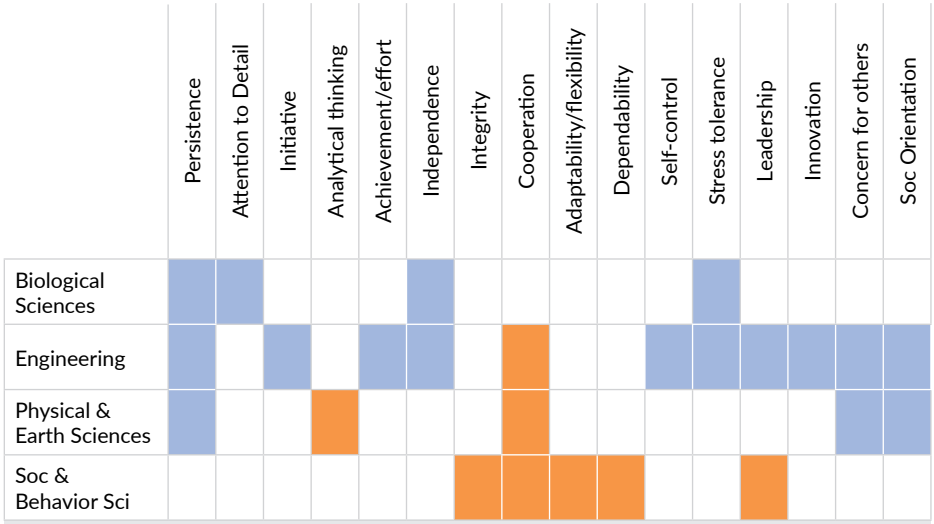
Figure 1. Differences in Importance of Attributes/Skills Between Those Employed by Colleges and Universities and Those Working Outside of the Academy by Selected Field



Blue denotes attributes that are more important for those working at colleges and universities, and orange denotes attributes considered more important by those working outside of the academy. No color denotes that there was no statistical difference by employment sector.

Takeaway Points:

- Together, these results suggest that STEM doctoral education offers relevant training that prepares graduates for jobs inside and outside of the academy. Programs and graduate schools are encouraged to continue to offer training and professional development opportunities that lead graduates to a variety of fulfilling career paths.
- Although large majorities of Engineering and Physical & Earth Sciences PhDs are satisfied with their PhD preparation for their current jobs, the numbers are significantly lower for those who work outside of the academy. This finding was particularly interesting, since there is a long history of Engineering and Physical Sciences PhDs working in other non-academic industries.
- Furthermore, fewer PhDs in Engineering and Physical & Earth Sciences who work outside of the academy reported that they definitely or probably would pursue a PhD in general or in the same field. While the vast majority of these PhD alumni would still pursue their degrees again, the finding suggests room for PhD programs in these fields to incorporate training and professional development opportunities, such as internships, that are more relevant to those who seek careers outside of the academy.

Table 3. Percent Responding "Extremely Important" or "Very Important" to Survey Item "How important are each of the following attributes/skills in successfully performing your work in this job?" by Selected Employment Sector for Selected Fields.

	Biological Sciences		Engineering		Physical & Earth Sciences		Social & Behavioral Sciences	
	Academic	Non-Academic	Academic	Non-Academic	Academic	Non-Academic	Academic	Non-Academic
Persistence	**93%**	**86%**	**93%**	**84%**	**88%**	**82%**	90%	87%
Initiative	91%	90%	**92%**	**87%**	85%	87%	88%	88%
Self-control	77%	71%	**78%**	**71%**	75%	70%	80%	76%
Attention to Detail	**91%**	**86%**	85%	88%	83%	85%	81%	87%
Achievement/effort	89%	85%	**88%**	**82%**	82%	77%	85%	84%
Analytical thinking	91%	92%	94%	92%	**86%**	**92%**	91%	95%
Independence	**88%**	**81%**	**86%**	**74%**	85%	81%	85%	78%
Innovation	69%	64%	**78%**	**71%**	65%	66%	62%	58%
Stress tolerance	**77%**	**68%**	**74%**	**65%**	72%	67%	78%	76%
Adaptability/ flexibility	81%	83%	78%	78%	77%	80%	**73%**	**83%**
Dependability	79%	83%	71%	76%	76%	76%	**76%**	**90%**
Integrity	88%	86%	85%	83%	84%	82%	**80%**	**90%**
Leadership	70%	66%	**76%**	**68%**	64%	62%	**56%**	**71%**
Cooperation	81%	86%	**75%**	**81%**	**72%**	**80%**	**65%**	**87%**
Concern for others	63%	59%	**57%**	**50%**	**63%**	**43%**	63%	68%
Social Orientation	46%	45%	**43%**	**33%**	**45%**	**31%**	51%	55%

Boldface denotes statistically significant difference by employment sector. P<0.05

See 'About the Data Source' below for data collection information.

About the Data Source:

The CGS PhD Career Pathways Project Fall 2017 Alumni Survey was distributed to doctoral degree recipients that were three, eight, or fifteen years out of their PhD in selected programs at 35 participating institutions. Each of the universities administered the survey individually and shared the resulting data with CGS. This brief is based upon the restricted-use, deidentified, individual-level data file, which includes doctoral degree recipients who reported working for one of five postsecondary sectors (Research University, Master's/Regional University, Liberal Arts College, Community or Two-Year College, and College or University System) in their current job and who reported at least a primary work responsibility. The sample sizes by field and by cohort are as follows: Biological Sciences (3-year, n=409; 8-year, n=262; 15-year, n=120), Engineering (3-year, n=402; 8-year, n=257; 15-year, n=124), Physical & Earth Sciences (3-year, n=387; 8-year, n=227; 15-year, n=139), and Social & Behavioral Sciences (3-year, n=274; 8-year, n=192; 15-year, n=137).

Conversation Starters for PhD Program Improvement:

We encourage graduate schools to engage in campus conversations about STEM PhD careers. Culture change happens incrementally and takes active participation by various stakeholders, including students, faculty, and employers. A good first step is understanding whether and to what extent there are already efforts that are taking place on your campus to make career diversity of STEM PhDs seen and celebrated. Some of the questions that you may want to ask of your campus colleagues (i.e., graduate school staff, college deans, graduate program directors, etc.), as well as stakeholders include:

- What kind of professional development opportunities does your institution provide PhD students in STEM fields for their career preparation outside of the academy and for achieving their long-term career goals?
- What kind of resources and guidance does your institution offer to STEM faculty members, so that they talk to their students about STEM PhD careers with more openness toward opportunities outside of the professoriate?
- What are your institution and its STEM PhD programs doing to foster partnerships with current and prospective PhD employers?
- How effective are these approaches and resources in fostering PhD education that leads graduates to a variety of fulfilling career paths? How do you assess the effectiveness of these efforts?

References:

National Science Foundation. (2019). Table 27-1. U.S. residing employed doctoral scientists and engineers, by selected demographic and employment-related characteristics and primary or secondary work activity: 2017. Retrieved from https://ncsesdata.nsf.gov/doctoratework/2017/html/sdr2017_dst_27-1.html.

Additional Resources:

Professional Development for STEM Graduate Students. CGS, with support from the National Science Foundation (grant number 1413827), conducted a pilot project that studied the professional development needs of graduate students in STEM fields, and the programs and resources in place to meet those needs.

Graduate STEM Education for the 21st Century. A recent consensus study by the National Academies of Sciences, Engineering, and Medicine calls for, among other recommendations, career exploration and preparation for graduate students. The report calls for STEM graduate students to have opportunities to explore the variety of career opportunities and pathways that STEM graduate degrees open doors for.

Center for the Improvement of Mentored Experiences in Research (CIMER). A program at the University of Wisconsin-Madison that provides free online training materials for engaging faculty mentors in career and advising for their graduate students and postdoctoral fellows.

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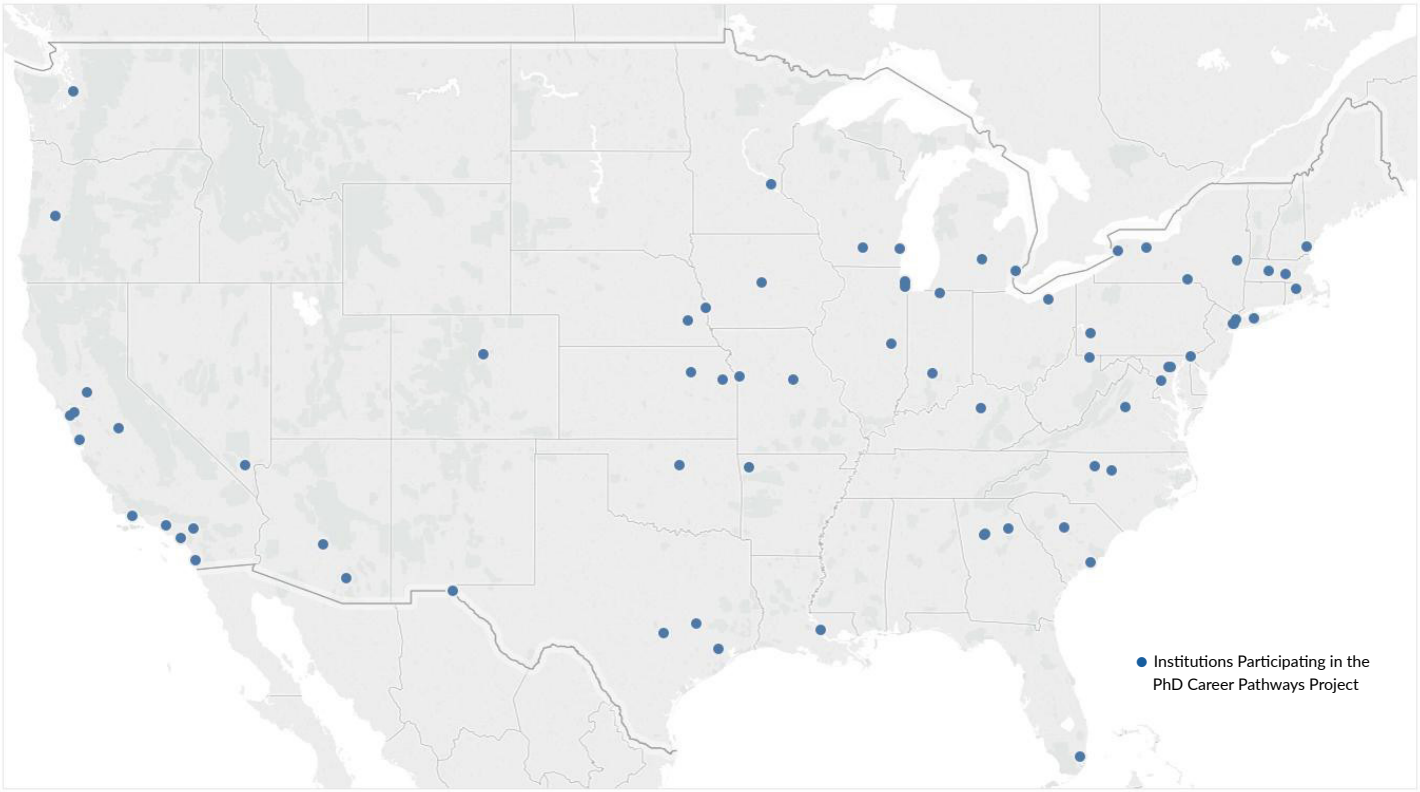
The CGS PhD Career Pathways Project

CGS PhD Career Pathways is a coalition of 70 doctoral institutions working to better understand and support PhD careers across all broad fields of study. Over the course of the project, universities will continue collecting data from current PhD students and alumni using surveys that were developed by CGS in consultation with senior university leaders, funding agencies, disciplinary societies, researchers, and PhD students and alumni. The resulting data will allow universities to analyze PhD career preferences and outcomes at the program level and help faculty and university leaders strengthen career services, professional development opportunities, and mentoring.

About CGS

For over 50 years, the Council of Graduate Schools has been the only national organization dedicated solely to advancing master's and doctoral education and research. CGS members award 86.9% of all U.S. doctoral degrees and 59.8% of all U.S. master's degrees. CGS accomplishes its mission through advocacy, the development and dissemination of best practices, and innovative research.



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