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Full-Time Graduate Enrollment in Science and Engineering Continues to Grow in 2016 Due to Increased Enrollment by Foreign Students on Temporary Visas

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The number of full-time graduate students enrolled in science and engineering (S&E) programs rose 0.8% in 2016 after rising by 2.8% in 2015. The 2016 increase was due to a 2.1% increase in the full-time enrollment of foreign students with temporary visas. In 2016, full-time S&E foreign graduate student enrollment grew to 210,260 and represented 45% of all full-time S&E graduate students. In contrast, full-time S&E graduate enrollment of U.S. citizens and permanent residents declined for the fifth year in a row.

These and other findings in this report are from the 2016 Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS), cosponsored by the National Center for Science and Engineering Statistics within the National Science Foundation and by the National Institutes of Health (NIH).

Characteristics of S&E Graduate Enrollment

In 2016, there were 620,489 students enrolled in S&E graduate programs in the United States, with 75% enrolled as full-time students. Fifty-eight percent of those enrolled in S&E graduate programs were men, and 61% were U.S. citizens or permanent residents. Female enrollment in S&E graduate programs grew to 261,575 in 2016, with 32% of those being temporary visa holders (table 1).

Overall S&E graduate enrollment of U.S. citizens and permanent residents decreased 0.8% between 2015 and 2016. The GSS collects data on race and ethnicity only for U.S. citizens and permanent residents. Among U.S. citizens and permanent residents, S&E graduate enrollment for Hispanics or Latinos increased 4.7% between 2015 and 2016, continuing a pattern of growth that started in 2008. Among the non-Hispanic subgroups, the number of Asian S&E graduate students and the number of S&E graduate students reporting more than one race showed continued growth, up 2.6% and 4.8%, respectively, between 2015 and 2016. The S&E graduate enrollment for the remaining race and ethnicity categories all declined in 2016, with American Indian or Alaska Native as well as Native Hawaiian or Other Pacific Islander showing the largest percent decrease between 2015 and 2016 (-7.6% and -7.8%, respectively) (table 1).

Graduate Enrollment, by S&E Field

In 2016, 73% of the 620,489 S&E graduate students were enrolled in science fields and the remainder were enrolled in engineering fields. Graduate enrollment in five of the nine science fields declined from 2015 to 2016, with psychology experiencing the largest decline at -4.3%, followed by earth, atmospheric, and ocean sciences (-2.8%), social sciences (-2.4%), agricultural sciences (-1.8%), and biological sciences (-1.2%). Computer sciences graduate enrollment increased for the fifth straight year in 2016, experiencing 7.5% growth from 2015 and 21.0% growth since 2014. The remaining science fields also showed graduate enrollment growth between 2015 and 2016, with mathematics and statistics increasing by 6.1%, followed by other sciences (5.3%) and physical sciences (0.3%) (table 2).

Graduate enrollment in engineering declined for the first time since 2011 to 168,443 students in 2016, down 0.5% from 2015. This decrease was mostly due to decreased enrollment in two of the historically larger engineering fields: electrical engineering

TABLE 1. Graduate enrollment in science and engineering fields, by enrollment status, sex, citizenship, race, and ethnicity: 2011–16

Characteristic	2011	2012	2013	2014old[a]	2014new[a]	2015	2016	% change 2015–16	% change 2011–14old	% change 2014new–16
All surveyed fields	626,820	627,243	633,010	650,738	666,586	685,397	684,825	-0.1	3.8	2.7
Science and engineering	560,941	561,418	570,300	587,161	601,883	618,008	620,489	0.4	4.7	3.1
Full-time enrollment	411,168	414,384	424,508	440,523	447,096	459,405	462,973	0.8	7.1	3.6
Part-time enrollment	149,773	147,034	145,792	146,638	154,787	158,603	157,516	-0.7	-2.1	1.8
Male	318,209	318,870	324,913	338,940	348,390	358,423	358,914	0.1	6.5	3.0
Female	242,732	242,548	245,387	248,221	253,493	259,585	261,575	0.8	2.3	3.2
U.S. citizens and permanent residents[b]	392,160	385,343	381,225	373,378	382,512	382,634	379,749	-0.8	-4.8	-0.7
Full-time enrollment	262,043	258,477	256,211	251,858	253,886	253,503	252,713	-0.3	-3.9	-0.5
Part-time enrollment	130,117	126,866	125,014	121,520	128,626	129,131	127,036	-1.6	-6.6	-1.2
Male	208,400	204,836	202,271	198,397	204,105	202,596	200,834	-0.9	-4.8	-1.6
Female	183,760	180,507	178,954	174,981	178,407	180,038	178,915	-0.6	-4.8	0.3
Hispanic or Latino	30,808	31,406	32,819	33,146	35,132	37,807	39,578	4.7	7.6	12.7
Not Hispanic or Latino										
American Indian or Alaska Native	2,392	2,188	2,198	2,048	2,112	2,012	1,860	-7.6	-14.4	-11.9
Asian	33,147	32,700	32,917	32,981	33,745	34,762	35,674	2.6	-0.5	5.7
Black or African American	32,197	31,338	30,911	29,714	30,482	30,788	30,600	-0.6	-7.7	0.4
Native Hawaiian or Other Pacific Islander	1,008	920	882	876	902	935	862	-7.8	-13.1	-4.4
White	256,096	250,783	246,518	240,295	245,103	241,649	237,563	-1.7	-6.2	-3.1
More than one race	6,103	7,578	8,015	9,136	9,335	10,030	10,514	4.8	49.7	12.6
Unknown race and ethnicity	30,409	28,430	26,965	25,182	25,701	24,651	23,098	-6.3	-17.2	-10.1
Temporary visa holders	168,781	176,075	189,075	213,783	219,371	235,374	240,740	2.3	26.7	9.7
Full-time enrollment	149,125	155,907	168,297	188,665	193,210	205,902	210,260	2.1	26.5	8.8
Part-time enrollment	19,656	20,168	20,778	25,118	26,161	29,472	30,480	3.4	27.8	16.5
Male	109,809	114,034	122,642	140,543	144,285	155,827	158,080	1.4	28.0	9.6
Female	58,972	62,041	66,433	73,240	75,086	79,547	82,660	3.9	24.2	10.1

[a] In 2014, the survey frame was updated following a comprehensive frame evaluation study. The study identified potentially eligible but not previously surveyed U.S. academic institutions with master's- or doctorate-granting programs in science, engineering, or health. For information on the impact of the frame update, see https://www.nsf.gov/statistics/2016/nsf16314/.

[b] 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.

(-5.4%) and civil engineering (-1.9%). Decreased graduate enrollment in industrial and manufacturing engineering (-0.5%) added to the overall decline (table 2).

Postdoctoral Appointees in SEH Fields

In 2016, a total of 64,712 postdoctoral appointees (postdocs) were conducting research in science, engineering, and health (SEH) fields at U.S. academic institutions and their affiliated research centers and hospitals. The total number of SEH postdocs increased by 1.3% from 2015. This was mainly due to an increase in the number of health postdocs (2.2%) and an increase in the number of U.S. citizen and permanent resident S&E postdocs (3.1%) who constitute the minority (44.2%) of the total S&E postdocs (table 3).

The number of S&E postdocs experienced a 1.0% increase from 2015 to 2016 to a total of 45,737. In 2016, the number of S&E postdocs increased for both men (1.1%) and women (0.7%), but the share of female S&E postdocs remains at its historical high, hovering at or near 36%, which began in 2011 (table 3). Within S&E fields, the largest percent increases from 2015 to 2016 in the number of S&E postdocs were for other engineering (22.4%), multidisciplinary and interdisciplinary studies (12.7%), and other sciences (8.6%).

Nonfaculty Researchers in SEH Fields

The total number of doctorate-holding nonfaculty researchers (NFRs) in SEH fields grew 8.6% between 2014 and 2016, increasing 1.8% between 2015 and 2016 to 25,747.[2] In 2016, biological

TABLE 2. Graduate enrollment in science, engineering, and health, by field: 2011–16

Characteristic	2011	2012	2013	2014old[a]	2014new[a]	2015	2016	% change 2015–16	% change 2011–14old	% change 2014new–16
All surveyed fields	626,820	627,243	633,010	650,738	666,586	685,397	684,825	-0.1	3.8	2.7
Science and engineering	560,941	561,418	570,300	587,161	601,883	618,008	620,489	0.4	4.7	3.1
Science	414,440	413,033	417,251	425,148	437,395	448,654	452,046	0.8	2.6	3.3
Agricultural sciences	16,129	16,234	16,429	16,947	17,505	18,610	18,284	-1.8	5.1	4.5
Biological sciences	75,423	76,447	76,649	76,029	78,490	80,096	79,146	-1.2	0.8	0.8
Computer sciences	51,234	51,789	56,339	68,766	76,546	86,192	92,650	7.5	34.2	21.0
Earth, atmospheric, and ocean sciences	15,820	16,069	15,816	15,423	15,710	15,447	15,015	-2.8	-2.5	-4.4
Mathematics and statistics	23,801	24,575	24,804	25,502	25,874	26,444	28,050	6.1	7.1	8.4
Physical sciences	39,694	39,928	40,019	40,196	40,332	40,386	40,518	0.3	1.3	0.5
Psychology[b]	54,486	54,117	54,102	50,938	48,833	49,740	47,609	-4.3	-6.5	-2.5
Social sciences	111,661	108,169	107,278	104,445	105,742	102,706	100,200	-2.4	-6.5	-5.2
Other sciences[c]	26,192	25,705	25,815	26,902	28,363	29,033	30,574	5.3	2.7	7.8
Engineering	146,501	148,385	153,049	162,013	164,488	169,354	168,443	-0.5	10.6	2.4
Aerospace engineering	5,691	5,069	5,181	5,116	5,116	5,345	5,416	1.3	-10.1	5.9
Architecture	3,111	2,363	2,176	1,812	1,817	1,565	1,671	6.8	-41.8	-8.0
Biomedical engineering	9,175	9,157	9,198	9,510	9,510	9,761	10,208	4.6	3.7	7.3
Chemical engineering	8,828	9,222	9,698	9,853	9,870	10,008	10,187	1.8	11.6	3.2
Civil engineering	19,596	19,922	20,110	20,660	20,789	20,978	20,569	-1.9	5.4	-1.1
Electrical engineering	41,580	42,347	45,562	50,051	51,909	52,940	50,062	-5.4	20.4	-3.6
Industrial and manufacturing engineering	14,494	14,469	14,363	14,659	14,845	16,284	16,200	-0.5	1.1	9.1
Mechanical engineering	21,883	23,088	24,087	25,508	25,651	27,314	27,898	2.1	16.6	8.8
Metallurgical/materials engineering	6,649	6,985	7,144	7,473	7,518	7,741	8,106	4.7	12.4	7.8
Other engineering	15,494	15,763	15,530	17,371	17,463	17,418	18,126	4.1	12.1	3.8
Health[b]	65,879	65,825	62,710	63,577	64,703	67,389	64,336	-4.5	-3.5	-0.6

[a] In 2014, the survey frame was updated following a comprehensive frame evaluation study. The study identified potentially eligible but not previously surveyed U.S. academic institutions with master's- or doctorate-granting programs in science, engineering, or health. For information on the impact of the frame update, see https://www.nsf.gov/statistics/2016/nsf16314/.

[b] More rigorous follow-up was done in recent years with institutions regarding the exclusion of practitioner-oriented graduate degree programs in psychology and in other health (a subfield of health). This change may affect interpretation of trends in these fields.

[c] Includes communication, family and consumer sciences and human sciences, multidisciplinary and interdisciplinary studies, and neurobiology and neuroscience.

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

sciences employed the largest share of SEH NFRs at 27.4%, followed by health (25.8%) and engineering (12.3%). Men hold a larger share of NFRs in the science fields and in engineering (60.7% and 77.3%, respectively), whereas men made up only 49.9% of the NFRs in health fields (table 4).

Data Sources and Limitations

Conducted since 1966, the GSS is an annual census of all academic institutions in the United States that grant research-based master's or doctoral degrees in science, engineering, and health (SEH) fields. The 2016 GSS collected data from 15,853 organizational units (departments, programs, affiliated research centers, and health care facilities) at 714 eligible institutions and their affiliates in the United States, Puerto Rico, and Guam. The unit response rate was 99.5%. An overview of the GSS is 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 Classification of Instructional Programs (CIP) taxonomy.[3] NIH information on trends seen within these selected health fields can be found at https://report.nih.gov/nihdatabook/.

In 2014, the survey frame was updated following a comprehensive frame evaluation study. A total of 151 newly eligible

TABLE 3. Postdoctoral appointees in science, engineering, and health, by sex, citizenship, ethnicity, race, and field: 2011–16

Characteristic	2011	2012	2013	2014old[a]	2014new[a]	2015	2016	% change 2015–16	% change 2011–14old	% change 2014new–16
All surveyed fields	62,639	62,851	61,942	62,379	63,593	63,861	64,712	1.3	-0.4	1.8
Science and engineering	44,121	43,841	43,395	43,476	44,623	45,295	45,737	1.0	-1.5	2.5
Male	28,314	28,176	27,858	27,920	28,618	28,970	29,299	1.1	-1.4	2.4
Female	15,807	15,665	15,537	15,556	16,005	16,325	16,438	0.7	-1.6	2.7
U.S. citizens and permanent residents[b]	20,340	20,214	20,257	20,018	20,453	19,593	20,205	3.1	-1.6	-1.2
Hispanic or Latino	901	862	961	978	1,020	1,025	1,041	1.6	8.5	2.1
Not Hispanic or Latino										
American Indian or Alaska Native	66	51	71	63	65	56	94	67.9	-4.5	44.6
Asian	3,502	3,330	3,526	3,374	3,489	3,305	3,697	11.9	-3.7	6.0
Black or African American	610	615	667	690	702	641	601	-6.2	13.1	-14.4
Native Hawaiian or Other Pacific Islander	53	63	50	52	53	32	73	128.1	-1.9	37.7
White	11,965	11,835	11,953	11,739	11,994	12,079	12,127	0.4	-1.9	1.1
More than one race	161	112	165	162	168	268	512	91.0	0.6	204.8
Unknown ethnicity and race	3,082	3,346	2,864	2,960	2,962	2,187	2,060	-5.8	-4.0	-30.5
Temporary visa holders	23,781	23,627	23,138	23,458	24,170	25,702	25,532	-0.7	-1.4	5.6
Science	37,335	36,738	36,289	36,184	37,316	37,639	37,941	0.8	-3.1	1.7
Agricultural sciences	19,629	19,262	18,738	18,955	19,655	20,567	20,326	-1.2	-3.4	3.4
Biological sciences	21,107	20,086	19,330	18,749	19,554	19,304	19,427	0.6	-11.2	-0.6
Computer sciences	759	760	765	833	834	888	914	2.9	9.7	9.6
Earth, atmospheric, and ocean sciences	1,774	1,956	2,032	2,059	2,061	2,129	2,104	-1.2	16.1	2.1
Mathematics and statistics	830	902	932	956	959	1,011	1,005	-0.6	15.2	4.8
Multidisciplinary and interdisciplinary studies	704	742	891	1,045	1,045	972	1,095	12.7	48.4	4.8
Neurobiology and nueroscience	1,398	1,525	1,696	1,778	1,878	1,957	2,071	5.8	27.2	10.3
Physical sciences	7,490	7,430	7,197	7,089	7,277	7,358	7,269	-1.2	-5.4	-0.1
Psychology	1,124	1,132	1,023	1,062	1,066	1,130	1,177	4.2	-5.5	10.4
Social sciences	774	799	938	1,050	1,051	1,179	1,193	1.2	35.7	13.5
Other sciences[c]	119	116	166	168	189	186	202	8.6	41.2	6.9
Engineering	6,786	7,103	7,106	7,292	7,307	7,656	7,796	1.8	7.5	6.7
Aerospace engineering	202	170	202	220	220	217	201	-7.4	8.9	-8.6
Biomedical engineering	1,069	1,161	1,103	1,196	1,198	1,201	1,278	6.4	11.9	6.7
Chemical engineering	1,137	1,098	1,230	1,244	1,244	1,283	1,218	-5.1	9.4	-2.1
Civil engineering	551	590	587	629	629	670	706	5.4	14.2	12.2
Electrical engineering	1,035	1,152	1,180	1,177	1,179	1,160	1,186	2.2	13.7	0.6
Industrial and manufacturing engineering	121	127	133	131	131	142	130	-8.5	8.3	-0.8
Mechanical engineering	889	985	1,034	1,055	1,058	1,161	1,080	-7.0	18.7	2.1
Metallurgical/materials engineering	860	854	809	776	780	911	882	-3.2	-9.8	13.1
Other engineering[d]	922	966	828	864	868	911	1,115	22.4	-6.3	28.5
Health	18,518	19,010	18,547	18,903	18,970	18,566	18,975	2.2	2.1	*

* = < 0.05%

[a] In 2014, the survey frame was updated following a comprehensive frame evaluation study. The study identified potentially eligible but not previously surveyed U.S. academic institutions with master's- or doctorate-granting programs in science, engineering, or health. For information on the impact of the frame update, see https://www.nsf.gov/statistics/2016/nsf16314/.

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

[c] Includes communication as well as family and consumer sciences and human sciences.

[d] Includes agricultural engineering, architecture, engineering science, mechanics, and physics, mining engineering, nuclear engineering, petroleum engineering, and engineering not elsewhere classified.

NOTE: "Field" refers to the field of the unit that reports postdoctoral appointees.

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

TABLE 4. Doctorate-holding nonfaculty researchers in science, engineering, and health, by sex and field: 2011–16

Field and sex	2011	2012	2013	2014old[a]	2014new[a]	2015	2016	% change 2015–16	% change 2011–14old	% change 2014new–16
All surveyed fields	21,498	21,908	22,465	23,290	23,706	25,292	25,747	1.8	8.3	8.6
Male	13,105	13,250	13,617	14,099	14,314	15,249	15,437	1.2	7.6	7.8
Female	8,393	8,658	8,848	9,191	9,392	10,043	10,310	2.7	9.5	9.8
Science and engineering	15,675	15,761	16,426	17,027	17,419	18,596	19,095	2.7	8.6	9.6
Male	10,140	10,190	10,504	10,925	11,126	11,865	12,119	2.1	7.7	8.9
Female	5,535	5,571	5,922	6,102	6,293	6,731	6,976	3.6	10.2	10.9
Science	13,363	13,264	13,932	14,283	14,674	15,667	15,940	1.7	6.9	8.6
Male	8,245	8,167	8,534	8,777	8,977	9,568	9,681	1.2	6.5	7.8
Female	5,118	5,097	5,398	5,506	5,697	6,099	6,259	2.6	7.6	9.9
Agricultural sciences	581	567	550	609	616	747	767	2.7	4.8	24.5
Biological sciences	6,224	6,249	6,527	6,492	6,841	6,948	7,058	1.6	4.3	3.2
Computer sciences	326	349	459	450	450	459	470	2.4	38.0	4.4
Earth, atmospheric, and ocean sciences	1,625	1,513	1,518	1,499	1,500	1,754	1,635	-6.8	-7.8	9.0
Mathematics and statistics	174	209	224	221	221	235	213	-9.4	27.0	-3.6
Multidisciplinary and interdisciplinary studies	509	497	538	658	661	630	727	15.4	29.3	10.0
Neurobiology and neuroscience	378	356	417	650	666	718	760	5.8	72.0	14.1
Physical sciences	2,322	2,296	2,312	2,433	2,445	2,701	2,735	1.3	4.8	11.9
Psychology	434	431	457	411	411	472	456	-3.4	-5.3	10.9
Social sciences	672	740	853	769	770	898	970	8.0	14.4	26.0
Other sciences[b]	118	57	77	91	93	105	149	41.9	-22.9	60.2
Engineering	2,312	2,497	2,494	2,744	2,745	2,929	3,155	7.7	18.7	14.9
Male	1,895	2,023	1,970	2,148	2,149	2,297	2,438	6.1	13.4	13.4
Female	417	474	524	596	596	632	717	13.4	42.9	20.3
Health	5,823	6,147	6,039	6,263	6,287	6,696	6,652	-0.7	7.6	5.8
Male	2,965	3,060	3,113	3,174	3,188	3,384	3,318	-2.0	7.0	4.1
Female	2,858	3,087	2,926	3,089	3,099	3,312	3,334	0.7	8.1	7.6

[a] In 2014, the survey frame was updated following a comprehensive frame evaluation study. The study identified potentially eligible but not previously surveyed U.S. academic institutions with master's- or doctorate-granting programs in science, engineering, or health. For information on the impact of the frame update, see https://www.nsf.gov/statistics/2016/nsf16314/.

[b] Includes communication as well as family and consumer sciences and human sciences.

NOTE: "Field" refers to the field of the unit that reports nonfaculty researchers.

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

institutions were added, and two private for-profit institutions offering mostly practitioner-based graduate degrees were determined to be ineligible. This 2014 frame update added over the previous frame a total of 15,848 SEH graduate students, an increase of 2.4%; 1,214 SEH postdocs, an increase of 1.9%; and 416 SEH NFRs, an increase of 1.8%. Because of the survey frame update, data comparisons across years should be made with caution. This is especially true for counts; however, proportions or shares are typically robust enough to allow for such comparisons. In this report, the data comparisons between 2014 and earlier years use the "2014old" data, and those between 2014 and 2016 use the "2014new" data. The effect of the frame update can be evaluated by using the "2014old" and "2014new" data. For more information on the survey frame update, see the special report *Assessing the Impact of Frame Changes on Trend Data from the Survey of Graduate Students and Postdoctorates in Science and Engineering.*[4]

In 2011, the GSS field taxonomy was updated to conform to the 2010 CIP. The impact on overall GSS counts because of this change was minimal, as described in appendix A, "Technical Notes" in *Graduate Students and Postdoctorates in Science and Engineering: Fall 2011.*[5]

Data tables from the 2016 GSS are available at https://www.nsf.gov/statistics/srvygradpostdoc/. For more information, contact the author.

Notes

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[2] For more information on the NFR data, see Einaudi P, Heuer R, Green P, Kang KH. 2015. *Examining the Reporting of Nonfaculty Doctorate Researchers in the Survey of Graduate Students and Postdoctorates in Science and Engineering.* Working Paper NCSES 15-201. Arlington, VA: National Science Foundation, National Center for Science and Engineering Statistics. Available at https://www.nsf.gov/statistics/2015/ncses15201/.

[3] The CIP provides a taxonomic scheme that supports the consistent reporting of fields of study and program completions activity. For more information see http://nces.ed.gov/ipeds/cipcode/.

[4] Arbeit CA, Einaudi P, Green P, Kang KH. 2016. *Assessing the Impact of Frame Changes on Trend Data from the Survey of Graduate Students and Postdoctorates in Science and Engineering.* Special Report NSF 16-314. Arlington, VA: National Science Foundation, National Center for Science and Engineering Statistics. Available at https://www.nsf.gov/statistics/2016/nsf16314/nsf16314.pdf.

[5] National Science Foundation, National Center for Science and Engineering Statistics. 2013. *Graduate Students and Postdoctorates in Science and Engineering: Fall 2011.* Detailed Statistical Tables NSF 13-331. Arlington, VA. Available at https://www.nsf.gov/statistics/nsf13331/.