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Differences in Master's and Doctoral Enrollment in Science, Engineering, and Health in 2017

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Graduate enrollment by degree level and field of study are available for the first time through the 2017 Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS), which allows for the monitoring of both master's and doctoral enrollment trends for science, engineering, and health (SEH) fields to assess the potential future stock of SEH personnel. These new data show notable differences in the composition and financial support of master's and doctoral students in SEH fields of study. The survey is sponsored by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF) and by the National Institutes of Health (NIH).

In total, 649,112 graduate students were enrolled in SEH programs in 2017, with 58% pursuing master's degrees and 42% pursuing doctoral degrees. More graduate students were enrolled in science (415,568) than in engineering (165,581) and health (67,963) combined. Over three-quarters (77%) of graduate students in health fields were enrolled in master's programs, compared with 55% of those in science fields and 58% of those in engineering fields (table 1 and figure 1).

Master's and Doctoral Students by Field of Study

Although the percentage of graduate students pursuing a master's degree varies among science, engineering, and health fields, the variation within these fields of study is even more pronounced. At one end of the spectrum, more than three-quarters of graduate students in the following fields were enrolled at the master's level: clinical medicine (85%), computer and information sciences (84%), and industrial and manufacturing engineering (77%). Conversely, in physical sciences, chemical engineering, and metallurgical and materials engineering, less than one-third of graduate students were enrolled at the master's level (15%, 32%, and 32%, respectively) (table 1).

A key benefit of separating master's and doctoral student enrollment counts in the GSS is that enrollment trends can be assessed across fields of study by degree level. As an example, the top three fields with the largest master's enrollment in 2017 were computer and information science (75,618 students), social sciences (41,208 students), and biological and biomedical sciences (33,926 students). For doctoral student enrollment, the top three fields in 2017 were biological and biomedical sciences (51,291 students), physical sciences (35,461 students), and social sciences (35,078 students) (table 1).

Graduate student enrollment status (part time or full time) also varied considerably by degree level and field of study. Eighty-seven percent of doctoral students were enrolled full time in 2017, as compared with 65% of master's students. Among master's students, only three broad fields enrolled at least three-quarters of their students full time in 2017: bioengineering and biomedical engineering (80%), metallurgical and materials engineering (75%), and other health (76%). In comparison, 19 of the 21 broad fields enrolled at least three-quarters of their doctoral students full time, with five of these fields enrolling more than 90% full time: biological and biomedical sciences (94%), chemical engineering (94%), physical sciences (93%), metallurgical and materials engineering (92%), and mathematics and statistics (91%) (table 1).

TABLE 1. Master's and doctoral enrollment in science, engineering, and health fields in all institutions, by enrollment status: 2017

Broad fields	Total	Master's				Doctoral			
		All	Percent of total	Percent full time	Percent part time	All	Percent of total	Percent full time	Percent part time
All surveyed fields	649,112	378,587	58.3	64.7	35.3	270,525	41.7	87.2	12.8
Science and engineering	581,149	325,925	56.1	64.2	35.8	255,224	43.9	88.0	12.0
Science	415,568	229,169	55.1	63.6	36.4	186,399	44.9	88.6	11.4
Agricultural sciences	9,347	5,603	59.9	64.4	35.6	3,744	40.1	84.3	15.7
Biological and biomedical sciences	85,217	33,926	39.8	70.4	29.6	51,291	60.2	93.5	6.5
Computer and information sciences	89,909	75,618	84.1	58.6	41.4	14,291	15.9	83.2	16.8
Geosciences, atmospheric sciences, and ocean sciences	12,545	6,006	47.9	68.4	31.6	6,539	52.1	88.7	11.3
Mathematics and statistics	29,669	16,568	55.8	69.7	30.3	13,101	44.2	90.9	9.1
Multidisciplinary and interdisciplinary studies	9,854	6,923	70.3	58.3	41.7	2,931	29.7	79.2	20.8
Natural resources and conservation	10,879	7,311	67.2	66.6	33.4	3,568	32.8	79.3	20.7
Physical sciences	41,829	6,368	15.2	65.9	34.1	35,461	84.8	92.9	7.1
Psychology	50,033	29,638	59.2	65.2	34.8	20,395	40.8	81.5	18.5
Social sciences	76,286	41,208	54.0	62.6	37.4	35,078	46.0	84.6	15.4
Engineering	165,581	96,756	58.4	65.7	34.3	68,825	41.6	86.6	13.4
Aerospace, aeronautical, and astronautical engineering	5,708	3,322	58.2	65.7	34.3	2,386	41.8	87.1	12.9
Bioengineering and biomedical engineering	10,882	4,037	37.1	80.1	19.9	6,845	62.9	89.2	10.8
Chemical engineering	10,166	3,292	32.4	72.8	27.2	6,874	67.6	93.8	6.2
Civil engineering	21,132	13,506	63.9	67.3	32.7	7,626	36.1	85.6	14.4
Electrical, electronics, and communications engineering	47,752	29,816	62.4	70.2	29.8	17,936	37.6	85.1	14.9
Industrial and manufacturing engineering	15,905	12,272	77.2	58.8	41.2	3,633	22.8	78.2	21.8
Mechanical engineering	27,428	16,279	59.4	66.2	33.8	11,149	40.6	87.4	12.6
Metallurgical and materials engineering	6,541	2,115	32.3	75.0	25.0	4,426	67.7	92.0	8.0
Other engineering	20,067	12,117	60.4	50.5	49.5	7,950	39.6	81.7	18.3
Health	67,963	52,662	77.5	68.0	32.0	15,301	22.5	72.4	27.6
Clinical medicine	29,693	25,283	85.1	59.5	40.5	4,410	14.9	73.9	26.1
Other health	38,270	27,379	71.5	75.8	24.2	10,891	28.5	71.8	28.2

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 2017.

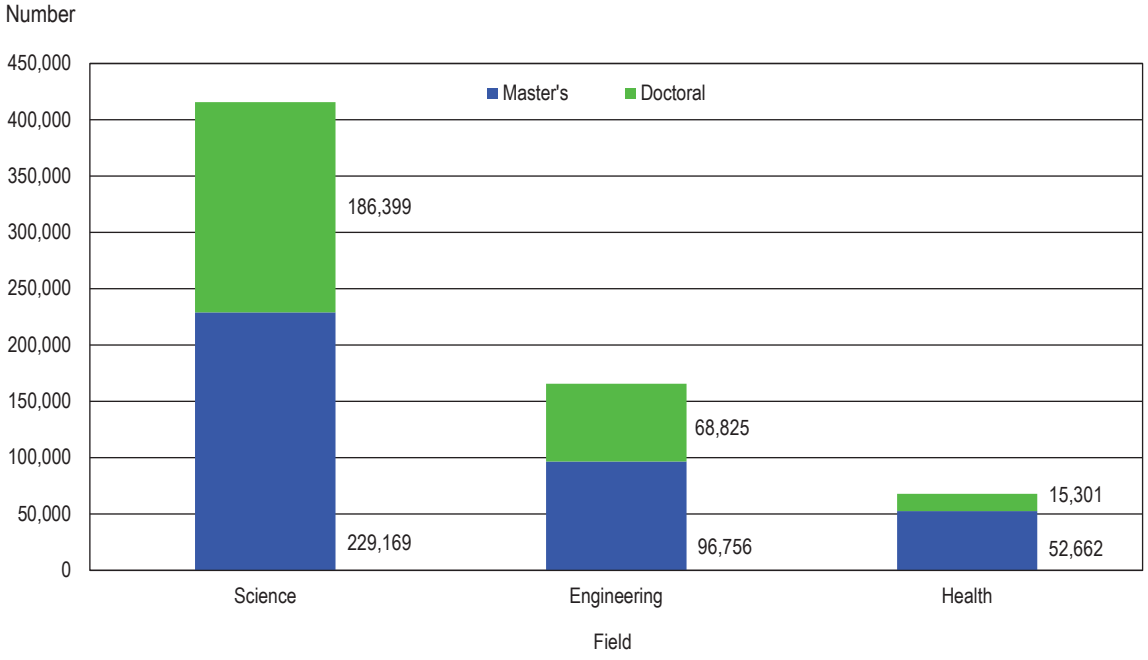
Demographics of Master's and Doctoral Students in Science and Engineering

Demographic characteristics of graduate students enrolled in science and engineering (S&E) fields of study varied by degree level and enrollment status. For example, temporary visa holders in S&E fields were more likely than their U.S. citizens and permanent resident peers to be enrolled full time at both the master's and doctoral levels. Among doctoral students, 91% of temporary visa holders were enrolled full time, compared with 86% of U.S. citizens and permanent residents. This difference in enrollment status was much greater among master's students, where 82% of temporary visa holders were enrolled full time, compared with 54% of U.S. citizens and permanent residents (table 2).

Male and female S&E graduate students were similar in the proportion seeking master's degrees (56% and 57%, respectively) as well as their enrollment status across degree levels. However, there were gender differences in enrollment status across citizenship levels. Female U.S. citizens and permanent residents were enrolled full time at higher rates than were their male counterparts at the master's level (59% versus 49%, respectively). Whereas female temporary visa holders were enrolled full time at modestly higher rates than were their male counterparts at the master's level (83% versus 81%, respectively) (table 2).

Key differences in enrollment can also be seen across racial and ethnic groups. The proportion of S&E graduate students seeking a master's degree was the highest among blacks or African Americans (69%), Native Hawaiians or Other Pacific Islanders (63%), and Hispanics (63%). Students with unknown race and ethnicity had the fourth highest proportion at the

FIGURE 1. Master's and doctoral students enrolled in science, engineering, and health: 2017



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 2017.

TABLE 2. Master's and doctoral enrollment in all institutions, by science and engineering enrollment status, sex, citizenship, race, and ethnicity: 2017

Characteristic	Total	Master's				Doctoral			
		All	Percent of total	Percent full time	Percent part time	All	Percent of total	Percent full time	Percent part time
All surveyed fields	649,112	378,587	58.3	64.7	35.3	270,525	41.7	87.2	12.8
Science and engineering	581,149	325,925	56.1	64.2	35.8	255,224	43.9	88.0	12.0
Male	339,317	188,466	55.5	62.7	37.3	150,851	44.5	88.1	11.9
Female	241,832	137,459	56.8	66.3	33.7	104,373	43.2	88.0	12.0
U.S. citizens and permanent residents[a]	356,217	203,301	57.1	53.5	46.5	152,916	42.9	85.8	14.2
Male	192,434	109,191	56.7	49.1	50.9	83,243	43.3	85.5	14.5
Female	163,783	94,110	57.5	58.6	41.4	69,673	42.5	86.2	13.8
Hispanic or Latino	37,920	23,858	62.9	56.3	43.7	14,062	37.1	87.5	12.5
Not Hispanic or Latino									
American Indian or Alaska Native	1,555	911	58.6	60.8	39.2	644	41.4	77.8	22.2
Asian	36,511	21,500	58.9	55.0	45.0	15,011	41.1	88.5	11.5
Black or African American	26,399	18,144	68.7	47.8	52.2	8,255	31.3	79.4	20.6
Native Hawaiian or Other Pacific Islander	573	361	63.0	51.5	48.5	212	37.0	82.5	17.5
White	221,438	119,792	54.1	53.6	46.4	101,646	45.9	85.7	14.3
More than one race	11,699	6,624	56.6	59.6	40.4	5,075	43.4	89.7	10.3
Unknown race and ethnicity	20,122	12,111	60.2	48.6	51.4	8,011	39.8	83.8	16.2
Temporary visa holders	224,932	122,624	54.5	81.9	18.1	102,308	45.5	91.4	8.6
Male	146,883	79,275	54.0	81.4	18.6	67,608	46.0	91.3	8.7
Female	78,049	43,349	55.5	83.0	17.0	34,700	44.5	91.6	8.4

[a] Race and ethnicity data are available for U.S. citizens and permanent residents only.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 2017.

master's level (60%). Further, across racial and ethnic groups, only black or African American students (52%) and students of unknown race and ethnicity (51%) enrolled part time in master's programs more often than full time (figure 2 and table 2).

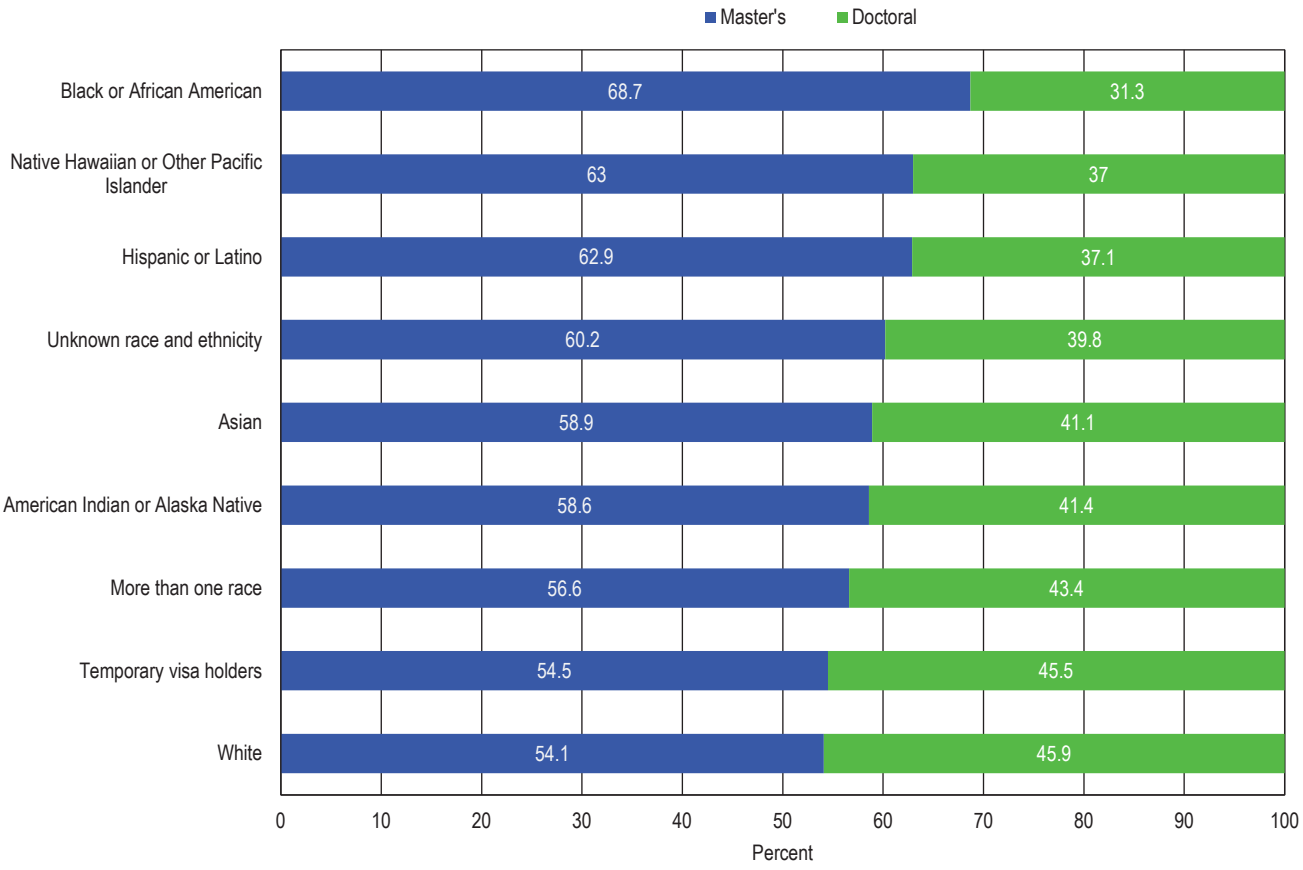
Sources and Mechanisms of Support for Full-Time Master's and Doctoral Students in Science and Engineering

Collecting financial support data by degree level allows greater insight into the differences in funding amounts and funding mechanisms that exist between master's and doctoral students. Although self-support is the primary source of support for just over one-third (37%) of all graduate students in S&E, there was a noticeable difference in self-support by degree level. Two-thirds (67%) of master's students and only one-tenth (10%) of doctoral students were self-supported (table 3).

In terms of primary sources for funding support, doctoral students enrolled in S&E fields of study were most commonly (58%) funded through institutional sources, although one-quarter (25%) were primarily supported by federal sources. More than one-half (65%) of the doctoral students primarily supported by grants from federal agencies were supported by NSF (8.3% of all doctoral students) or by NIH (7.7% of all doctoral students). The most common primary mechanisms of support reported for doctoral students were research assistantships (37%), teaching assistantships (28%), and fellowships (15%) (table 3).

Unlike doctoral students, master's students were most commonly self-supported, leaving only 33% to be

FIGURE 2. Master's and doctoral students enrolled within S&E fields, by race, ethnicity, and citizenship: 2017



NOTE: Race and ethnicity data are available for U.S. citizens and permanent residents only.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 2017.

TABLE 3. Primary source and mechanism of support for full-time master's and doctoral students in science and engineering: 2017

Source and mechanism	All full-time graduate students		Master's		Doctoral	
	Total	Percent	All	Percent	All	Percent
All full-time	433,916	100.0	209,221	100.0	224,695	100.0
Self-support	161,641	37.3	139,373	66.6	22,268	9.9
All sources of support	272,275	62.7	69,848	33.4	202,427	90.1
Federal	65,999	15.2	10,736	5.1	55,263	24.6
Department of Agriculture	2,361	0.5	938	0.4	1,423	0.6
Department of Defense	8,089	1.9	2,568	1.2	5,521	2.5
Department of Energy	4,472	1.0	491	0.2	3,981	1.8
Health and Human Services (HHS)	19,358	4.5	809	0.4	18,549	8.3
National Institutes of Health	18,096	4.2	699	0.3	17,397	7.7
Other HHS	1,262	0.3	110	0.1	1,152	0.5
National Aeronautics and Space Administration	1,806	0.4	276	0.1	1,530	0.7
National Science Foundation	20,815	4.8	2,192	1.0	18,623	8.3
Other	9,098	2.1	3,462	1.7	5,636	2.5
Institutional	182,135	42.0	52,319	25.0	129,816	57.8
Other U.S. source	19,432	4.5	5,136	2.5	14,296	6.4
Foreign	4,709	1.1	1,657	0.8	3,052	1.4
All mechanisms of support	272,275	62.7	69,848	33.4	202,427	90.1
Fellowships	39,368	9.1	5,687	2.7	33,681	15.0
Traineeships	10,945	2.5	1,497	0.7	9,448	4.2
Research assistantships	103,586	23.9	19,702	9.4	83,884	37.3
Teaching assistantships	84,499	19.5	22,171	10.6	62,328	27.7
Other mechanisms	33,877	7.8	20,791	9.9	13,086	5.8

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 2017.

funded primarily through institutional support (25%), federal sources (5%), other U.S. sources (3%), or foreign sources (1%). Teaching assistantships were most commonly reported as the primary mechanism of support for master's students (11%). Another 9% were primarily supported by research assistantships, and 10% received their funding through other mechanisms of support (table 3).

Data Source and Limitations

Conducted since 1966, the GSS is an annual survey of all academic institutions in the United States that grant research-based master's or doctoral degrees in SEH fields. The 2017 GSS collected data from 18,745 organizational units (departments, programs, affiliated research centers, and health care facilities) at 703 eligible institutions and their affiliates in the United States, Puerto Rico, and Guam. The unit response rate was 97.6%. An overview of the survey is available at https://www.nsf.gov/statistics/srvygradpostdoc/.

In 2017, the GSS was redesigned to collect demographic and financial support data separately for master's and doctoral students, to prioritize electronic data interchange (EDI)[2] as the primary means of data submission, and to utilize the U.S. Department of Education's Classification of Instructional Programs (CIP)[3] codes to report fields of study for graduate student enrollment data. These methods were successfully piloted in the 2016 data collection and fully implemented for 2017. More information regarding the 2017 GSS redesign is available in the technical notes for the 2017 data tables (https://ncsesdata.nsf.gov/grad-postdoc/2017/gss_2017_tech_notes.pdf) and in the forthcoming companion InfoBrief (https://www.nsf.gov/statistics/srvygradpostdoc/).

Further, in 2017, NSF updated the GSS fields of study to align with the NCSES Taxonomy of Disciplines to increase comparability to other NCSES surveys and more accurately reflect how disciplines are currently organized. This update resulted in several fields becoming ineligible (including architecture, communication, and public administration) and the reorganization of subfields within and across broad

fields. A special report is forthcoming that will provide more information about the updated GSS taxonomy.

Due to these changes, the 2017 data are not directly comparable to previously collected GSS data. Trend comparisons can be made using the "2017old" estimates in the 2017 data tables, available at https://www.nsf.gov/statistics/srvygradpostdoc/.

GSS health fields are collected under the advisement of NIH. These GSS fields are about one-third of all health fields in the U.S. Department of Education's CIP taxonomy. NIH information on trends seen within these selected health fields can be found at https://report.nih.gov/nihdatabook/.

The full set of data tables from the 2017 survey are available at https://www.nsf.gov/statistics/srvygradpostdoc/. Data are also available in NCSES's interactive data tool (https://ncsesdata.nsf.gov/ids/gss). For more information about the survey, contact the GSS project officer, Michael Yamaner.

Notes

1. Caren A. Arbeit and Christopher Davies, RTI International, Research Triangle Park, NC. For information, contact Michael Yamaner, Human Resources Statistics Program, National Center for Science and Engineering Statistics, National Science Foundation, 2415 Eisenhower Avenue, Suite W14200, Alexandria, VA 22314 (myamaner@nsf.gov; 703-292-7815).

2. Electronic data interchange (EDI) is a method for transferring data between computer systems or networks using a standardized format.

3. CIP is a taxonomy used for reporting postsecondary fields to the U.S. Department of Education for the Integrated Postsecondary Education Data System, a mandatory survey for institutions receiving federal financial aid. Thus, most of institutions in the GSS already use CIP codes to report data on graduate students. The CIP taxonomy was developed by the National Center for Education Statistics, which updates the taxonomy about once a decade; CIP was last revised in 2010. For more information, see http://nces.ed.gov/ipeds/cipcode/.