

Math Pathways: What do we know? What do we want to know?

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**Upper-Division Pathways:
Southeast Regional Meeting**

Morehouse College

Atlanta, Georgia

June 10-11, 2019

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Overview

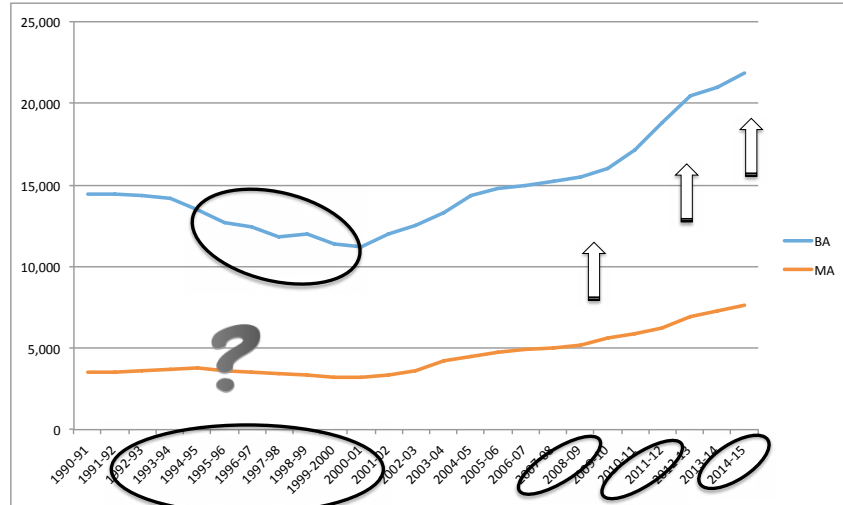
- Mathematics BA/BS graduate trends
 - Number of graduates
 - Demographics
- Changes: What, Who, & Why?
 - National trends
 - Regional trends

- Mathematics Coursetaking
 - Who takes how much of what?
 - Gender differences

- What else do we want to know?
- What data do we need to collect/analyze?

NB: "Math majors" data based on population samples may be small Ns and uncertain weighting; also single year data points may be unstable – use caution in interpretation.

Math Majors -National



The post-1990s decline may be due to the emigration of Soviet-bloc mathematicians and students, decreasing the demand for new math graduates. (With thanks to Uwe Mayer for suggesting this explanation, which is consistent with findings at the PhD level by George Borjas and Kirk Doran: "The Collapse of the Soviet Union and the Productivity of American Mathematicians" by George J. Borjas and Kirk B. Doran. *The NBER Digest*, June 2012.

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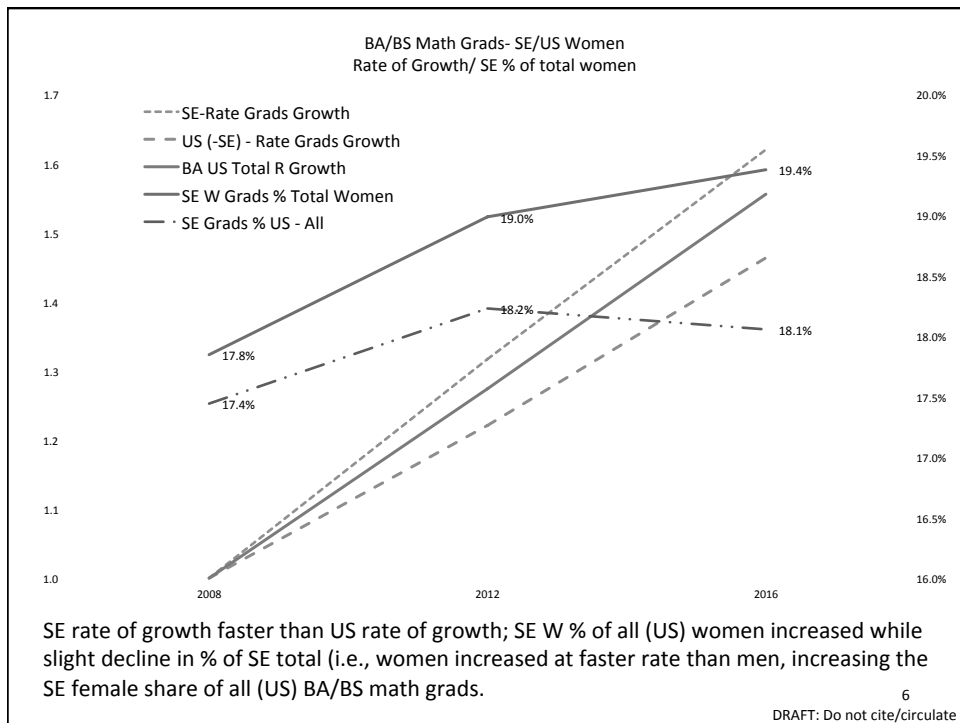
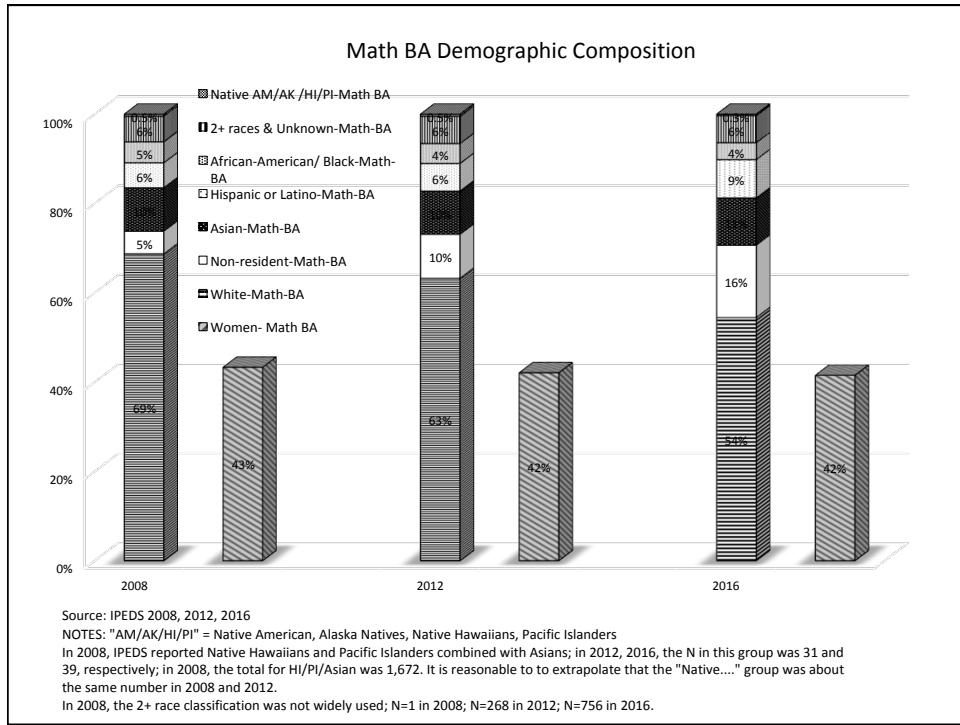
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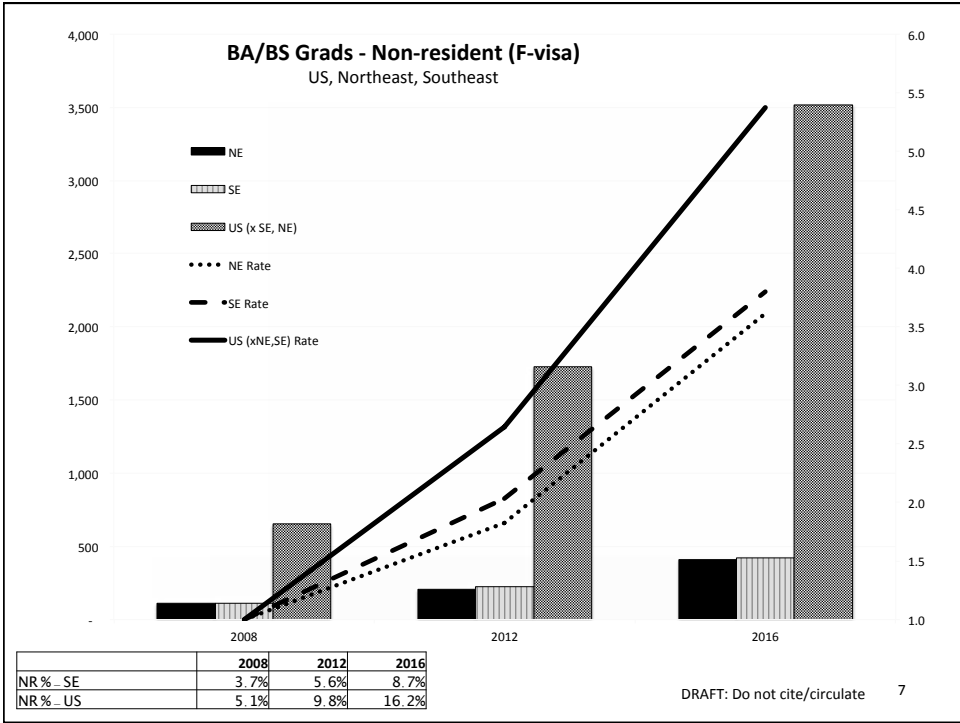
BA/BS Degrees Awarded- Southeast Region/US & Other regions Rate of increase (2008 = 1.0)



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US – BA/BS-2008 – 2016 *Largest programs in 2016*

Largest programs in 2016

Institution Name (Top 15)	Total math BA/ BS degrees awarded in 2016	Cumulative % of Total-2016	Total math BA degrees awarded in 2008	Cumulative % of Total 2008
UNIVERSITY OF CALIFORNIA-LOS ANGELES	589	2%	228	1%
UNIVERSITY OF CALIFORNIA-BERKELEY	437	4%	225	3%
UNIVERSITY OF WASHINGTON-SEATTLE CAMPUS	364	5%	154	4%
STONY BROOK UNIVERSITY	318	7%	120	4%
UNIVERSITY OF MINNESOTA-TWIN CITIES	313	8%	110	5%
PURDUE UNIVERSITY-MAIN CAMPUS	309	9%	123	6%
UNIVERSITY OF ILLINOIS AT URBANA- CHAMPAIGN	286	10%	129	6%
THE UNIVERSITY OF TEXAS AT AUSTIN	278	11%	154	7%
UNIVERSITY OF MICHIGAN-ANN ARBOR	265	12%	145	8%
UNIVERSITY OF CALIFORNIA-SANTA BARBARA	246	13%	115	9%
UNIVERSITY OF WISCONSIN-MADISON	237	14%	89	9%
HARVARD UNIVERSITY	212	15%	77	10%
UNIVERSITY OF CALIFORNIA-SAN DIEGO	211	16%	106	10%
UNIVERSITY OF CALIFORNIA-DAVIS	209	16%	86	11%
UNIVERSITY OF NORTH CAROLINA - CHAPEL HILL	200	17%	82	11%
Group Total	4,474	17%	1,943	11%
TOTAL	26,205		17,223	
<i>Universities at 50% cumulative (2016 cf. 2008)</i>	106 Universities	@ 50%	156 Universities	@ 50%
	SAN FRANCISCO STATE UNIVERSITY	56 Grads	SUNY AT GENESEO	27 Grads

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Largest number BA/BS grads 2016	Total MATH BA degrees awarded in 2016	Total MATH BA degrees awarded in 2008	Total MATH BA degrees awarded to women in 2016	Total MATH BA degrees awarded to women in 2008	BA % Women 2016	BA Delta Women 08-16
Total ALL US	26794	17223	11124	7457	42%	3667
Total Southeast Region	4838	3004	2156	1331	45%	825
University of North Carolina at Chapel Hill	200	82	79	37	40%	42
Virginia Polytechnic Institute and State University	143	85	54	29	38%	25
Florida State University	126	40	40	16	32%	24
University of Florida	124	96	38	40	31%	-2
University of Virginia-Main Campus	117	62	41	24	35%	17
North Carolina State University at Raleigh	107	121	39	47	36%	-8
University of Georgia	102	47	44	18	43%	26
University of North Carolina at Charlotte	102	40	49	15	48%	34
Vanderbilt University	99	65	26	17	26%	9
Emory University	97	21	55	12	57%	43
The University of Alabama	93	30	36	14	39%	22
Duke University	91	50	32	12	35%	20
University of Kentucky	75	30	22	10	29%	12
James Madison University	72	39	31	22	43%	9
College of William and Mary	65	36	25	9	38%	16
George Mason University	62	33	29	10	47%	19
University of South Florida-Main Campus	61	46	26	22	43%	4
Auburn University	59	29	35	16	59%	19
Virginia Commonwealth University	57	35	32	20	56%	12
Louisiana State University-Ag & Mechanical College	52	36	28	19	54%	9
University of South Carolina-Columbia	52	43	22	15	42%	7
Kennesaw State University	52	0	23	0	44%	23
Clemson University	50	26	32	11	64%	21
The University of Tennessee-Knoxville	50	39	19	15	38%	4
University of Central Florida	48	16	21	5	44%	16

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Vanderbilt University	99	65	26	17	26%	9
College of William and Mary	65	36	25	9	38%	16
University of Mary Washington	35	19	24	14	69%	10
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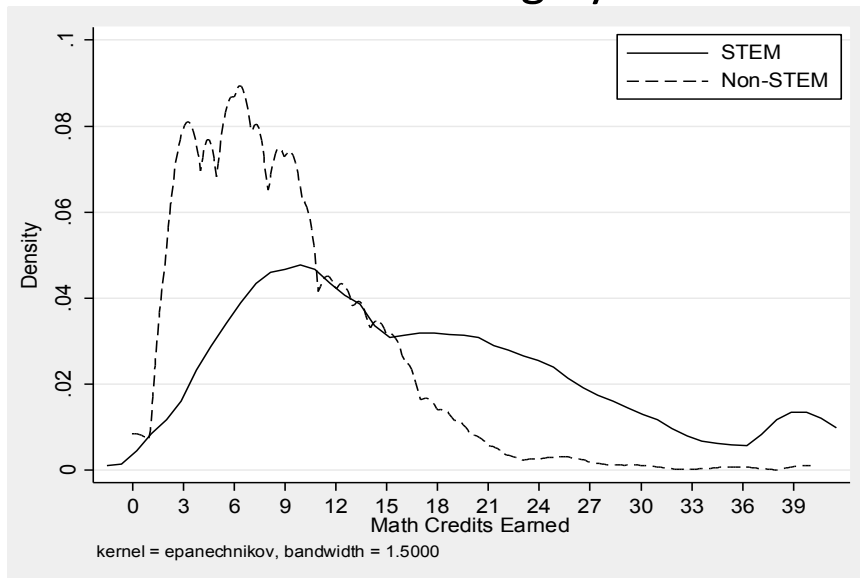
Daniel Douglas & Hal Salzman (2019):
 "Math Counts: Major and Gender Differences in College Mathematics Coursework"
The Journal of Higher Education
 DOI: 10.1080/00221546.2019.1602393

Mathematics is widely viewed as a core subject in postsecondary education for employment skills as well as for an informed citizenry. It is also one of the more hotly contested aspects of U.S. postsecondary education, with its substantive role vs. gatekeeping role of longstanding debate. There is surprisingly little empirical evidence on mathematics and quantitative reasoning course taking among bachelors-level students, in part because reliable data were not available. Through detailed development of NCES transcript data, the authors have conducted the first in-depth analysis of math coursetaking for a nationally representative cohort of Bachelors graduates.

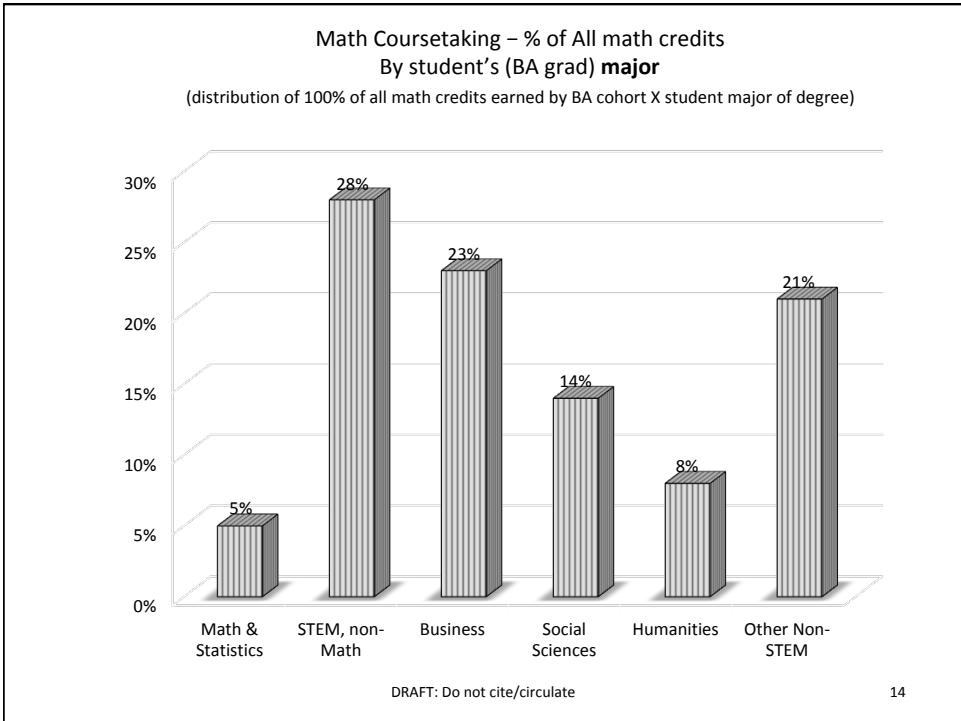
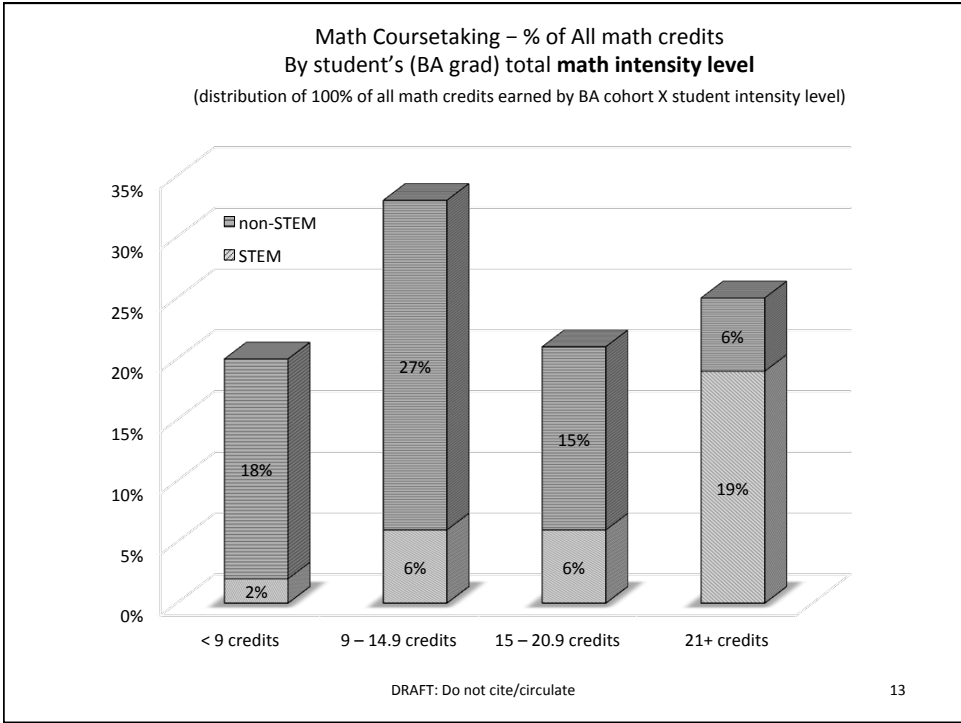
Key findings include:

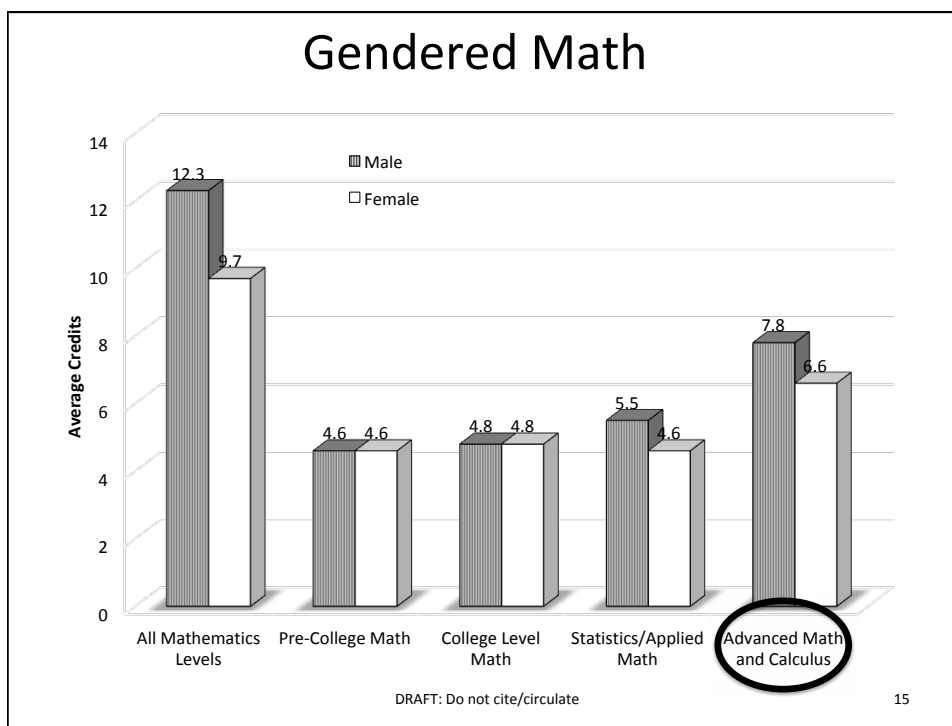
1. There is wide variation among STEM graduates in mathematics coursetaking, with high variation both within major and especially between majors, with engineers taking 22 credits on average as compared to 10 credits among life science graduates.
2. A large population of Non-STEM graduates earn mathematics credits at levels comparable to their STEM peers; in general, math coursetaking is found to be much greater than commonly assumed.
3. Mathematics does appear to a greater obstacle than other courses to BA graduates, with nearly a quarter receiving Ds or failing grades in traditional mathematics sequences, as compared to only 15% receiving less than a C in other courses.
4. Gender differentials in advanced math coursetaking appear to be a direct result of the gender disparity in engineering and computer science, not due to gender differences in math coursetaking per se. When controlling for major, our analysis finds no advanced mathematic coursetaking disadvantage for women.
5. This study is also a significant advance in developing course coding classifications for researchers, correcting errors in NCES datasets and providing a schema for classifications with greater internal and external validity.

MATH – Coursetaking by BA Grads



Math Credits Earned by Major Group among BA Graduates, Kernel Density Estimate
 (Credits top-coded at 40 credits)





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Interact-ed Math

Advanced Mathematics Credit Earning Among BA graduates, STEM subgroups. OLS and WLS Regression.

	Gender Only		Gender, Major		Gender, Major, Interactions	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
<i>Gender (ref. Male)</i>						
Female	-1.75 (0.14)***	-1.81 (0.22)***	-0.36 (.11)**	-0.33 (0.15)*	-0.59 (0.12)***	-0.55 (0.12)***
<i>Major (ref. non-STEM field)</i>						
B/C/O	--	--	3.19 (.16)***	3.17 (0.26)***	2.98 (0.23)***	2.81 (0.38)***
P/E/M	--	--	11.85 (.18)***	11.99 (0.42)***	11.08 (0.22)***	11.39 (0.54)***
<i>Interaction Terms</i>						
Female*B/C/O	--	--	--	--	0.35 (0.32)	0.68 (0.05)
Female*P/E/M	--	--	--	--	2.31 (0.39)***	1.95 (1.20)
Model R ²	0.029	0.032	0.464	0.468	0.467	0.471
N (rounded, unweighted)	5,320					
N (weighted)	1,047,888					

Major Categories: B/C/O=Biological Sciences, Computer Science, and Other STEM; P/E/M= Physical Sciences, Engineering, and Mathematics

Analysis from: "Math Counts: Investigating Mathematics Coursework in US Post-Secondary Education"

*p<.05 **p<.01 ***p<.001

DRAFT: Do not cite/circulate Daniel Douglas and Hal Salzman/HSalzman@Rutgers.edu 16
Draft paper/under review, 2018.

