Investigating National-Scale Variation in Doctoral Student Funding Mechanisms Across Engineering Disciplines

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Although funding STEM graduate students in the United States is a multibillion-dollar endeavor annually, we have little information on how students' experiences and outcomes differ as a function of their funding mechanisms. The purpose of this NSF-funded research project is to understand how to spend graduate student funding wisely to ensure a variety of student experiences and an optimal set of outcomes, including access for all students to the financial, academic, professional and social resources that support success in graduate study. Specifically, the five-year research project is addressing the following research questions:

1. How do graduate students' funding mechanisms vary across their incoming characteristics (i.e., demographics and bachelor's or master's institutional type, location, or affiliation) and STEM discipline?
2. What is the relationship between graduate students' funding mechanisms and their post-doctoral outcomes, including time to degree, field of first job, job placement, and salary of first job?
3. How does the relationship between graduate students' funding mechanisms and their post-doctoral outcomes vary across their incoming characteristics (i.e., demographics and bachelor's or master's institutional type, location, or affiliation) and STEM discipline?
4. What do STEM graduate students, faculty members, and administrators perceive to be the benefits and drawbacks of various graduate student funding mechanisms? How does each group make decisions about offering or accepting offers of different funding mechanisms?
5. How does funding mechanism impact STEM graduate students' experiences, socialization, identity formation, and other factors previously shown to contribute to overall success?

We are following a mixed methods approach to address these research questions. Our quantitative data are drawn from the complete Survey of Earned Doctorates, which is a restricted-use data set that is characterized by a greater than 90% response rate of all U.S. doctorate earners for the past several decades. The data set includes variables that will address the first three research questions. To address the final two research questions, the team is conducting a case study analysis of three STEM departments at each of eight different institutions. This qualitative aspect of the study seeks to understand how funding mechanisms enable or inhibit experiences and outcomes for students from the perspectives of department administrators, faculty advisors, and graduate students. Data collection at two of the eight sites will have been completed prior to the ASEE annual meeting in June 2017.

Preliminary Project Results

Much of the quantitative work to date has focused on developing variables to quantify STEM graduate programs' doctoral student funding portfolios and to determine the extent to which those funding portfolios vary across and within fields. Our poster focuses on engineering specifically and illuminates how there is considerable variation in graduate student funding—institutions cluster into different "modes" of funding portfolios. Table 1 shows characteristics of different groups of engineering colleges/schools based on a cluster analysis of their funding

portfolios. For each institution, we calculated the percentage of doctoral recipients over the past five years who pointed to each funding mechanism as their primary source of funding throughout their PhD training. The values in the table represent average funding portfolios for each cluster. For example, across the 93 institutions in Cluster 1, on average 14% of students from those institutions indicated grants and fellowships was their primary funding mechanism.

Table 1. Average funding portfolios of institutions within each cluster for **Engineering**

Funding Mechanism	**Cluster 1** (n=93)	**Cluster 2** (n=47)	**Cluster 3** (n=17)	**Cluster 4** (n=12)	**Cluster 5** (n=9)	**Cluster 6** (n=3)
Grants and Fellowships	14%	28%	52%	13%	52%	0%
Teaching Assistantship	11%	11%	3%	37%	3%	0%
Research Assistantship	64%	46%	36%	32%	36%	1%
Other Assistantship	0%	0%	0%	1%	0%	0%
Traineeship	0%	1%	1%	0%	1%	0%
Internship, clinical residency	0%	0%	0%	0%	0%	0%
Personal	5%	8%	4%	8%	4%	71%
Employer	4%	3%	3%	7%	3%	23%
Foreign	1%	2%	1%	2%	1%	4%
Other	0%	0%	0%	0%	0%	0%

[1] Total percentages in a column may not sum to 100% because of rounding percentages to integers. Percentages represent average percentages across institutions within each cluster

We explored this variation by examining differences in institutional characteristics across clusters, including Carnegie class characteristics as well as *U.S. News and World Report* college-level metrics. Clusters with higher percentages of research assistantships also had the highest percentages of institutions classified as Doctoral Universities with highest research activity. Clusters with the highest levels of personal and employer funding contained higher percentages of institutions classified as Doctoral Universities with moderate research activity. Moreover, the cluster with the highest percentage of grants and fellowships was the cluster with the highest percentage of private institutions. Institutional control (i.e., public/private) appears to be the best institutional or college-level discriminating variable between these clusters, but the three largest funding clusters (i.e., Clusters 1-3) all contained both public and private institutions. Thus, although we saw alignment between funding portfolios and what we would anticipate based on an institution's/college's characteristics, we found those variables were not necessarily indicative the graduate funding portfolio. Understanding why such variation exists—and its implication for students—is the next step in our research.

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