

ANALYSIS

Recent Trends in Bachelors Degree Recipients in Mathematics at US Institutions

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Introduction

The purpose of this article is twofold. First, we seek to make the *Notices* reader aware of a rich source of data on collegiate education available from the federal government, and second, to illustrate the value of this data by reporting on the race/ethnicity profile of bachelors degree recipients majoring in mathematics, statistics, or mathematics teacher education.

The US Department of Education's National Center for Education Statistics (NCES) gathers detailed data on numerous aspects of postsecondary education in the US. The data is reported to the NCES by the central

administration of each of the postsecondary institutions in the US; and participation is very close to 100%. The data is publicly available online via the Integrated Postsecondary Education Data System (IPEDS) [nces.ed.gov/ipeds/]. The present report provides a short summary of the IPEDS data on the individuals who completed a bachelors degree with a major in mathematics, statistics, or mathematics teacher education for the three academic year cycles 2002–2003, 2007–2008 and 2012–2013. The data used to produce this summary is available in a user-friendly form on the AMS website [www.ams.org/profession/data/other-sources/other-sources].

Table 1: Profile of bachelors degree recipients as reported by the National Center for Education Statistics via its Integrated Postsecondary Education Data System (IPEDS).

	2002–2003 Academic Year	2012–2013 Academic Year	% change 2002–2003 to 2012–2013
Total bachelors degrees awarded in all disciplines	1,373,582	1,796,905	30.8%
Total of these awarded to Non-resident Aliens	44,220	68,001	53.8%
Totals for selected subject areas			
Biological and Biomedical Sciences (26)	61,285	103,096	68.2%
Computer and Information Sciences and Support Services (11)	48,882	38,906	-20.4%
Engineering (14)	63,177	86,547	37.0%
<i>Mathematics and Statistics (27)</i>	14,000	23,839	70.3%
Physical Sciences (40)	18,847	29,303	55.5%
Total for selected areas	206,191	281,691	36.6%
Total for selected areas as a % of all bachelors degrees	15.0%	15.7%	

Note: Numbers in parentheses after each subject area are codes from NCES's Classification of Instructional Programs. For more information on IPEDS visit nces.ed.gov/ipeds/.

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The Big Picture: Who and how many earn these degrees?

Table 1 compares the total number of bachelors degrees awarded by four-year public and not-for-profit institutions during 2002–2003 with the totals awarded during 2012–2013. For context, the table also contains the same comparison in a selection of science and engineering disciplines. Over this ten-year span, the number of bachelors degrees awarded in all disciplines of science and mathematics combined increased 31%, and the number of these degrees earned by non-resident aliens, while small overall, grew by 54% over this same ten-year period. The largest percentage increase in any of the disciplines listed was the NCES-defined discipline of *Mathematics and*

Statistics with an increase of 70%, followed closely by the 68% increase in *Biological and Biomedical Sciences*.

Table 2 provides a profile of combined counts of bachelors degrees awarded to majors in the three NCES disciplinary categories relevant to this report: *Mathematics and Statistics*, *Mathematics Teacher Education*, and *Computer Science and Mathematics*. For simplicity, we refer to these three as *math-related bachelors*. The bottom line of the table shows that the number of math-related bachelors degrees has grown significantly since the baseline year of 2002–2003, up by 65% in 2012–2013. The number of US citizens and permanent residents earning these degrees is up by 55% over the ten years since 2002–2003. From its relatively small total of 764 in 2002–2003, the number of these degrees awarded to non-resident aliens grew to

Table 2: Profile of US math-related bachelors degree recipients as reported by the National Center for Education Statistics via its Integrated Postsecondary Education Data System (IPEDS).

	July to June Reporting Year		
	2002–2003	2007–2008	2012–2013
Domestic (US Citizen or Permanent Resident)			
Total Math-related Majors	15,183	18,298	23,505
Percent Female	46.4%	45.8%	44.0%
Percent Underrepresented Minority ¹	11.6%	11.4%	13.5%
Mathematics Education Majors	1,525	1,924	2,211
Percent Female	66.2%	67.3%	66.8%
Percent Underrepresented Minority ¹	7.4%	7.0%	9.8%
Foreign (Non-resident Alien)			
Total Math-related Majors	764	903	2,734
Percent Female	36.0%	39.8%	44.4%
Number of Math Education Majors	6	13	12
Domestic and Foreign majors combined	15,947	19,201	26,239

¹ Percent after deleting counts of individuals whose race/ethnicity was reported as *unknown* and, in 2012–2013, as *2 or more races*. See Data Source Notes on p. 661 of this report for further details on the data and the definition of underrepresented minorities.

2,734, an increase of over 250% over ten years with most of the increase coming in the five years since 2007–2008. Though not separately displayed in Table 2, the number of bachelors degrees awarded to majors in the NCES category *Computer Science and Mathematics* is very small, below 200 in each of the years.

From the 2010 CBMS survey [www.ams.org/profession/data/cbms-survey/cbms2010], Table SP.25, approximately 15% of the 2009–2010 bachelors math majors were reported by their department to be headed to graduate school in mathematics or statistics. The estimate of 1st year underrepresented minority graduate students in fall 2013 derived from Table GS.2 [www.ams.org/annual-survey/2013Survey-DepartmentalProfile-Report.pdf] of the Fall 2014 Departmental Profile Report, is 192. This number is surprisingly small given that Table

2 shows there were over 3,100 bachelors degrees awarded to underrepresented minority students during 2012–2013.

Table 2 also shows the relatively low number of bachelors degrees awarded to mathematics teacher education majors, dropping from 9.6% of all degrees for 2002–2003 to 8.5% for 2012–2013. Furthermore, these degrees go more frequently to females than for all degrees combined, and underrepresented minorities are even less well represented here than in all the degrees combined. For additional details on these degrees, see Table 4.

Table 3 shows tallies of math-related bachelors degrees grouped according to the highest degree awarded by the mathematics department at the institution. From 2002–2003 to 2012–2013, the number of degrees is up significantly across all three subcategories. Keep in mind that the NCES data is institutional, not departmental, and consequently the bachelors recipients in the NCES

totals could have come from a mathematics, applied mathematics or statistics department, and in a very small number of instances, from a computer science department. Grouping the institutional data in this way produces totals analogous to the totals reported in the

AMS Annual Survey of Mathematical Sciences, which show the same trend in numbers as the NCES data.

When the counts of math-related degrees are totaled for those US citizens and permanent residents whose race/ethnicity classifications make up the underrepresented

Table 3: Profile of US math-related undergraduate degree recipients by mathematical science department groupings based on data from the National Center for Education Statistics.

	July to June Reporting Year		
	2002–2003	2007–2008	2012–2013
All Institutions with Doctoral Math Department			
Total Majors	7,019	8,595	12,578
Total US citizens & Permanent Residents ¹	6,211	7,619	9,838
Percent Female	40.8%	39.7%	37.3%
Percent Underrepresented Minority	9.9%	9.4%	11.7%
All Institutions with Master's Math Department			
Total Majors	2,851	3,605	4,605
Total US citizens & Permanent Residents ¹	2,601	3,257	4,132
Percent Female	52.4%	51.9%	49.7%
Percent Underrepresented Minority	18.6%	18.8%	20.5%
All Institutions with Bachelor's Math Department			
Total Majors	6,077	7,001	9,056
Total US citizens & Permanent Residents ¹	5,630	6,362	8,011
Percent Female	50.5%	51.3%	49.9%
Percent Underrepresented Minority	10.2%	10.0%	12.1%

¹ Excludes individuals whose race/ethnicity was reported as *unknown* and in 2012–2013 as *2 or more races*.

Table 4: Profile of undergraduate degree recipients with a major in Mathematics Teacher Education as reported by the National Center for Education Statistics via its Integrated Postsecondary Education Data System.

	July to June Reporting Year		
	2002–2003	2007–2008	2012–2013
All Institutions with Doctoral Math Department			
Total Majors	457	580	593
Total US citizens & Permanent Residents ¹	445	571	564
Percent Female	67.6%	69.5%	65.0%
Percent Underrepresented Minority	6.1%	7.4%	8.9%
All Institutions with Master's Math Department			
Total Majors	436	537	615
Total US citizens & Permanent Residents ¹	412	503	586
Percent Female	68.7%	66.4%	67.1%
Percent Underrepresented Minority	9.7%	8.2%	12.3%
All Institutions with Bachelor's Math Department			
Total Majors	638	820	1,015
Total US citizens & Permanent Residents ¹	622	790	973
Percent Female	62.1%	66.6%	68.2%
Percent Underrepresented Minority	6.8%	6.1%	8.8%

¹ Excludes individuals whose race/ethnicity was reported as *unknown* and in 2012–2013 as *2 or more races*.

minorities, the data show an increase in the proportion of degrees awarded to underrepresented minorities over the ten years covered in Table 3. Most of the increase came within the most recent five years. For 2012–2013 underrepresented minorities make up just under 20.5% of the total baccalaureate degree recipients in institutions whose highest degree awarded in mathematics is a masters. This percentage is more than eight percentage points higher than for the two groupings of institutions whose math department’s highest degree awarded is a bachelors or a PhD. Turning once again to NCES data on undergraduate enrollments, one discovers that these masters institutions have a considerably higher proportion of their total undergraduate enrollment made up of students from underrepresented minorities than for the other two groups of institutions. For 2012–2013, the percentages of total (US citizen plus permanent resident) undergraduate enrollment in the underrepresented minorities categories are 24%, 37%, and 28% for doctoral, masters, and bachelors institutions, respectively.

Sources: Which institutions produce most of the degrees?

Table 5 gives some distributional statistics on the list of math-related bachelors degrees reported for 2012–2013. One striking result of this analysis not evident in Table 5 is that the institutions at or above the 90th percentile in terms of degrees awarded account for 47% of all math-related bachelors degrees.

Table 6 (following page) lists the first fifty institutions when the NCES list of 1,267 institutions is sorted from highest to lowest on the number of math-related degrees reported by the institutions for 2012–2013. When the same list is sorted on the column “Math-related Bachelors per 1,000 Undergraduate FTE enrollments”, the result is a list whose first fifty institutions are shown in Table 7 (following page). The highlighted institutions are those that appear in both lists.

There are two notable differences between the institutions shown in Table 6 and Table 7. Of the institutions listed in Table 6, all have doctorate-granting mathematics departments except for Grand Valley State University and CUNY Queens College. Furthermore,

Table 5: A statistical profile of math-related bachelors degrees awarded by US public and private not-for-profit four-year institutions during the 2012–2013 academic cycle.

	Number of Math-related Bachelors Awarded	Number of Math-related Bachelors Awarded per 1000 FTE Udg. Enrollments
90th Percentile	49	8.7
75th Percentile	22	5.4
50th Percentile	10	3.7
25th Percentile	4	1.7
Total math-related bachelors degrees reported	26,239	
Total math-related bachelors degrees reported by institutions at or above 90th percentile	12,323	6,063

thirteen of the institutions are private not-for-profit. In Table 7 thirty-four of the institutions have a mathematics department whose highest degree awarded is a bachelors degree and forty-four of the fifty institutions are private.

IPEDS Counts versus Annual Survey Counts

The numbers of bachelors degrees awarded by mathematical sciences departments are gathered each year through AMS' *Annual Survey of the Mathematical Sciences*. The data collected are used to estimate total bachelors degrees awarded in the mathematical sciences, and an analysis is reported annually in *Notices of the AMS*. For 2013, the Annual Survey requested that departments report the total bachelors degrees awarded to their majors during the period July 1, 2012 through June 30, 2013, the same time frame used for IPEDS reporting. Hence, it is natural to ask how these two counts compare. The short answer is that they are roughly comparable. The IPEDS counts and the Annual Survey counts for 2012–2013 are in very close alignment for institutions with a doctorate-granting or with a masters-granting mathematics department. The Annual Survey estimate for institutions with bachelors-granting mathematics departments runs approximately 20% higher than the comparable estimate based on the IPEDS data for these institutions. Further work with these two data sets is planned with the goal of obtaining an understanding of the sources of the differences between the two counts.

Data Source Notes

The data analyzed for this report was initially downloaded from the National Center for Education Statistics' IPEDS Data Center [nces.ed.gov/ipeds/datacenter/] during the fall of 2015. Counts include first and second majors awarded at the bachelors level by 4-year public and 4-year private not-for-profit institutions in the US. Degree recipients are those whose degree was reported in the Classification of Instructional Program (CIP) codes for *Mathematics or Statistics* (code=27), for *Mathematics Teacher Education* (code=13.1311) or for *Computer Science and Mathematics* (code=30.08). For more information on IPEDS visit nces.ed.gov/ipeds/.

The race/ethnicity categories used in the 2012–2013 IPEDS data are as follows:

- American Indian or Alaska Native
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Other Pacific Islander
- Asian
- White
- Two or more races

The underrepresented minority percentages include only those reported to IPEDS in exactly one of the first four categories above. The 2012–2013 categories *Native Hawaiian or Other Pacific Islanders* and *Two or more races* were not available for 2002–2003 and 2007–2008. In these survey years *Native Hawaiian or Other Pacific Islanders* were reported under *Asian & Other Pacific Islanders*.

Table 6: First fifty institutions based on the combined total of math-related bachelors degrees awarded for Academic Year 2012–2013.

Institution	Total Math-related Bachelors Degrees	Total Math. Teacher Ed. Bachelors Degrees	Math-related Bachelors per 1000 Undergrad. FTE	Fall 2013 Undergrad. FTE Enrollment
University of California–Berkeley	384	0	15.1	25,357
University of Washington–Seattle Campus	320	9	11.3	28,300
University of California–Los Angeles	318	0	11.1	28,702
University of Michigan–Ann Arbor	284	0	10.3	27,706
Stony Brook University	245	5	15.9	15,383
The University of Texas at Austin	234	0	6.1	38,142
University of Minnesota–Twin Cities	232	0	7.4	31,163
Purdue University–Main Campus	220	0	7.5	29,383
University of Wisconsin–Madison	189	0	6.4	29,328
University of Illinois at Urbana–Champaign	181	0	5.7	31,992
Pennsylvania State University–Main Campus	162	0	4.2	38,432
University of California–San Diego	158	6	6.8	23,139
North Carolina State University at Raleigh	155	46	6.7	23,008
University of North Carolina at Chapel Hill	152	0	8.5	17,893
Brigham Young University–Provo	144	50	5.5	26,137
University of Chicago	144	0	25.5	5,658
University of Maryland–College Park	140	0	5.5	25,384
University of California–Santa Barbara	140	0	7.4	18,952
Harvard University	136	0	15.9	8,536
Massachusetts Institute of Technology	131	0	29	4,510
Grand Valley State University	130	0	6.6	19,715
University of Arizona	125	18	4.2	29,785
University of California–Davis	125	0	5	25,121
Indiana University–Bloomington	122	16	3.7	33,395
University of Iowa	121	0	5.9	20,511
Virginia Polytechnic Institute and State Univ.	119	0	5	23,723
SUNY at Albany	115	0	9.3	12,353
Columbia University in the City of New York	115	0	15.1	7,608
Brown University	115	0	18.6	6,169
University of Colorado Boulder	114	0	4.6	24,712
Arizona State University–Tempe	111	0	3	36,499
Carnegie Mellon University	109	0	18.8	5,799
SUNY at Binghamton	108	0	8.5	12,752
Vanderbilt University	107	0	15.8	6,792
Texas A & M University–College Station	105	0	2.5	41,430
Rutgers University–New Brunswick	103	0	3.5	29,557
Ohio State University–Main Campus	100	0	2.4	41,707
Iowa State University	100	0	3.7	26,771
Northwestern University	100	0	11.4	8,805
University of Georgia	99	27	3.9	25,364
New York University	99	8	4.5	21,775
University of Florida	98	0	3.1	31,466
Boston College	97	12	10.3	9,414
University of California–Riverside	96	0	5.2	18,373
CUNY Queens College	94	37	7.5	12,574
Johns Hopkins University	94	0	15.7	5,972
University of Pittsburgh–Pittsburgh Campus	91	0	5.1	17,940
University of Houston	90	0	3.4	26,364
University of Massachusetts–Amherst	89	0	4.2	21,162
University of Rochester	89	0	14.9	5,971

Note: Highlighted institutions appear in both Table 5 and Table 6. Mathematics Teacher Education degrees are included in the column "Total Math-related Bachelors Degrees."

Table 7: First fifty Institutions based on the combined total of math-related bachelors degrees awarded per 1000 FTE undergraduate enrollments for Academic Year 2012–2013.

Institution	Math-related Bachelors per 1000 Undergrad. FTE	Total Math-related Bachelors Degrees	Total Math. Teacher Ed. Bachelors Degrees	Fall 2013 Undergrad. FTE Enrollment
Harvey Mudd College	48.6	39	0	802
Williams College	32.8	68	0	2076
California Institute of Technology	32.6	32	0	983
Bryn Mawr College	30.4	40	0	1317
Massachusetts Institute of Technology	29.0	131	0	4510
Hamilton College	25.6	49	0	1913
University of Chicago	25.5	144	0	5658
Pomona College	25.0	40	0	1602
Bowdoin College	24.5	44	1	1793
Colby College	23.1	42	0	1820
College of the Holy Cross	20.4	59	0	2891
St Olaf College	20.3	63	0	3098
Wheelock College	20.3	17	0	838
Macalester College	20.3	41	0	2022
Mount Saint Mary College	19.8	38	0	1923
Carleton College	19.7	40	0	2033
Amherst College	19.6	35	0	1787
Lyon College	19.2	11	0	574
Simpson College	19.0	30	0	1575
Wabash College	18.8	17	0	902
Carnegie Mellon University	18.8	109	0	5799
Saint Joseph's College-New York	18.7	74	41	3959
Brown University	18.6	115	0	6169
Athens State University	18.3	38	0	2082
SUNY College at Geneseo	16.6	86	23	5178
Grinnell College	16.6	28	0	1686
Swarthmore College	16.4	25	0	1529
St Mary's College of Maryland	16.2	29	0	1785
Davidson College	16.2	29	0	1788
Haverford College	16.0	19	0	1187
Harvard University	15.9	136	0	8536
Stony Brook University	15.9	245	5	15383
Rice University	15.8	62	0	3928
Vanderbilt University	15.8	107	0	6792
Johns Hopkins University	15.7	94	0	5972
Centre College	15.2	21	0	1379
University of California-Berkeley	15.1	384	0	25357
Columbia University in the City of New York	15.1	115	0	7608
University of Rochester	14.9	89	0	5971
McMurry University	14.5	16	7	1103
Loras College	13.9	21	0	1511
Defiance College	13.8	11	8	795
Wesleyan University	13.8	40	0	2903
Wellesley College	13.7	31	0	2266
Bates College	13.4	24	0	1791
Lewis & Clark College	13.3	28	0	2102
Saint Vincent College	12.8	20	0	1557
Franklin College	12.8	13	2	1015
Luther College	12.7	31	0	2434
SUNY College at Potsdam	12.6	46	11	3641

Note: Highlighted institutions are on both First Fifty lists. Mathematics Teacher Education degrees are included in total mathsci-related degrees.